Early Detection of Chronic Kidney Disease using Machine Learning

Team ID : PNT2022TMID16555

Team Leader :	Yamini.T	(111919104165)
Team Member 1 :	Subhasini.R	(111919104142)
Team Member 2 :	Dharshini.R	(111919104029)
Team Member 3 :	Vasavi.M	(111919104155)

1.INTRODUCTION

1.1 Project overview:

The kidney is a vital organ of the body. The function of kidney is to filter the blood in the body. When the kidneys filter blood, urine is made from excess and excess fluid in the body. The kidneys process waste, excess salt, and urea (nitrogenous wastes produced during the body's metabolic processes), regulate body fluids, blood pressure, and blood levels, and also regulate salt *levels, maintaining* the concentration of sodium, potassium, and phosphorus in the blood cells and minerals such as blood.

Kidney failure occurs when the kidneys are not functioning properly. Kidney failure can have a profound effect on body health. Chronic kidney failure is a progressive kidney loss that includes uremia (urea and other nitrogenous residues in the blood) and can be fatal and cause other problems if there is no dialysis or kidney transplantation.Chronic Kidney Disease (CKD) is a condition characterized by a progressive loss of kidney function over time caused by many diseases.

The most effective weapons against CKD are early diagnosis and treatment, which in most of the cases can only postpone the onset of complete kidney failure. In the medical diagnosis of chronic kidney disease, two medical tests are used to detect CKD, which are by a blood test to check the glomerular filtrate or by a urine test to check albumin.

1.2 Purpose:

The rationale for testing asymptomatic people for CKD is that earlier detection might allow for the implementation of therapeutic interventions and avoidance of inappropriate exposure to nephrotoxic agents, both of which may slow the progression of CKD to end-stage kidney disease.

The detection of CKD also identifies an important risk factor for cardiovascular disease (CVD).CKD is a disorder that disrupts normal kidney function.

Due to the increasing number of people with CKD, effective prediction measures for the early diagnosis of CKD are required. The novelty of this study lies in developing the diagnosis system to detect chronic kidney diseases. This study assists experts in exploring preventive measures for CKD through early diagnosis using machine learning techniques. Risk factors for CKD patients include diabetes, blood pressure, and cardiovascular disease (CVD) [3]. CKD patients suffer from side effects, especially in the late stages, which damage the nervous and immune system. In developing countries, patients may reach the late stages, so they must undergo dialysis or kidney transplantation.

2. LITERATURE SURVEY

2.1Existing problem:

Chronic Kidney Disease (CKD) is a major medical problem, can be if treated in the early stages. Usually, people are not aware that medical tests we take for different purposes could contain valuable information concerning kidney diseases. Consequently, attributes of various medical tests are investigated to distinguish which attributes may contain helpful information about the disease. The information says that it helps us to measure the severity of the problem, the predicted survival of the patient after the illness, the pattern of the disease and work for curing the disease.

2.2 References:

S.NO	TITLE	DESCRIPTION	ALGORITHM AND TECHNIQUES USED
01.	A Machine Learning Methodology for Diagnosing Chronic Kidney Disease	A machine learning approach for diagnosing CKD was proposed in this study. A model that combines logistic regression and random forest with the aid of perceptron was utilized and it was able to attain an average accuracy of after ten times of simulation.	Feed Forward Neural Network, knearest neighbour, Naive Bayes classifier,Random Forest, Support vector machine, Logistic regression.
02.	Chronic Kidney Disease Prediction using Machine Learning	This study proposes the techniques for CKD such as Ant Colony Optimization (ACO) technique and Support Vector Machine (SVM) classifier, predicts whether the person is having CKD or not by using minimum number of features.	Support Vector Machine (SVM) classifier , Ant Colony Optimization technique

03.	Performance Analysis of Machine Learning Classifier for Predicting Chronic Kidney Disease	This proposed system detects chronic kidney disease using machine learning; They have attained an accuracy of 100% in decision tree classifier, 95.12% in random forest and 98.82% in logistic regression.	Random Forest classifier, Logistic Regression and Classification, Decision tree classifier
04.	Statistical and Data Mining Aspects on Kidney Stones: A Systematic Review and Meta-analysis	They predicted good accuracy with Classification tree and Random Forest followed by Support Vector Machines . Logistic and NN has also shown good accuracy results .	Random Forest, Support vector machine, Logistic and NN
05.	A Neural Network based Model for Predicting Chronic Kidney Diseases	The 14 different properties are analysed and linked to chronic kidney disorder victims and foretold accuracy for a machine learning algorithm named Artificial Neural Network. After analysing the outcomes, it is recognized that the algorithm gives correctness of 96	Artificial Neural Network
06.	Prediction of chronic kidney disease (CKD) using Data Science	This proposed research work is primarily focused on finding the best classification algorithm which can be used for the diagnosis of CKD based on the classification report.	Support Vector Machine, Random Forest, XGBoost, Logistic Regression, Neural networks
07.	Chronic Kidney Disease Prediction Using Data Mining	They have diagnosed kidney-related diseases using various data mining techniques, and in that, our overall objective is not to find the ideal solution but to indulge the solid diagnosis.	Back Propogation Neural Network, Random Forest Algorithm

08.	Predict chronic kidney disease using data mining algorithms in hadoop	This paper presents the prediction of chronic kidney disease using data mining classifiers. To elicitate the hidden information about chronic disease from a given dataset, data mining technology is used to make decisions.	KNN (K-Nearest Neighbor) and SVM (Support Vector Machine).
09.	Classifcation with Ant Colony Optimisation	The primary objective of this research is to propose and investigate a novel ant colony optimization-based classification rule discovery algorithm and its variants.	Ant Colony Optimization

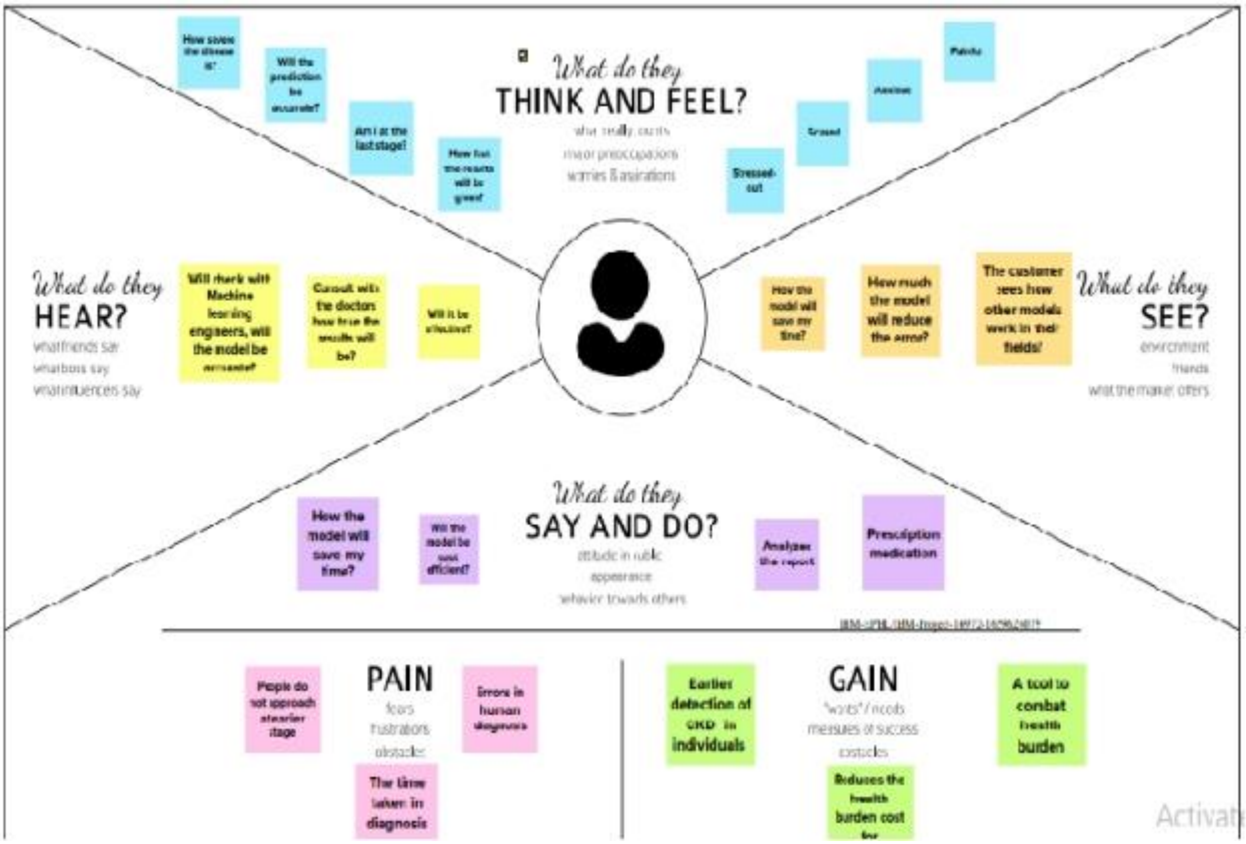
2.3 Problem Statement Definition:

Kidney disesase can lead to other health problems such as heart disease .If you have kidney disease , it increases your chances of having a stroke or heart attack. High blood pressure damages your kidneys and damaged kidneys don’t work as well to help control your blood pressure. If you have CKD you also have higher chance of having a sudden change in kidney function .Diagnosis is by blood tests to measure albumin caused by illness , injury or certain medicanes. This is called acute kidney injury (AKI). Screening at risk people is recommended. Initial treatments may include medications to lower blood pressure, blood sugar and cholesterol.

Many people are afraid to learn that they have kidney disease because they think that all kidney disease leads to diagnosis leads to dialysis. However most people with kidney disease will not need dialysis. If you have kidney disease, you can continue to live a productive life, work, spend time with friends and family, stay physically active and do other things you enjoy. You may need to change what you eat and add healthy habits to your daily routine to help you protect your kidneys.

3. IDEATION AND PROPOSED SOLUTION

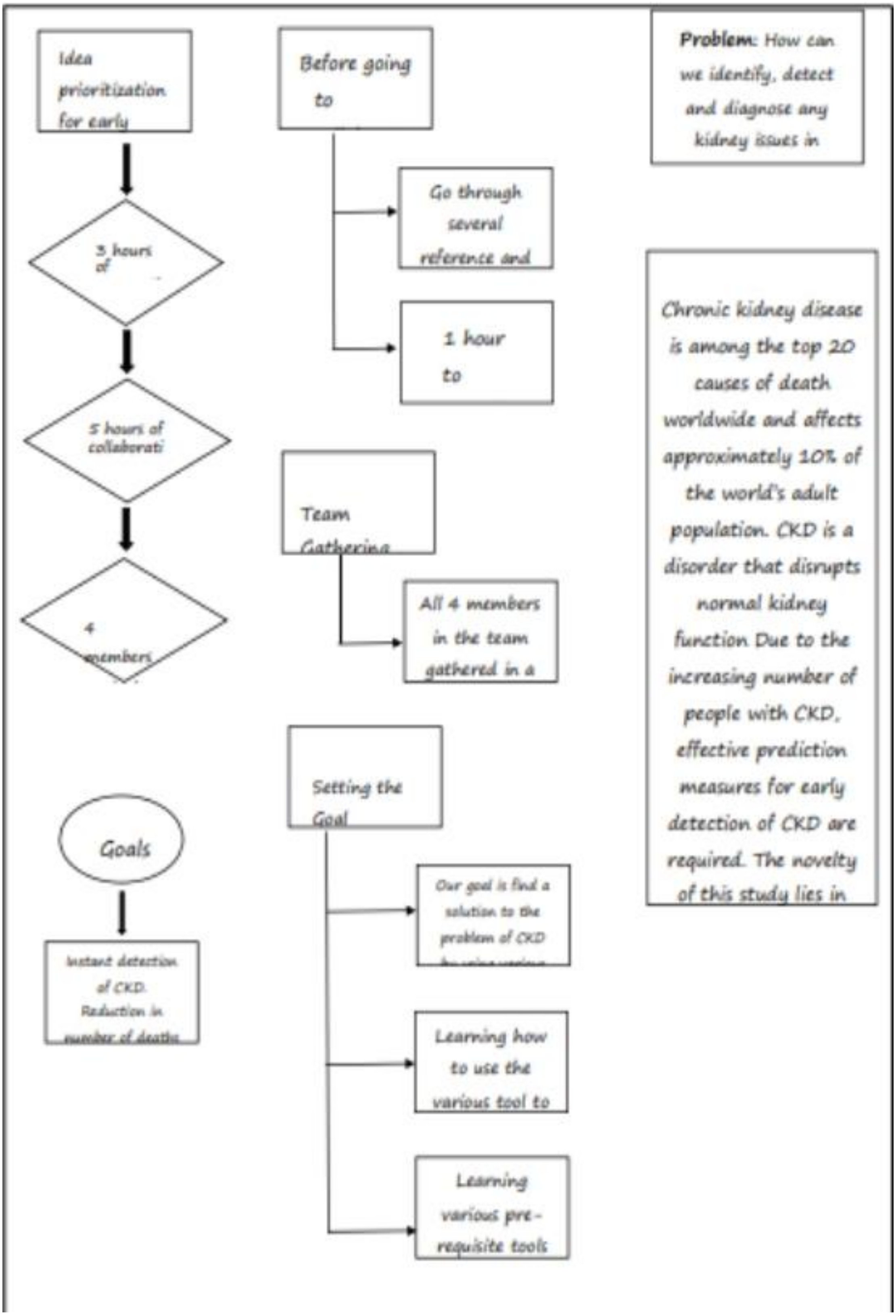
3.1 Empathy Map Canvas


What do they
THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations
How severe the disease is?
Will the prediction be accurate?
Am I at the last stage?
How fast the results will be given?
Stressed-out
Stressed
Anxious
Panic
What do they
HEAR?
what friends say
what boss say
what influences say
Will check with Machine learning engineers, will the model be accurate?
Consult with the doctors how true the results will be?
Will it be effective?
What do they
SEE?
environment
friends
what the market offers
How the model will save my time?
How much the model will reduce the error?
The customer sees how other models work in their fields!
What do they
SAY AND DO?
attitude in public
appearance
behavior towards others
How the model will save my time?
Will the model be cost efficient?
Analyze the report
Prescription medication
PAIN
fears
frustrations
obstacles
People do not approach at earlier stage
Errors in human diagnosis
The time taken in diagnosis
GAIN
"wants" / needs
measures of success
obstacles
Earlier detection of CKD in individuals
Reduces the health burden cost for
A tool to combat health burden
Activat

3.2 Ideation and Brainstroming

Brainstorming provides a free and open environment that encourages everyone within a team to to participate in the creative thinking process that leads to problem-solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Reference:
Step1:
Team Gathering ,Colloboration and select the problem statement


Idea prioritization for early
3 hours of
5 hours of collaborati
4 members
Goals
Instant detection of CKD. Reduction in number of deaths
Before going to
Go through several reference and
1 hour to
Team Gathering
All 4 members in the team gathered in a
Setting the Goal
Our goal is find a solution to the problem of CKD by using various
Learning how to use the various tool to
Learning various pre-requisite tools

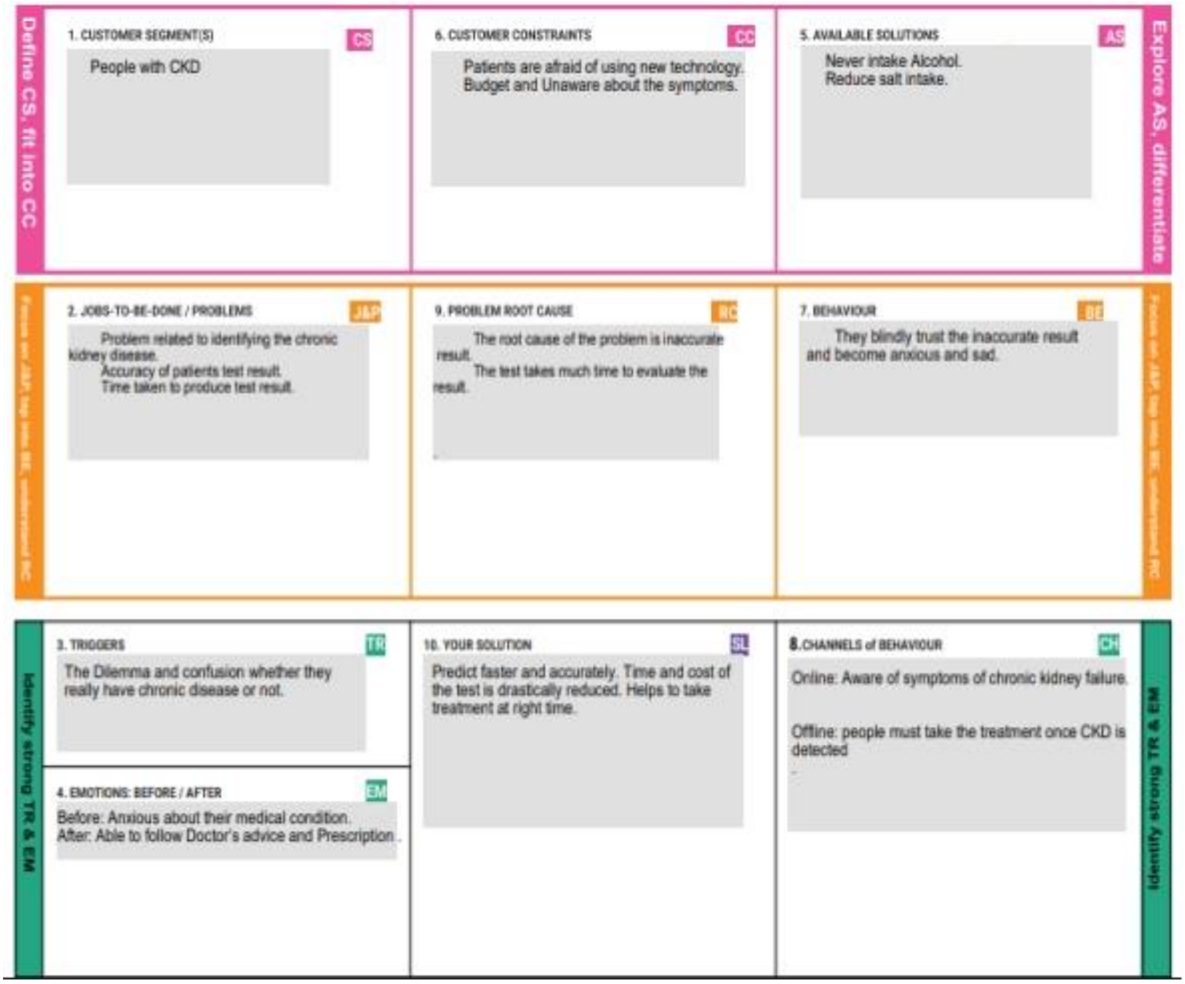
Problem: How can we identify, detect and diagnose any kidney issues in

Chronic kidney disease is among the top 20 causes of death worldwide and affects approximately 10% of the world's adult population. CKD is a disorder that disrupts normal kidney function Due to the increasing number of people with CKD, effective prediction measures for early detection of CKD are required. The novelty of this study lies in

3.3 Proposed Solution

Once any person gets kidney disease, they may suffer from the disease which may decrease their working capability as well as living quality. Our aim is to predict patients with chronic kidney failure (ckd) disease and patients who do not (not-ckd) suffer from the disease. So for that we are building a Machine Learning model to predict the compressive strength of concrete using IBM Watson AutoAI Machine Learning Service. The model is deployed on IBM cloud to get a scoring end point which can be used as web app building. We make use of the scoring end point to give user input values to the deployed model. The model prediction is then showcased on User Interface.

3.4 Problem Solution fit


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

1. CUSTOMER SEGMENT(S)

People with CKD

6. CUSTOMER CONSTRAINTS

Patients are afraid of using new technology.
Budget and Unaware about the symptoms.

5. AVAILABLE SOLUTIONS

Never intake Alcohol.
Reduce salt intake.

2. JOBS-TO-BE-DONE / PROBLEMS

Problem related to identifying the chronic kidney disease.
Accuracy of patients test result.
Time taken to produce test result.

9. PROBLEM ROOT CAUSE

The root cause of the problem is inaccurate result.
The test takes much time to evaluate the result.

7. BEHAVIOUR

They blindly trust the inaccurate result and become anxious and sad.

3. TRIGGERS

The Dilemma and confusion whether they really have chronic disease or not.

4. EMOTIONS: BEFORE / AFTER

Before: Anxious about their medical condition.
After: Able to follow Doctor's advice and Prescription.

10. YOUR SOLUTION

Predict faster and accurately. Time and cost of the test is drastically reduced. Helps to take treatment at right time.

8.CHANNELS of BEHAVIOUR

Online: Aware of symptoms of chronic kidney failure.

Offline: people must take the treatment once CKD is detected

4. REQUIREMENT ANALYSIS

4.1 Functional Requirement

Following are the functional requirements of the proposed solution.

FR NO.	**Functional Requirement (Epic)**	**Functional Requirement (Epic)**
FR-1	User Registration	Registration are done through forms Registration are done through Gmail
FR-2	User Confirmation	Confirmation via Email will be sent to user Confirmation via OTP will be generated
FR-3	Data Collection	Input data through Form will be collected The data collected and stored in database
FR-4	Data Analysis	Check whether the input format is correct Pre-process the data
FR-5	Prediction of disease	Evaluate the ML model with the dataStore that result in database
FR-6	Provide output to the user	Display the prediction result in UI

4.2 Non-Functional Requirement

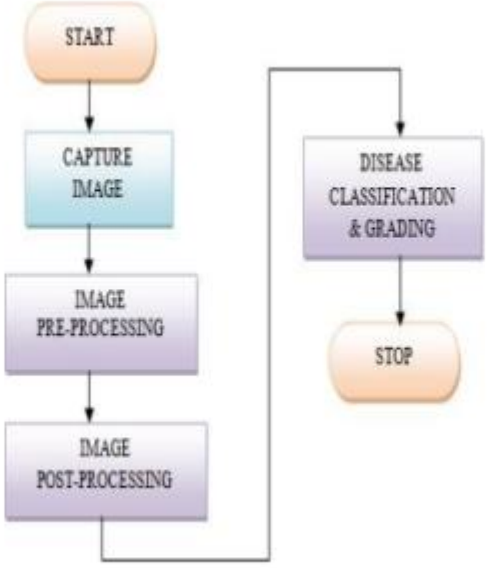
FR NO.	**Non Functional Requirement (Epic)**	**Non Functional Requirement (Epic)**
NFR-1	Usability	The Web UI is simple and easy for navigation and understanding, even by common people with the help of knowing the labels and description.
NFR-2	Security	The users are required to register so the verified users are only allowed to use the application.
NFR-3	Reliability	Accuracy and freedom from errors are expected in the predicted result
NFR-4	Performance	The webpage should be loaded

		quickly even when the internet connection is low. The ML Model should predict the result with great accuracy and speed
NFR-5	Availability	The website should be free from any downtime for any updates.
NFR-6	Scalability	This simple web application should have high scalability for supporting more/large number of users

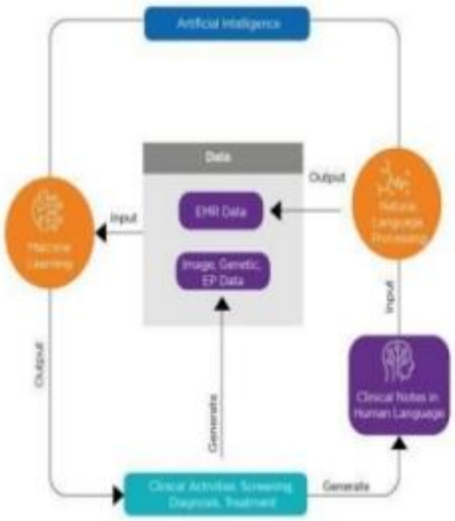
5. PROJECT DESIGN

5.1 Data Flow Diagrams

Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



Example: DFD Level 0 (AI driven digitization for chronic disease)



5.2 Solution and Technical Architecture

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions.

Its goals are to:

- Nanoparticle-based magnetic resonance imaging (MRI) is the best tech solution to detect early Chronic Kidney Diseases. As it is in development stage, we use machine learning algorithms.

- First, we apply class balancing in order to tackle the non-uniform distribution, then feature ranking and analysis are performed, and finally, several ML models are trained and evaluated based on various performance metrics to find a solution with a higher accuracy.

● Development phases:

○ Step 1: Data pre-processing.

○ Step 2: Features Analysis.

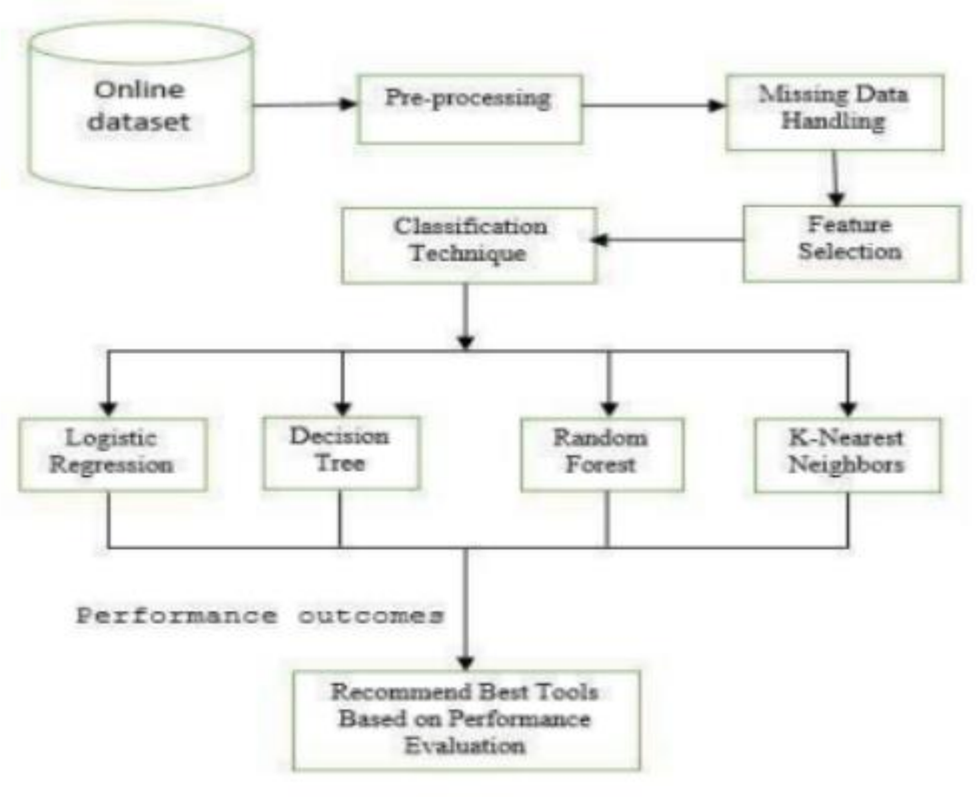
○ Step 3: Comparative Evaluation of various models.

○ Step 4: Performance Evaluation.

● Requirements: A dataset of people who are diagnosed with kidney failure with the attributes like Diastolic Blood Pressure, Albumin level, Glucose, Blood Urea, Serum Creatinine, Sodium, Potassium, etc.

● Based on the past specifications of Chronic Kidney Disease prediction analysis.

Example - Solution Architecture Diagram



5.3 User Stories

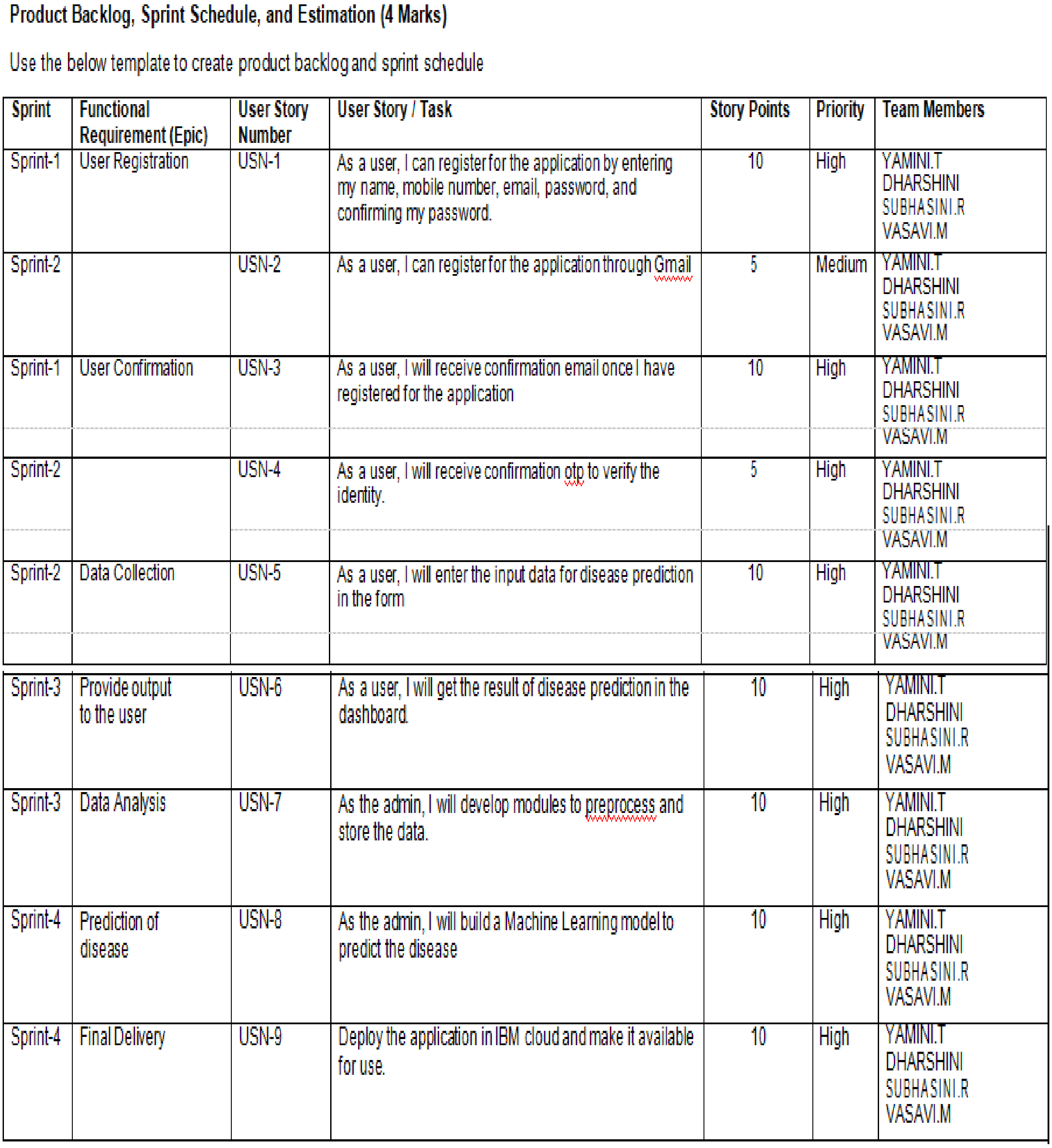
Use the below template to list all the user stories for the product.

Team ID : PNT2022TMID16555

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Releas e
Nurse(Mobile user)	Registration	USN-1	As a user, I can register for the application by entering patient name,age,gender.	I can access my account / dashboard	High	Sprint-1
Collecting certificate	Collect	USN-2	Certificate is necessary for testing RBC,CAD,PC,DM,PE	I can access my account / dashboard	High	Sprint-2
Testing process	Test	USN-3	After testing we will find that the patient will have kidney disease or not.	I can access my account / dashboard	High	Sprint-3

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning and Estimation



Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	User Registration	USN-1	As a user, I can register for the application by entering my name, mobile number, email, password, and confirming my password.	10	High	YAMINI.T DHARSHINI SUBHASINI.R VASAVI.M
Sprint-2		USN-2	As a user, I can register for the application through Gmail	5	Medium	YAMINI.T DHARSHINI SUBHASINI.R VASAVI.M
Sprint-1	User Confirmation	USN-3	As a user, I will receive confirmation email once I have registered for the application	10	High	YAMINI.T DHARSHINI SUBHASINI.R VASAVI.M
Sprint-2		USN-4	As a user, I will receive confirmation otp to verify the identity.	5	High	YAMINI.T DHARSHINI SUBHASINI.R VASAVI.M
Sprint-2	Data Collection	USN-5	As a user, I will enter the input data for disease prediction in the form	10	High	YAMINI.T DHARSHINI SUBHASINI.R VASAVI.M
Sprint-3	Provide output to the user	USN-6	As a user, I will get the result of disease prediction in the dashboard.	10	High	YAMINI.T DHARSHINI SUBHASINI.R VASAVI.M
Sprint-3	Data Analysis	USN-7	As the admin, I will develop modules to preprocess and store the data.	10	High	YAMINI.T DHARSHINI SUBHASINI.R VASAVI.M
Sprint-4	Prediction of disease	USN-8	As the admin, I will build a Machine Learning model to predict the disease	10	High	YAMINI.T DHARSHINI SUBHASINI.R VASAVI.M
Sprint-4	Final Delivery	USN-9	Deploy the application in IBM cloud and make it available for use.	10	High	YAMINI.T DHARSHINI SUBHASINI.R VASAVI.M

6.2 Sprint Delivery Schedule:

Project Tracker, Velocity & Burndown Chart: (4 Marks)

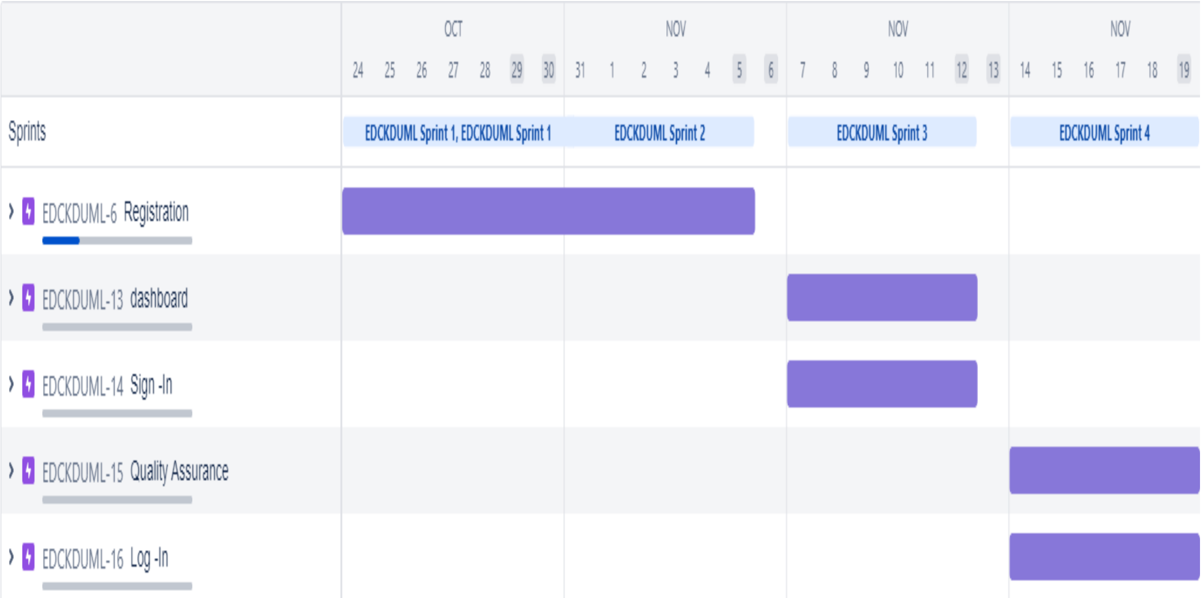
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

Velocity:
We have a 6-day sprint duration, and the velocity of the team is 20 (points per sprint).
The team’s average velocity (AV) per iteration unit (story points per day)

AV = Sprint duration / velocity = 20 / 6 = 3.33

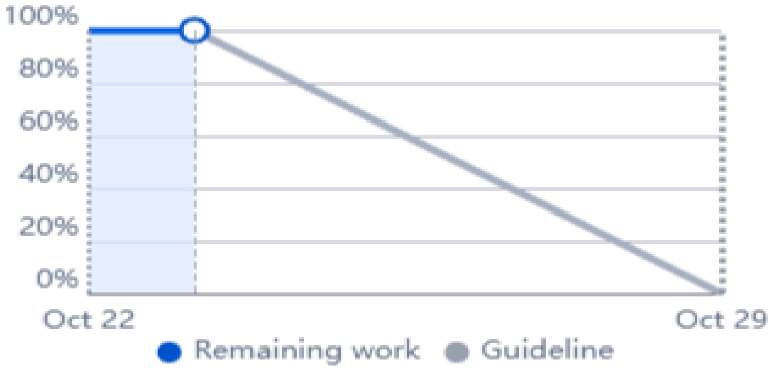
6.3 Reports from JIRA :

Roadmap:

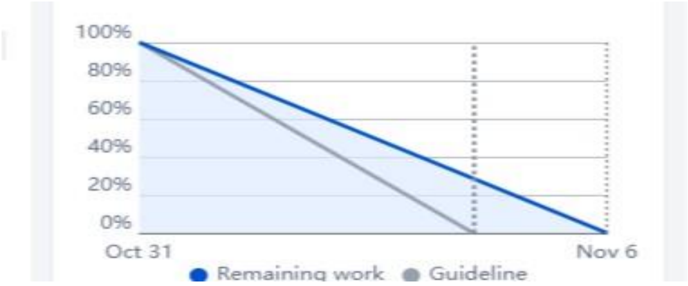


Burnt Down Chart:

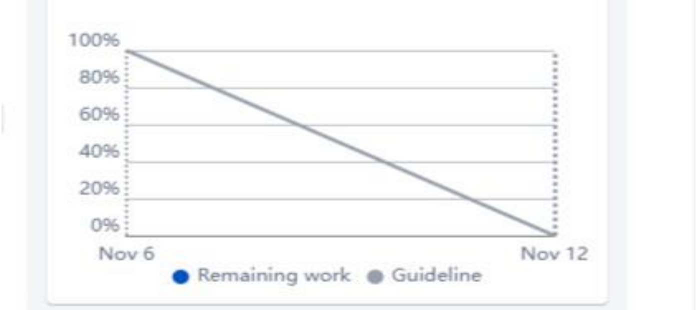
Sprint 1:



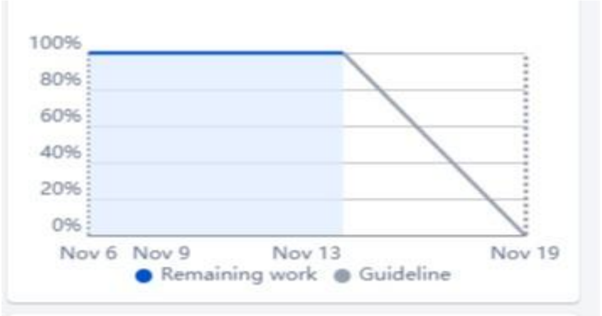
Sprint 2:



Sprint 3:

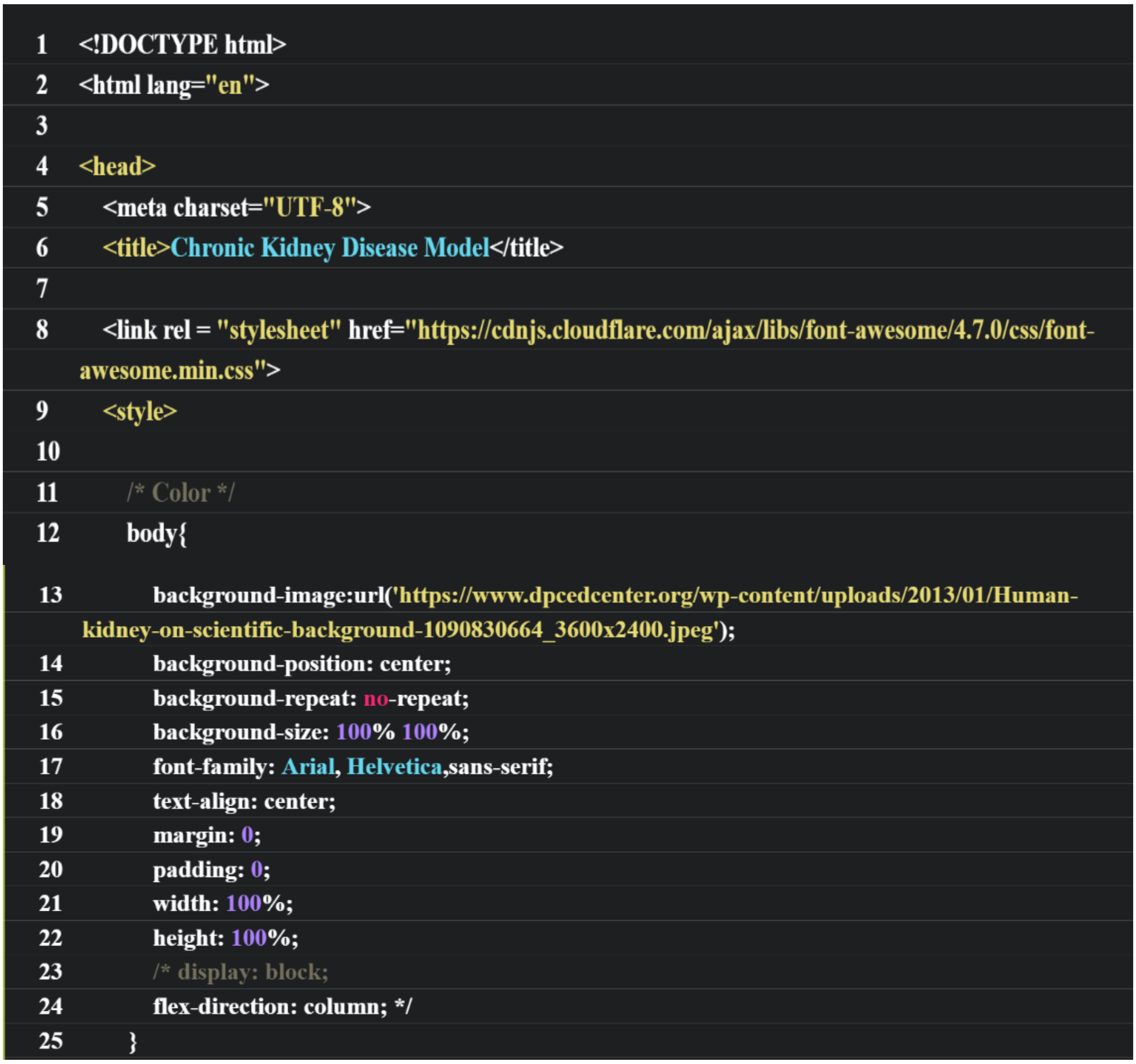


Sprint 4:

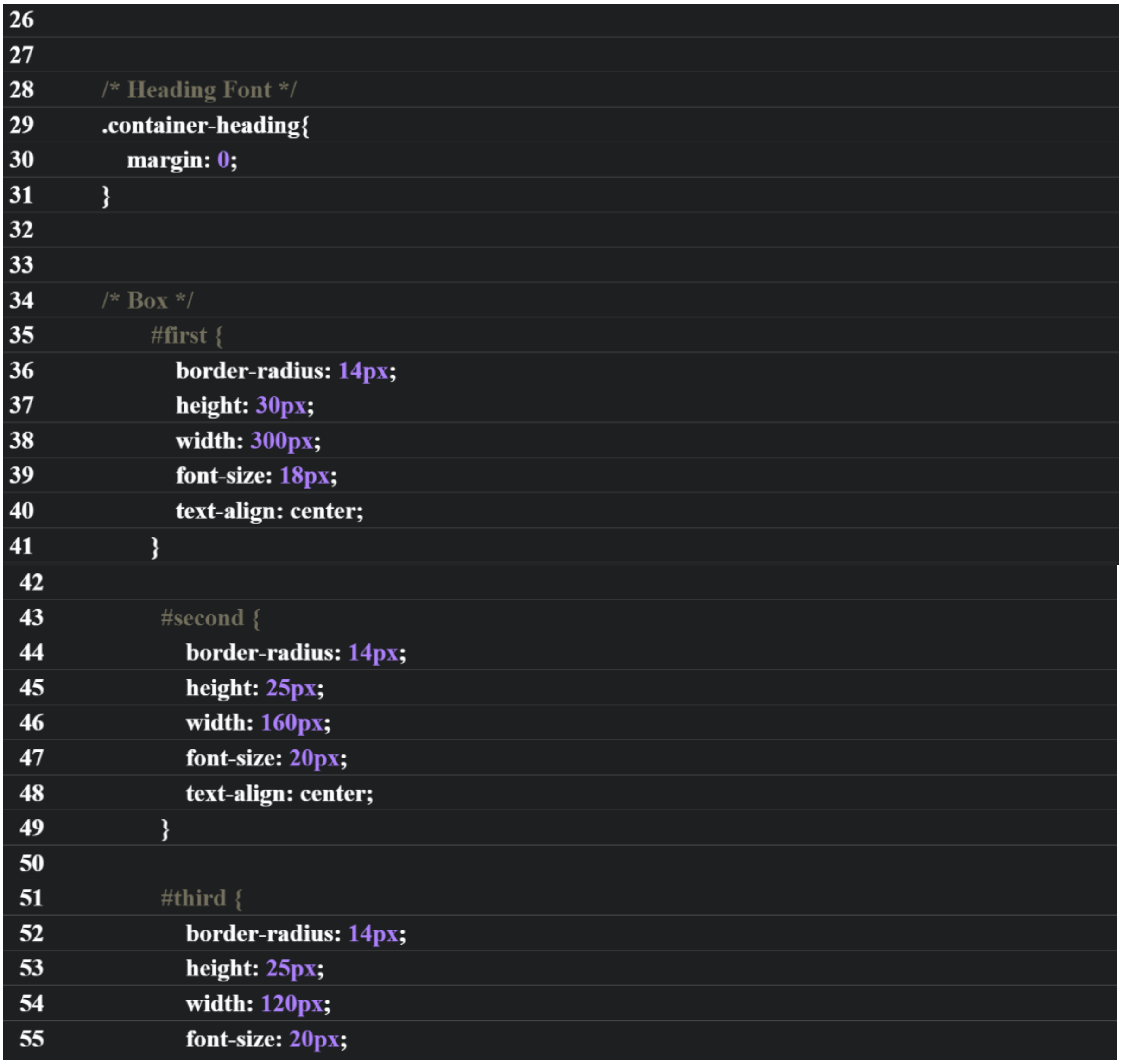


7. CODING AND SOLUTIONS

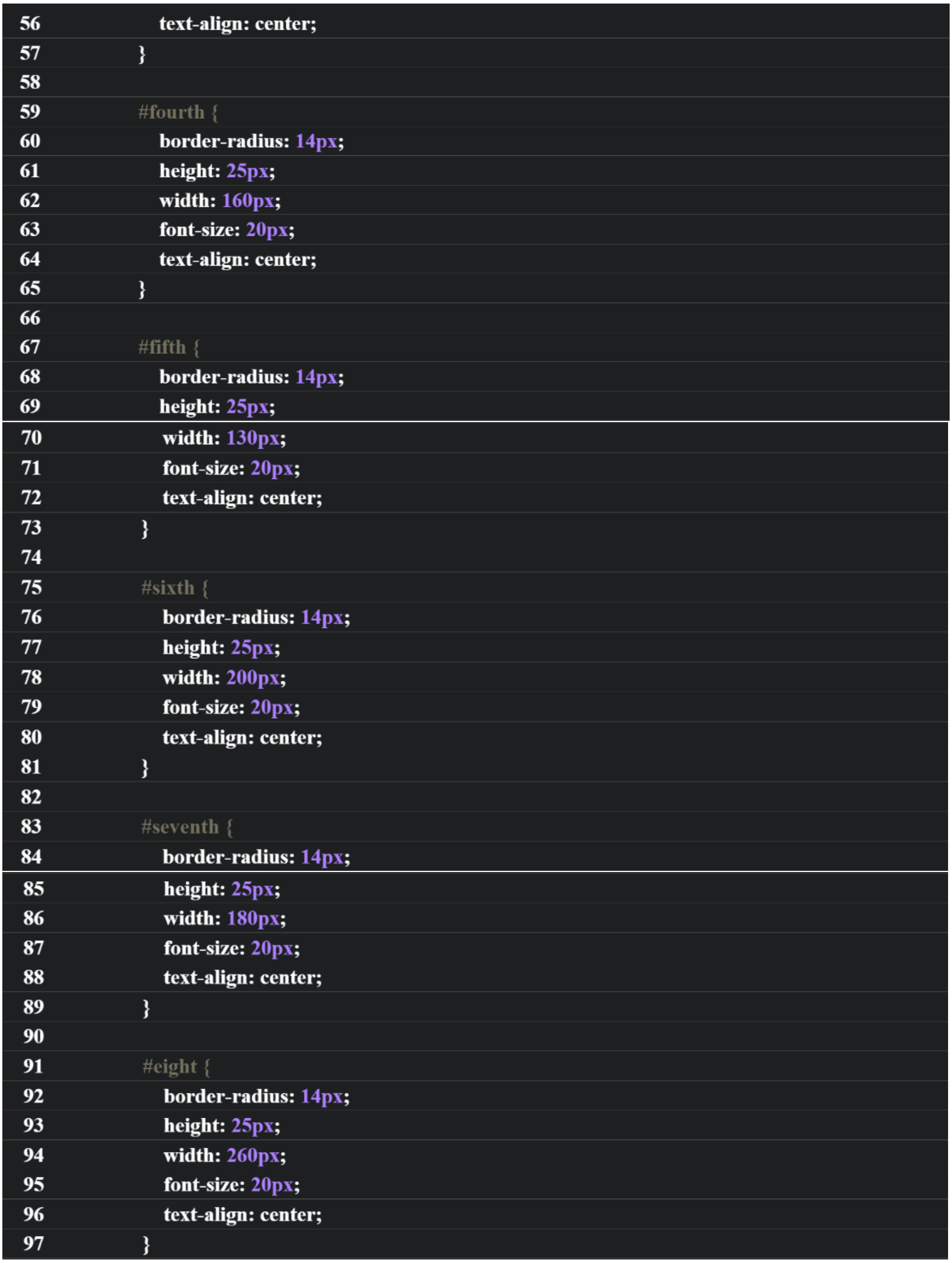
INDEX.HTML:



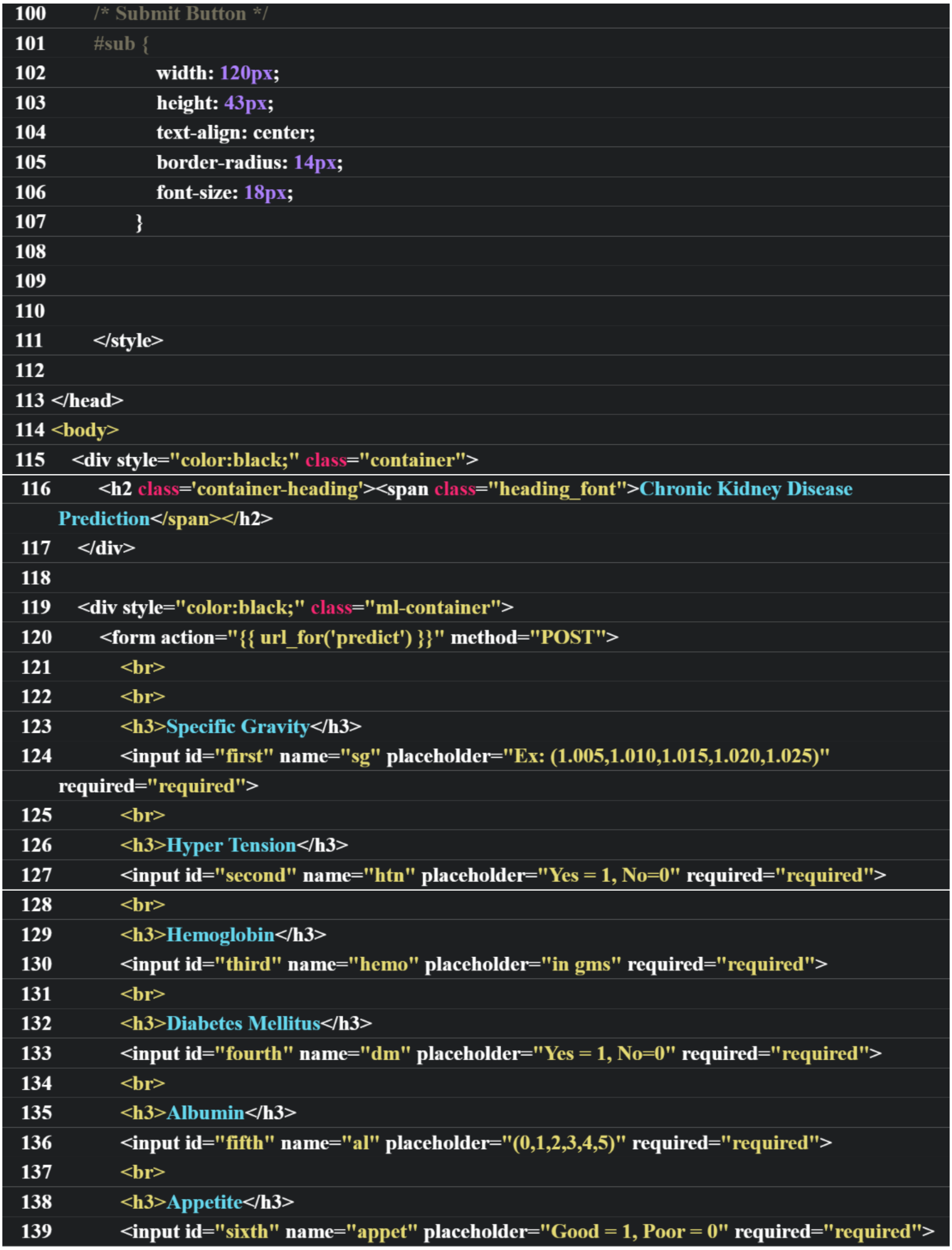
```
<!DOCTYPE html>
<html lang="en">

<head>
  <meta charset="UTF-8">
  <title>Chronic Kidney Disease Model</title>

  <link rel = "stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
  <style>

      /* Color */
      body{
          background-image:url('https://www.dpcedcenter.org/wp-content/uploads/2013/01/Human-kidney-on-scientific-background-1090830664_3600x2400.jpeg');
          background-position: center;
          background-repeat: no-repeat;
          background-size: 100% 100%;
          font-family: Arial, Helvetica,sans-serif;
          text-align: center;
          margin: 0;
          padding: 0;
          width: 100%;
          height: 100%;
          /* display: block;
          flex-direction: column; */
      }
```



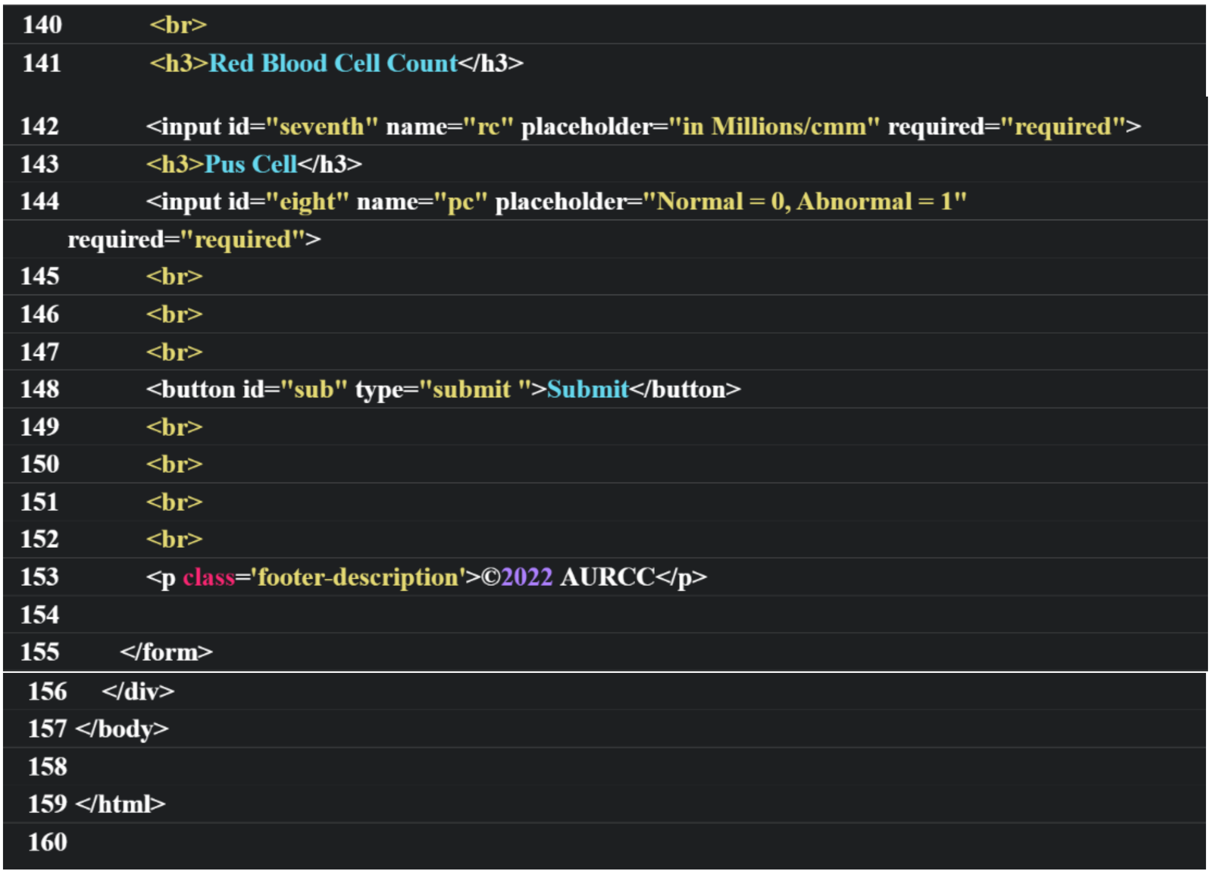
```
/* Heading Font */
.container-heading{
    margin: 0;
}


/* Box */
        #first {
            border-radius: 14px;
            height: 30px;
            width: 300px;
            font-size: 18px;
            text-align: center;
        }

        #second {
            border-radius: 14px;
            height: 25px;
            width: 160px;
            font-size: 20px;
            text-align: center;
        }

        #third {
            border-radius: 14px;
            height: 25px;
            width: 120px;
            font-size: 20px;
```



```
        text-align: center;
    }

    #fourth {
        border-radius: 14px;
        height: 25px;
        width: 160px;
        font-size: 20px;
        text-align: center;
    }

    #fifth {
        border-radius: 14px;
        height: 25px;
        width: 130px;
        font-size: 20px;
        text-align: center;
    }

    #sixth {
        border-radius: 14px;
        height: 25px;
        width: 200px;
        font-size: 20px;
        text-align: center;
    }

    #seventh {
        border-radius: 14px;
        height: 25px;
        width: 180px;
        font-size: 20px;
        text-align: center;
    }

    #eight {
        border-radius: 14px;
        height: 25px;
        width: 260px;
        font-size: 20px;
        text-align: center;
    }
```

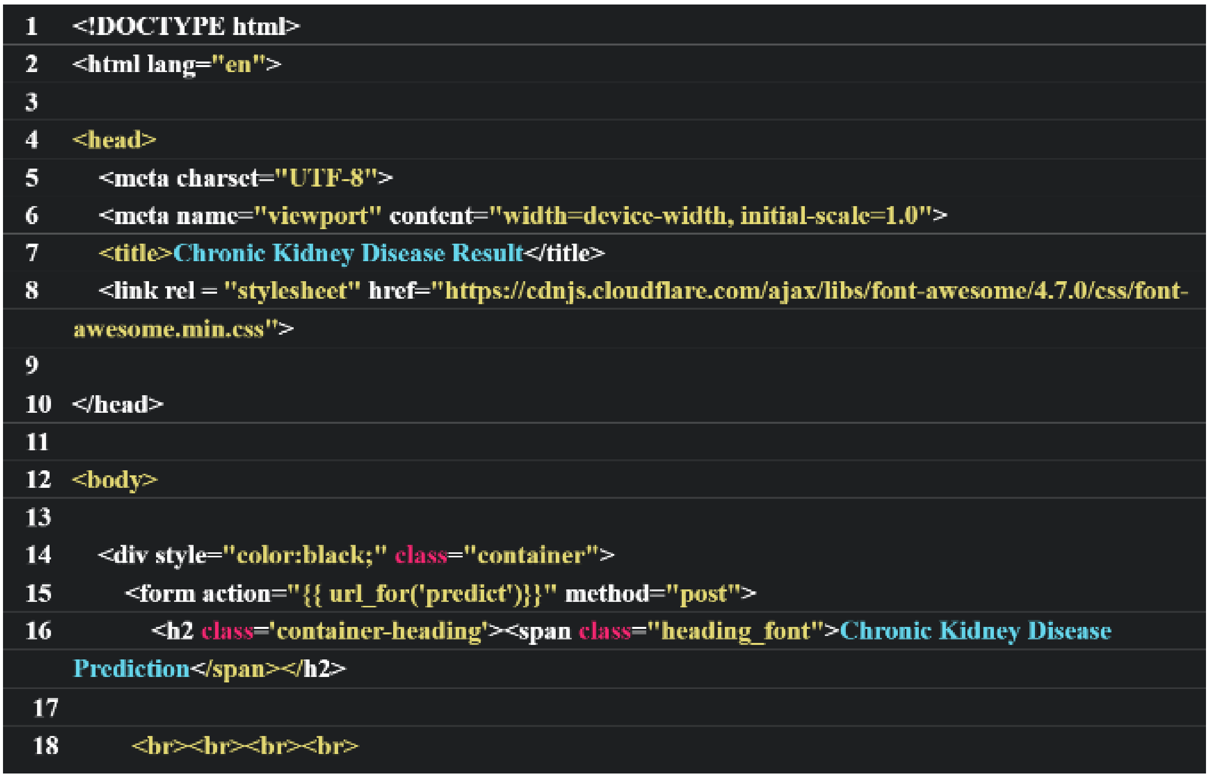


```
        /* Submit Button */
        #sub {
                width: 120px;
                height: 43px;
                text-align: center;
                border-radius: 14px;
                font-size: 18px;
              }



        </style>

</head>
<body>
    <div style="color:black;" class="container">
        <h2 class='container-heading'><span class="heading_font">Chronic Kidney Disease Prediction</span></h2>
    </div>

    <div style="color:black;" class="ml-container">
        <form action="{{ url_for('predict') }}" method="POST">
            <br>
            <br>
            <h3>Specific Gravity</h3>
            <input id="first" name="sg" placeholder="Ex: (1.005,1.010,1.015,1.020,1.025)" required="required">
            <br>
            <h3>Hyper Tension</h3>
            <input id="second" name="htn" placeholder="Yes = 1, No=0" required="required">
            <br>
            <h3>Hemoglobin</h3>
            <input id="third" name="hemo" placeholder="in gms" required="required">
            <br>
            <h3>Diabetes Mellitus</h3>
            <input id="fourth" name="dm" placeholder="Yes = 1, No=0" required="required">
            <br>
            <h3>Albumin</h3>
            <input id="fifth" name="al" placeholder="(0,1,2,3,4,5)" required="required">
            <br>
            <h3>Appetite</h3>
            <input id="sixth" name="appet" placeholder="Good = 1, Poor = 0" required="required">
```

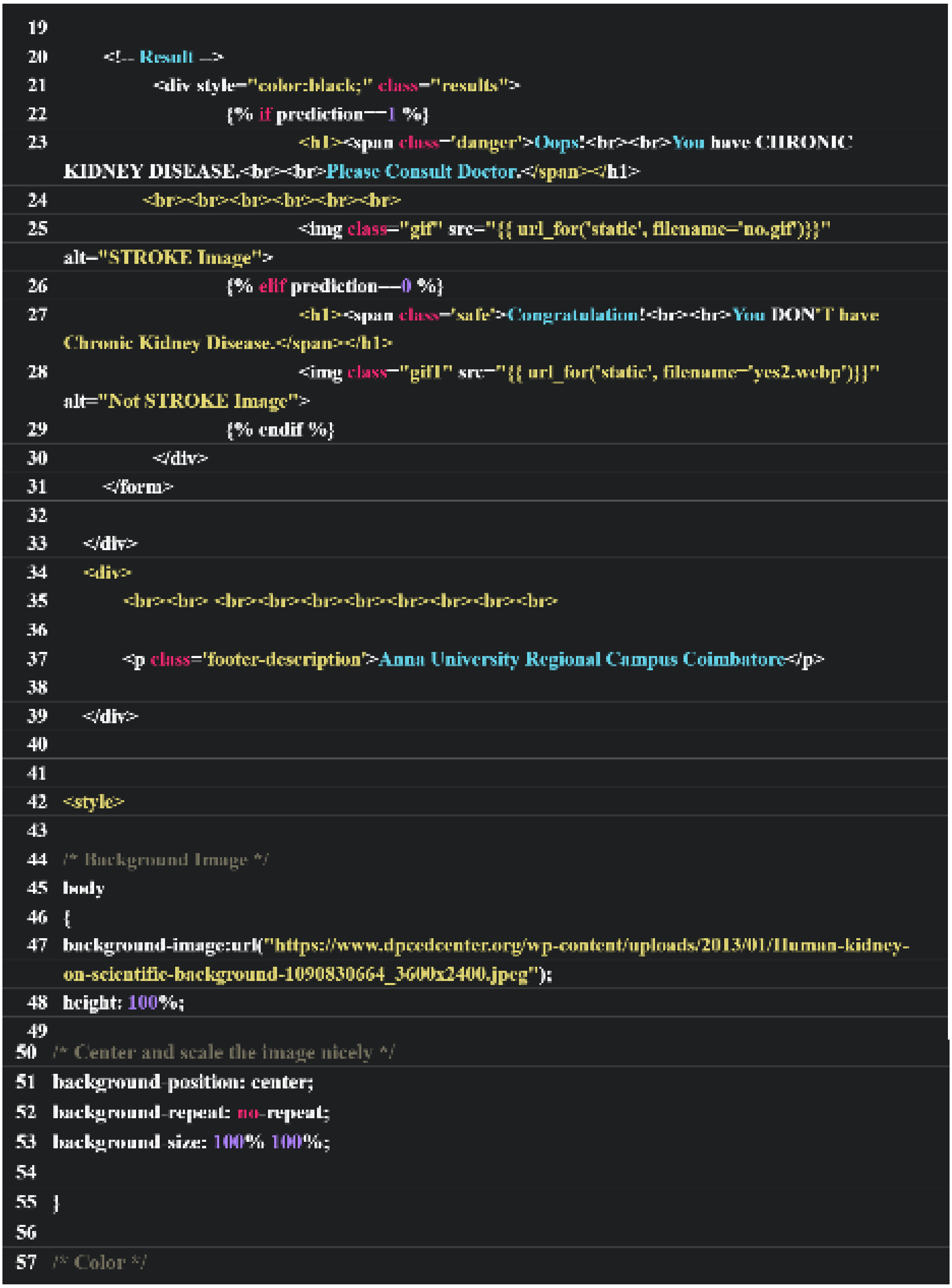


```
          <br>
          <h3>Red Blood Cell Count</h3>

          <input id="seventh" name="rc" placeholder="in Millions/cmm" required="required">
          <h3>Pus Cell</h3>
          <input id="eight" name="pc" placeholder="Normal = 0, Abnormal = 1"
    required="required">
          <br>
          <br>
          <br>
          <button id="sub" type="submit ">Submit</button>
          <br>
          <br>
          <br>
          <br>
          <p class='footer-description'>©2022 AURCC</p>

        </form>
    </div>
</body>

</html>

```

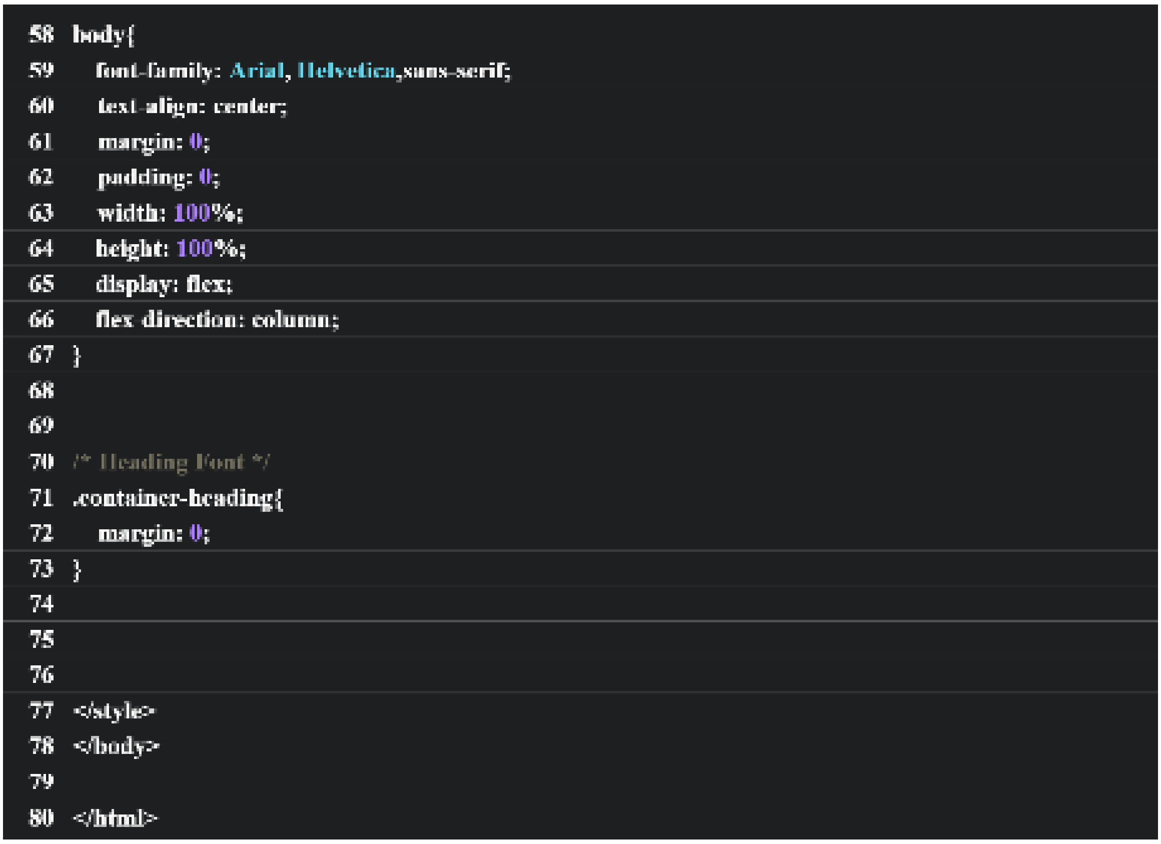
RESULT.HTML:



```
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Chronic Kidney Disease Result</title>
    <link rel = "stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-
awesome.min.css">

</head>

<body>

    <div style="color:black;" class="container">
        <form action="{{ url_for('predict')}}" method="post">
            <h2 class='container-heading'><span class="heading_font">Chronic Kidney Disease
Prediction</span></h2>

            <br><br><br><br>
```

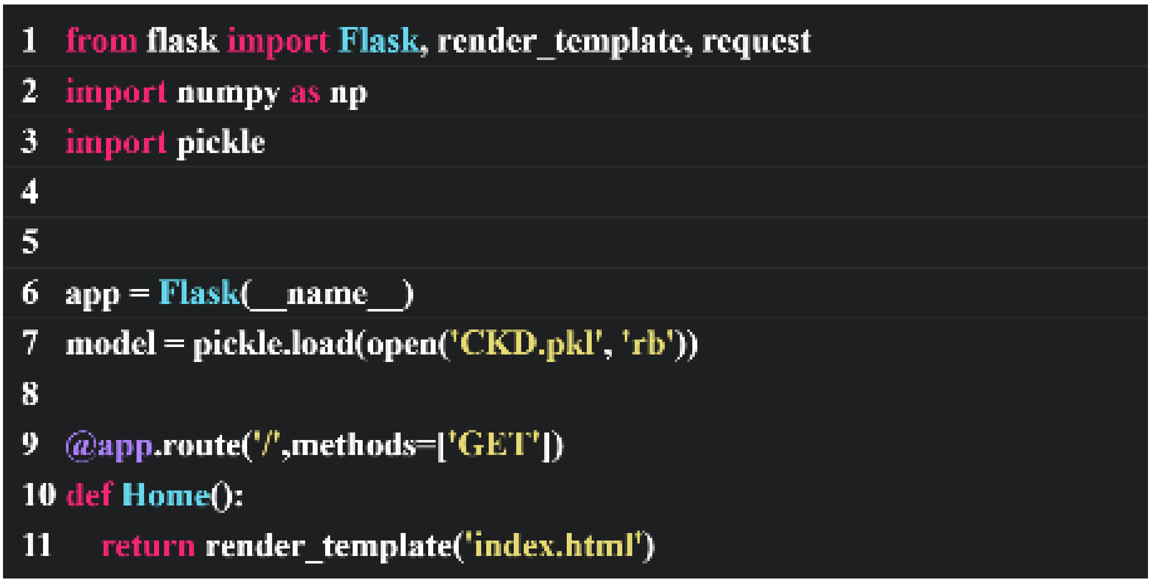


```

        <!-- Result -->
             <div style="color:black;" class="results">
                     {% if prediction==1 %}
                             <h1><span class='danger'>Oops!<br><br>You have CHRONIC KIDNEY DISEASE.<br><br>Please Consult Doctor.</span></h1>
               <br><br><br><br><br><br>
                             <img class="gif" src="{{ url_for('static', filename='no.gif')}}" alt="STROKE Image">
                     {% elif prediction==0 %}
                             <h1><span class='safe'>Congratulation!<br><br>You DON'T have Chronic Kidney Disease.</span></h1>
                             <img class="gif1" src="{{ url_for('static', filename='yes2.webp')}}" alt="Not STROKE Image">
                     {% endif %}
             </div>
        </form>

    </div>
    <div>
         <br><br> <br><br><br><br><br><br><br><br>

         <p class='footer-description'>Anna University Regional Campus Coimbatore</p>

    </div>


<style>

/* Background Image */
body
{
background-image:url("https://www.dpcedcenter.org/wp-content/uploads/2013/01/Human-kidney-on-scientific-background-1090830664_3600x2400.jpeg");
height: 100%;

/* Center and scale the image nicely */
background-position: center;
background-repeat: no-repeat;
background-size: 100% 100%;

}

/* Color */
```

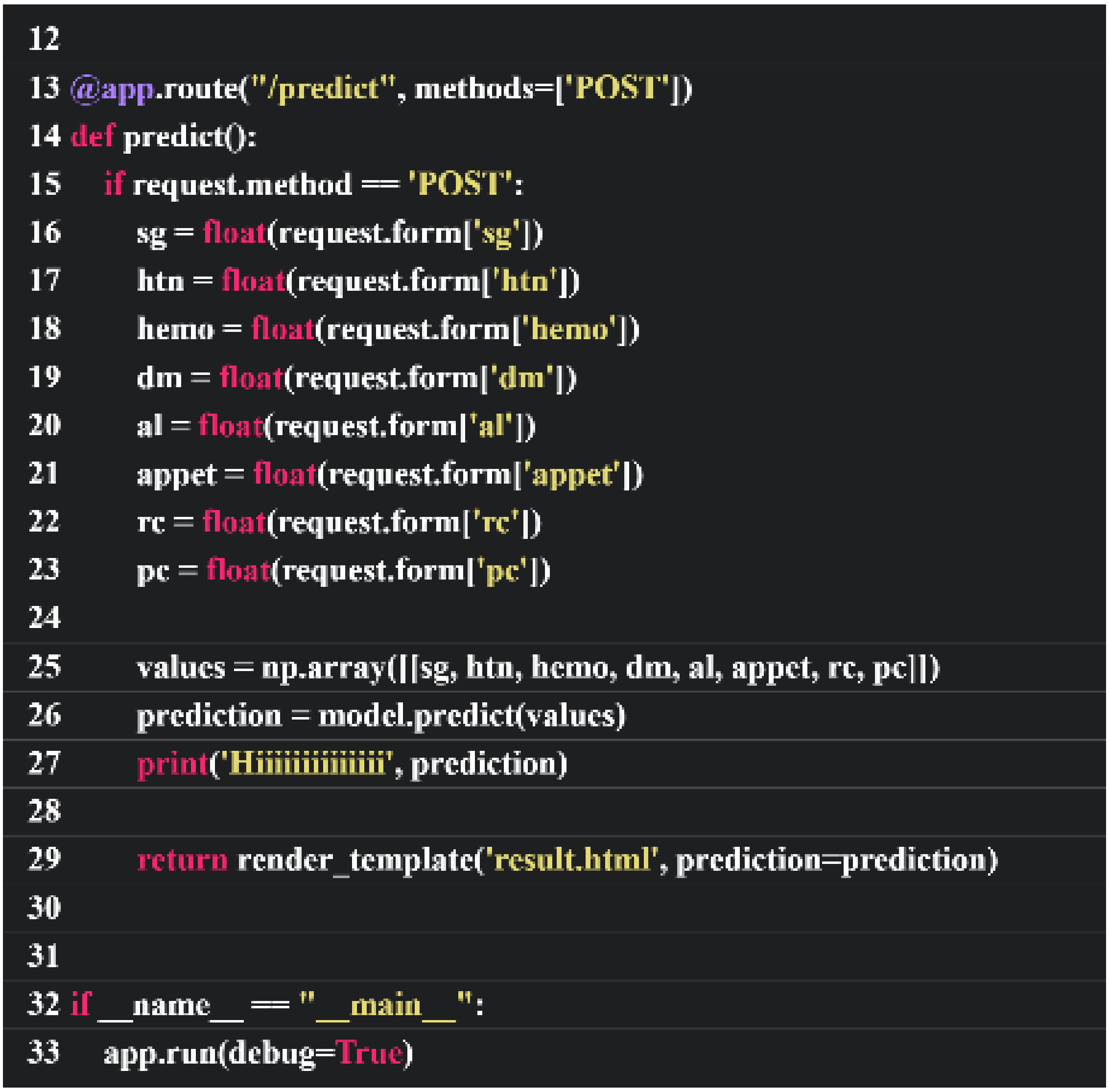


```
body{
   font-family: Arial, Helvetica,sans-serif;
   text-align: center;
   margin: 0;
   padding: 0;
   width: 100%;
   height: 100%;
   display: flex;
   flex-direction: column;
}


/* Heading Font */
.container-heading{
   margin: 0;
}



</style>
</body>

</html>
```

APP.PY:



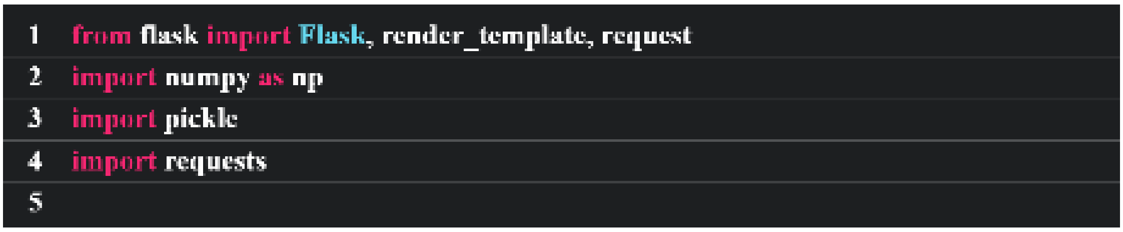
```
from flask import Flask, render_template, request
import numpy as np
import pickle


app = Flask(__name__)
model = pickle.load(open('CKD.pkl', 'rb'))

@app.route('/',methods=['GET'])
def Home():
    return render_template('index.html')
```



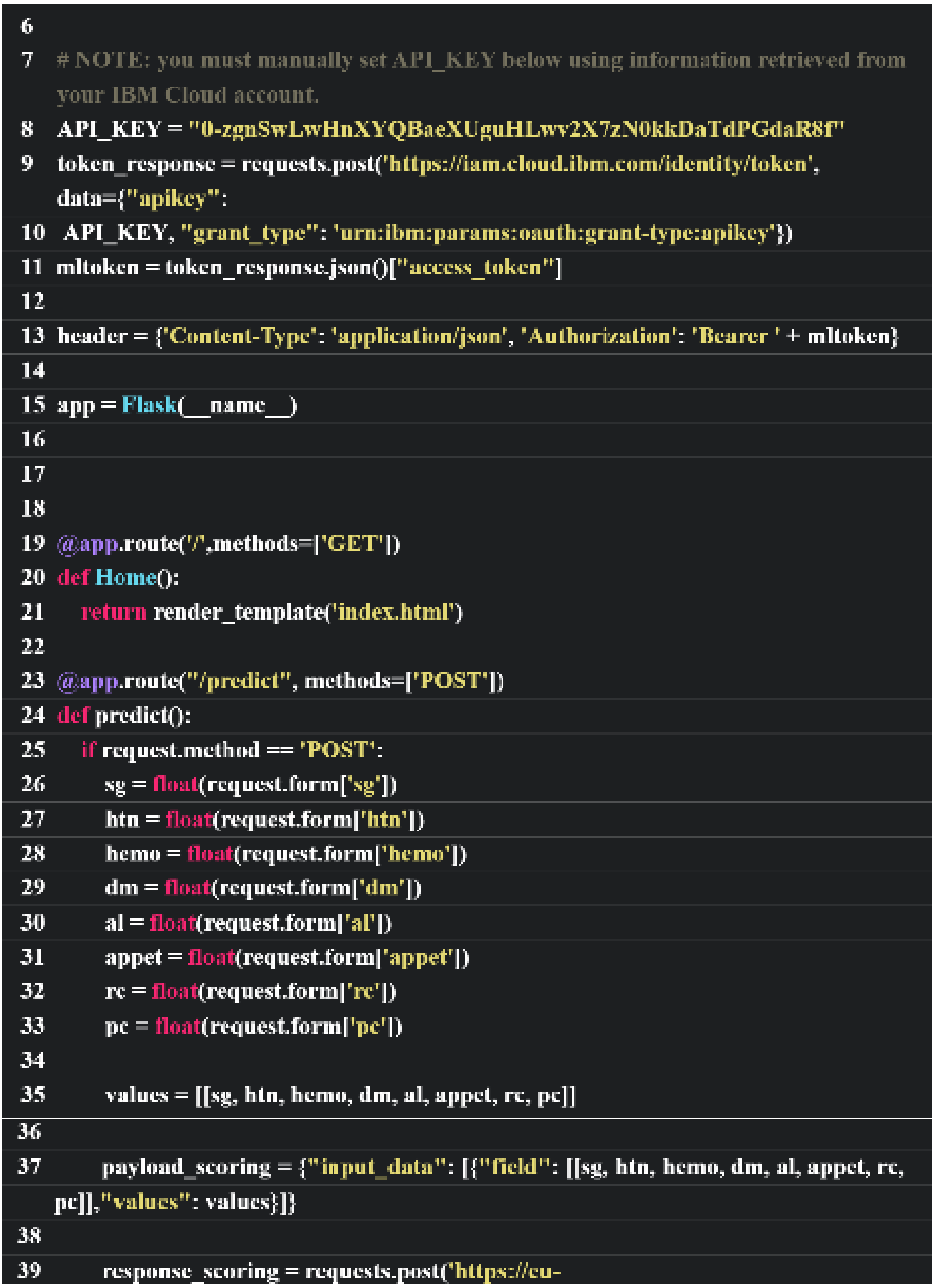
```
@app.route("/predict", methods=['POST'])
def predict():
    if request.method == 'POST':
        sg = float(request.form['sg'])
        htn = float(request.form['htn'])
        hemo = float(request.form['hemo'])
        dm = float(request.form['dm'])
        al = float(request.form['al'])
        appet = float(request.form['appet'])
        rc = float(request.form['rc'])
        pc = float(request.form['pc'])

        values = np.array([[sg, htn, hemo, dm, al, appet, rc, pc]])
        prediction = model.predict(values)
        print('Hiiiiiiiiiiiii', prediction)

        return render_template('result.html', prediction=prediction)


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

IBM DEPLOYMENT:

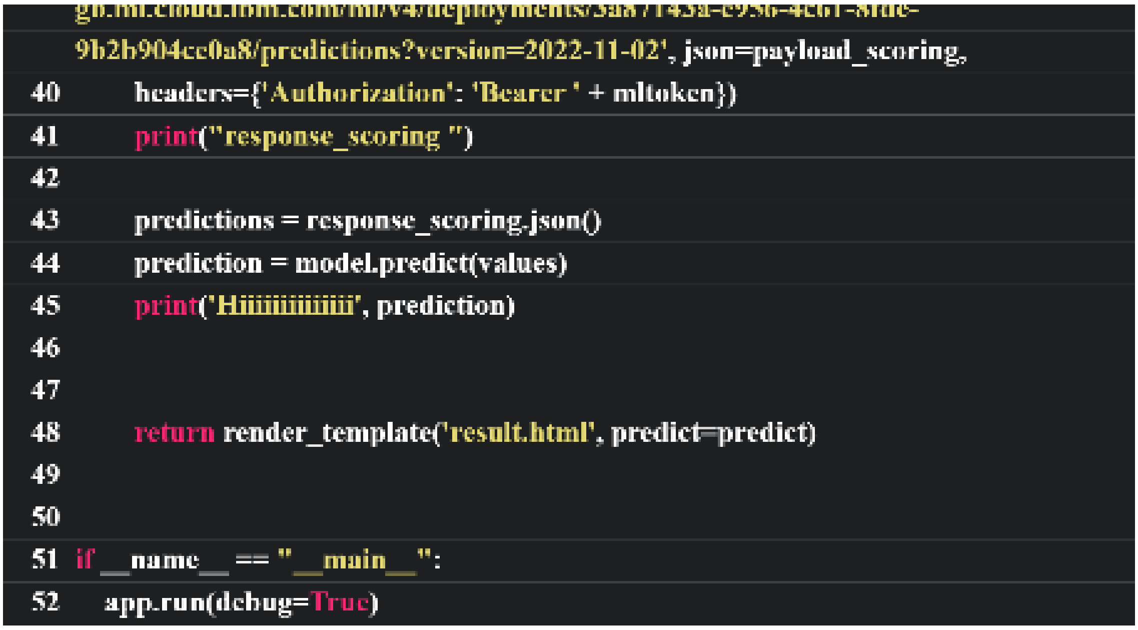
APP_IBM.PY:



```
from flask import Flask, render_template, request
import numpy as np
import pickle
import requests

```



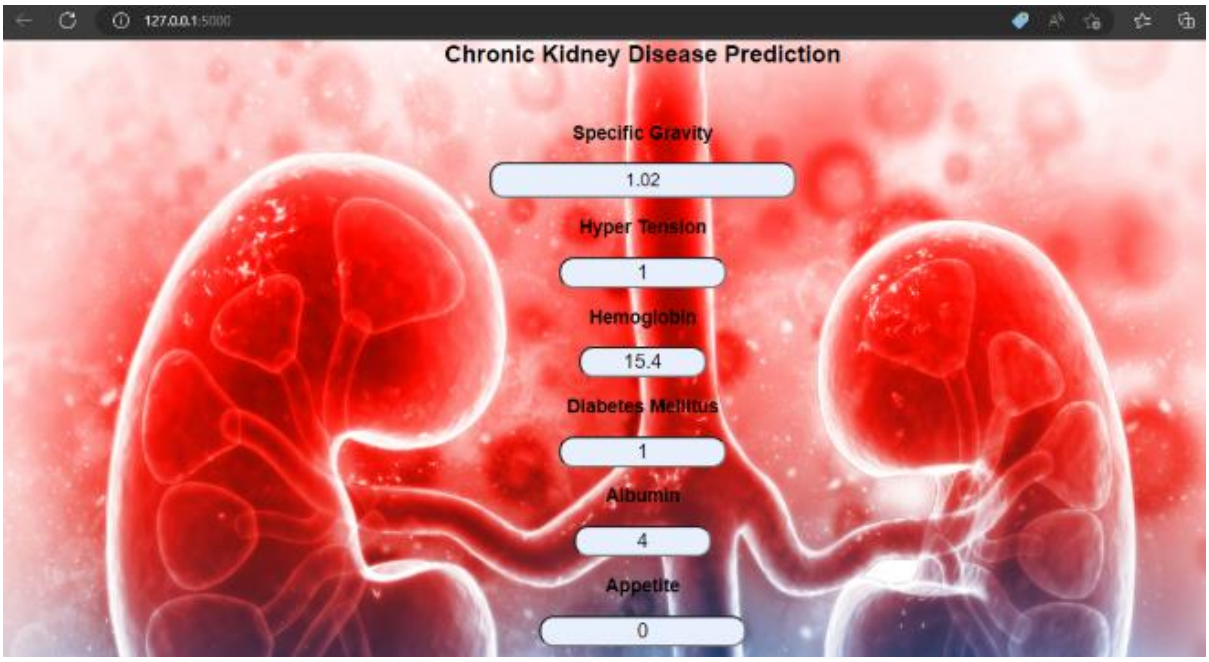
```python

# NOTE: you must manually set API_KEY below using information retrieved from your IBM Cloud account.
API_KEY = "0-zgnSwLwHnXYQBaeXUguHLwv2X7zN0kkDaTdPGdaR8f"
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('/',methods=['GET'])
def Home():
    return render_template('index.html')

@app.route("/predict", methods=['POST'])
def predict():
    if request.method == 'POST':
        sg = float(request.form['sg'])
        htn = float(request.form['htn'])
        hemo = float(request.form['hemo'])
        dm = float(request.form['dm'])
        al = float(request.form['al'])
        appet = float(request.form['appet'])
        rc = float(request.form['rc'])
        pc = float(request.form['pc'])

        values = [[sg, htn, hemo, dm, al, appet, rc, pc]]

        payload_scoring = {"input_data": [{"field": [[sg, htn, hemo, dm, al, appet, rc, pc]],"values": values}]}

        response_scoring = requests.post('https://eu-
```



```
gb.ml.cloud.ibm.com/ml/v4/deployments/3a87143a-e956-4e61-8fde-
9b2b904ce0a8/predictions?version=2022-11-02', json=payload_scoring,
        headers={'Authorization': 'Bearer ' + mltoken})
        print("response_scoring ")

        predictions = response_scoring.json()
        prediction = model.predict(values)
        print('Hiiiiiiiiiiii', prediction)


        return render_template('result.html', predict=predict)


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

8. TESTING

8.1 TEST CASES:



Chronic Kidney Disease Prediction

Specific Gravity: 1.02

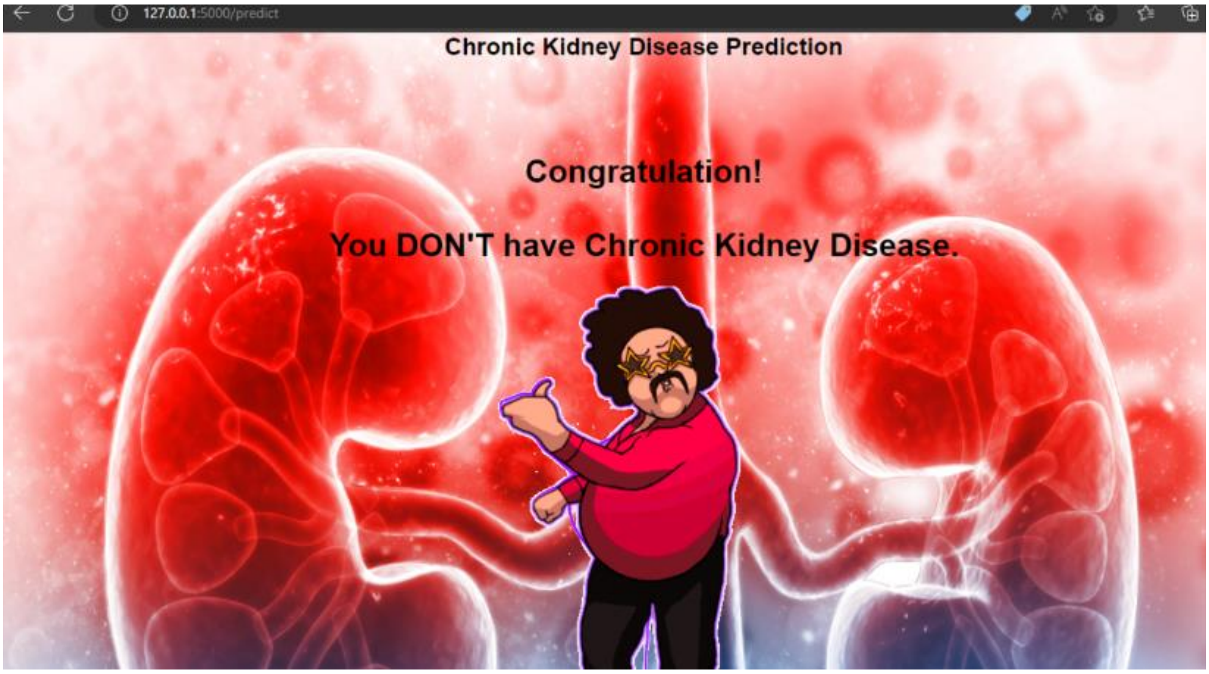
Hyper Tension: 1

Hemoglobin: 15.4

Diabetes Mellitus: 1

Albumin: 4

Appetite: 0

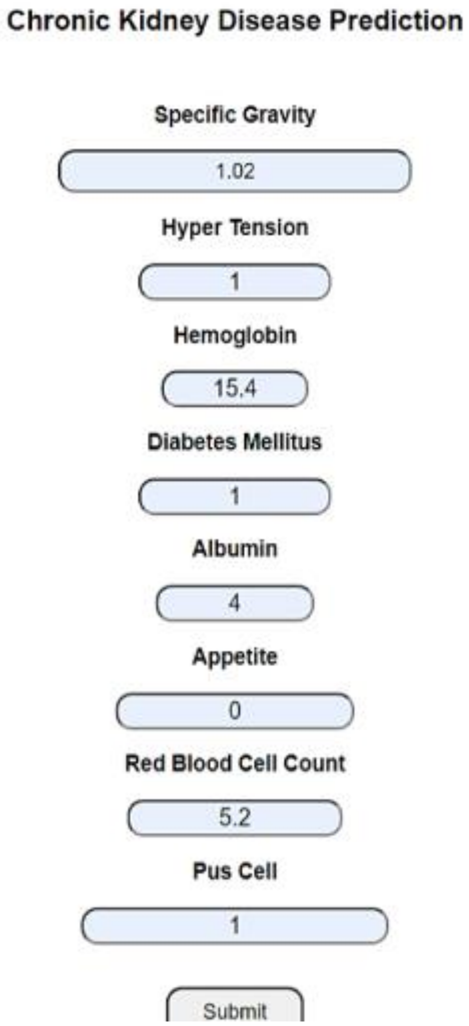


Chronic Kidney Disease Prediction

Congratulation!

You DON'T have Chronic Kidney Disease.

Team ID : PNT2022TMID16555



Chronic Kidney Disease Prediction

Specific Gravity: 1.02

Hyper Tension: 1

Hemoglobin: 15.4

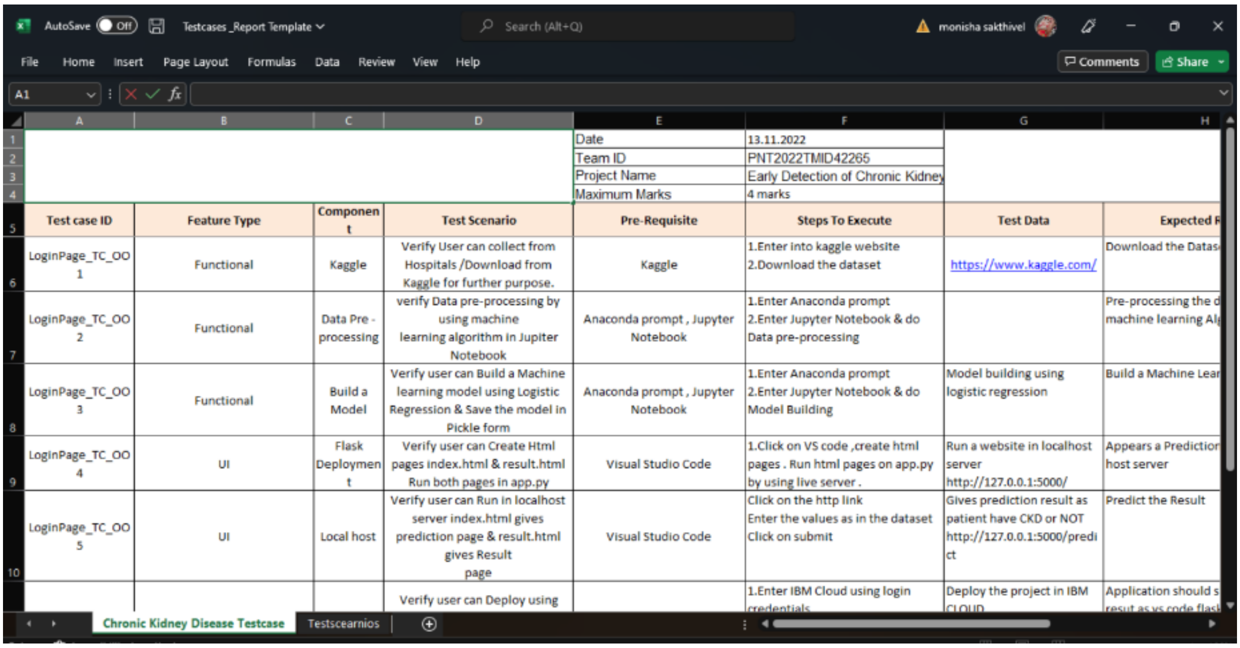
Diabetes Mellitus: 1

Albumin: 4

Appetite: 0

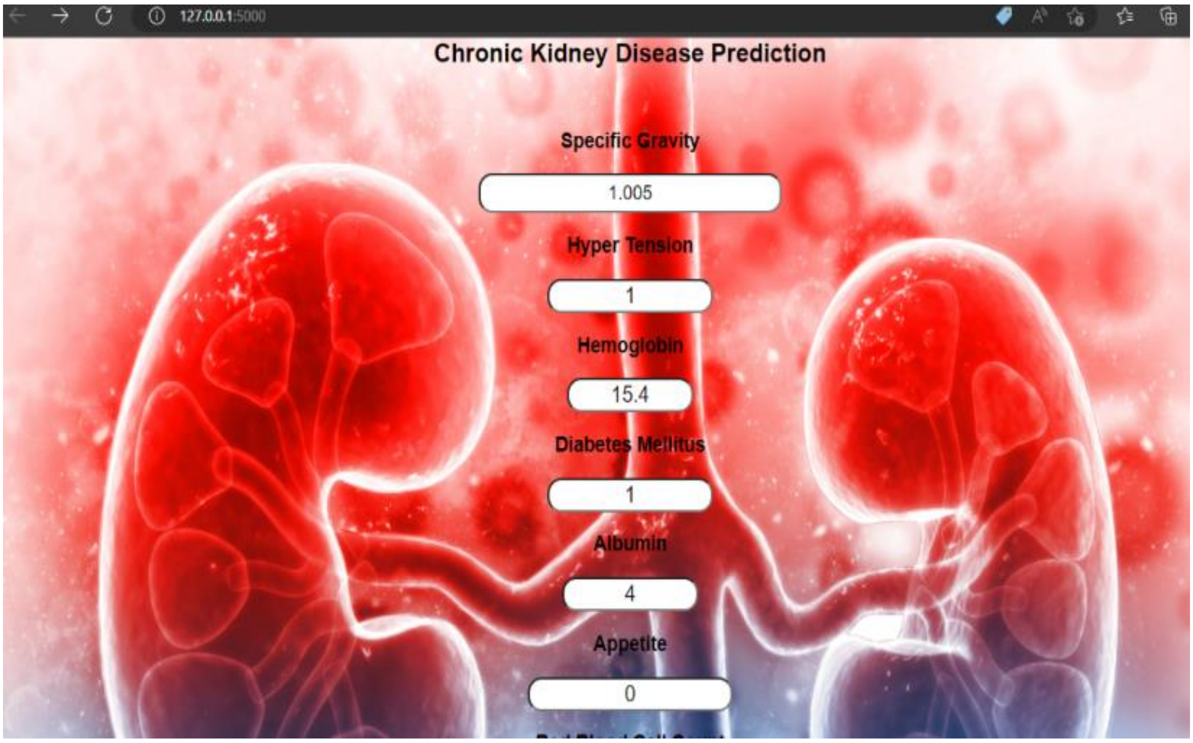
Red Blood Cell Count: 5.2

Pus Cell: 1



	A	B	C	D	E	F	G	H
1					Date	13.11.2022		
2					Team ID	PNT2022TMID42265		
3					Project Name	Early Detection of Chronic Kidney		
4					Maximum Marks	4 marks		
5	Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected R
6	LoginPage_TC_OO1	Functional	Kaggle	Verify User can collect from Hospitals /Download from Kaggle for further purpose.	Kaggle	1.Enter into kaggle website 2.Download the dataset	https://www.kaggle.com/	Download the Datas
7	LoginPage_TC_OO2	Functional	Data Pre - processing	verify Data pre-processing by using machine learning algorithm in Jupiter Notebook	Anaconda prompt , Jupyter Notebook	1.Enter Anaconda prompt 2.Enter Jupyter Notebook & do Data pre-processing		Pre-processing the d machine learning Al
8	LoginPage_TC_OO3	Functional	Build a Model	Verify user can Build a Machine learning model using Logistic Regression & Save the model in Pickle form	Anaconda prompt , Jupyter Notebook	1.Enter Anaconda prompt 2.Enter Jupyter Notebook & do Model Building	Model building using logistic regression	Build a Machine Lear
9	LoginPage_TC_OO4	UI	Flask Deployment	Verify user can Create Html pages index.html & result.html Run both pages in app.py	Visual Studio Code	1.Click on VS code ,create html pages . Run html pages on app.py by using live server .	Run a website in localhost server http://127.0.0.1:5000/	Appears a Prediction host server
10	LoginPage_TC_OO5	UI	Local host	Verify user can Run in localhost server index.html gives prediction page & result.html gives Result page	Visual Studio Code	Click on the http link Enter the values as in the dataset Click on submit	Gives prediction result as patient have CKD or NOT http://127.0.0.1:5000/predict	Predict the Result
				Verify user can Deploy using		1.Enter IBM Cloud using login credentials	Deploy the project in IBM CLOUD	Application should s resut as vs code flask

8.2 USER ACCEPTANCE TESTING:



Chronic Kidney Disease Prediction

Specific Gravity

1.005

Hyper Tension

1

Hemoglobin

15.4

Diabetes Mellitus

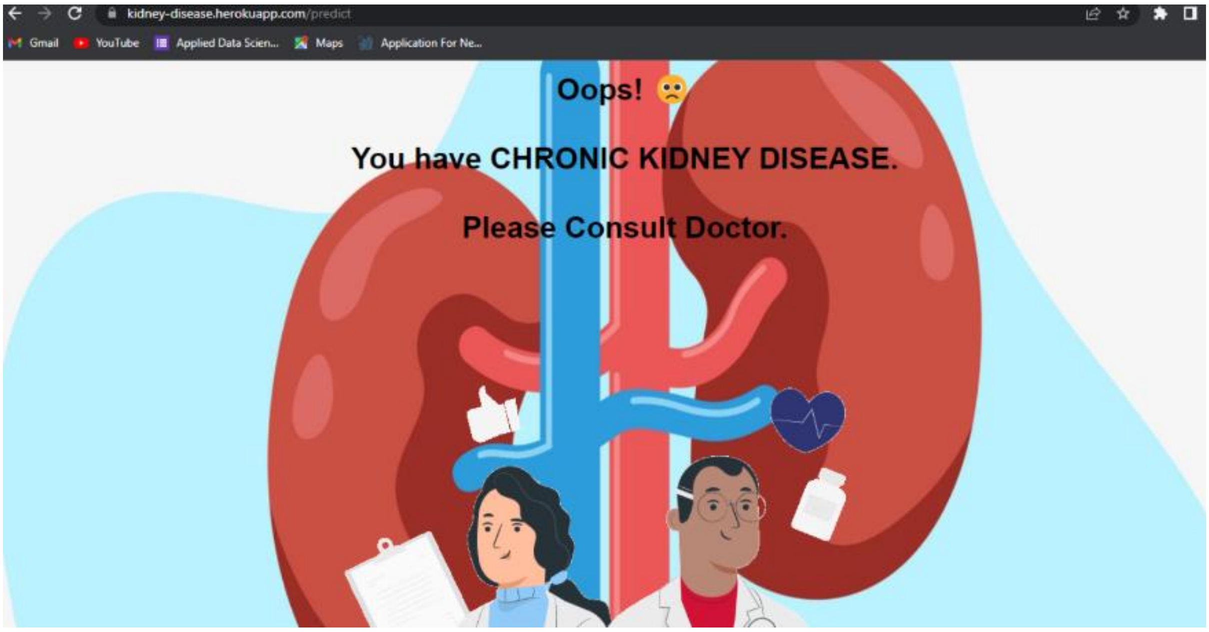
1

Albumin

4

Appetite

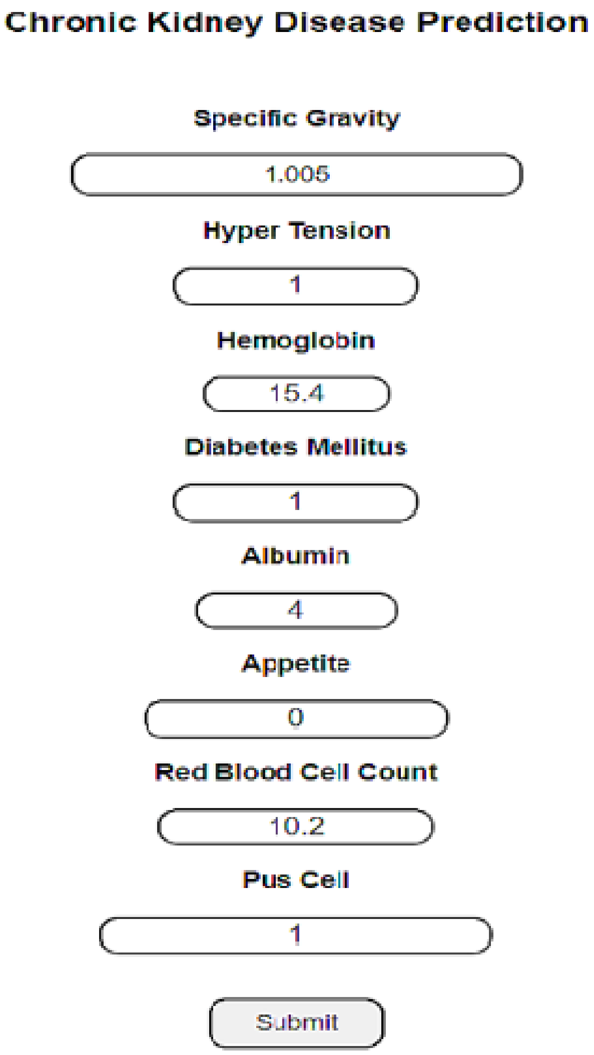
0



Oops! 🙁

You have CHRONIC KIDNEY DISEASE.

Please Consult Doctor.



Chronic Kidney Disease Prediction

Specific Gravity: 1.005

Hyper Tension: 1

Hemoglobin: 15.4

Diabetes Mellitus: 1

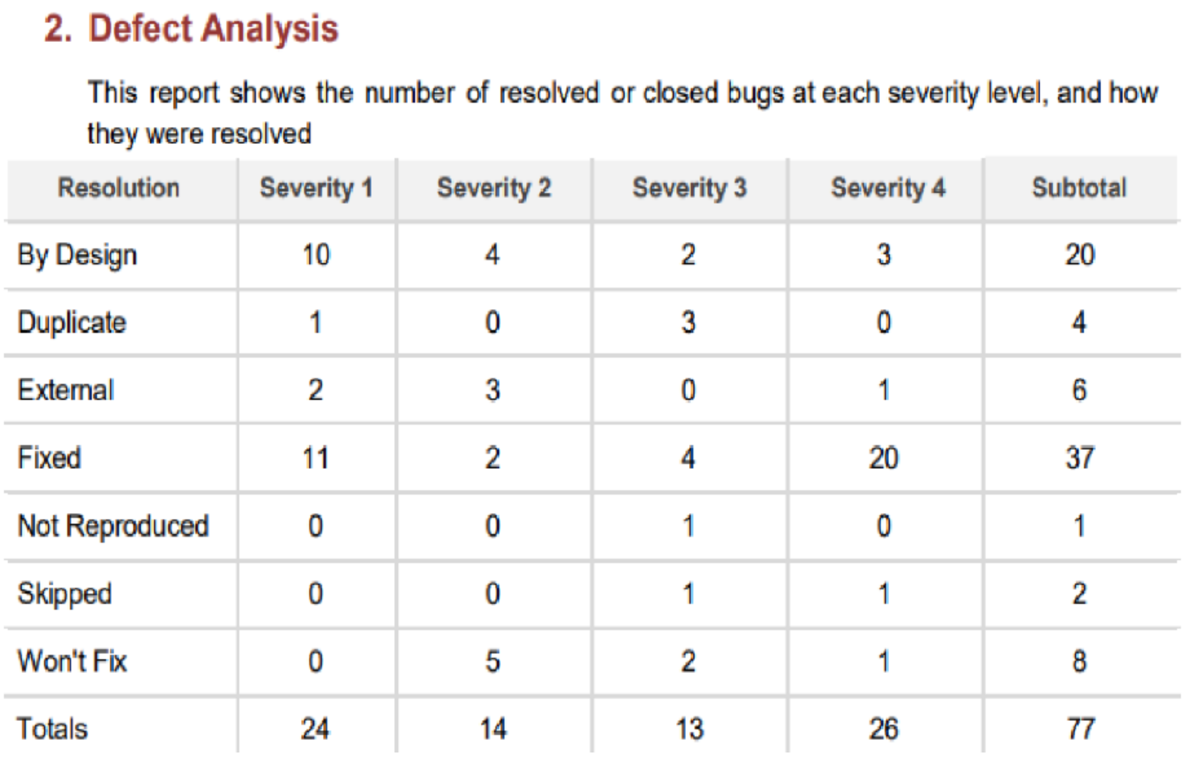
Albumin: 4

Appetite: 0

Red Blood Cell Count: 10.2

Pus Cell: 1

2. DEFECT ANALYSIS:

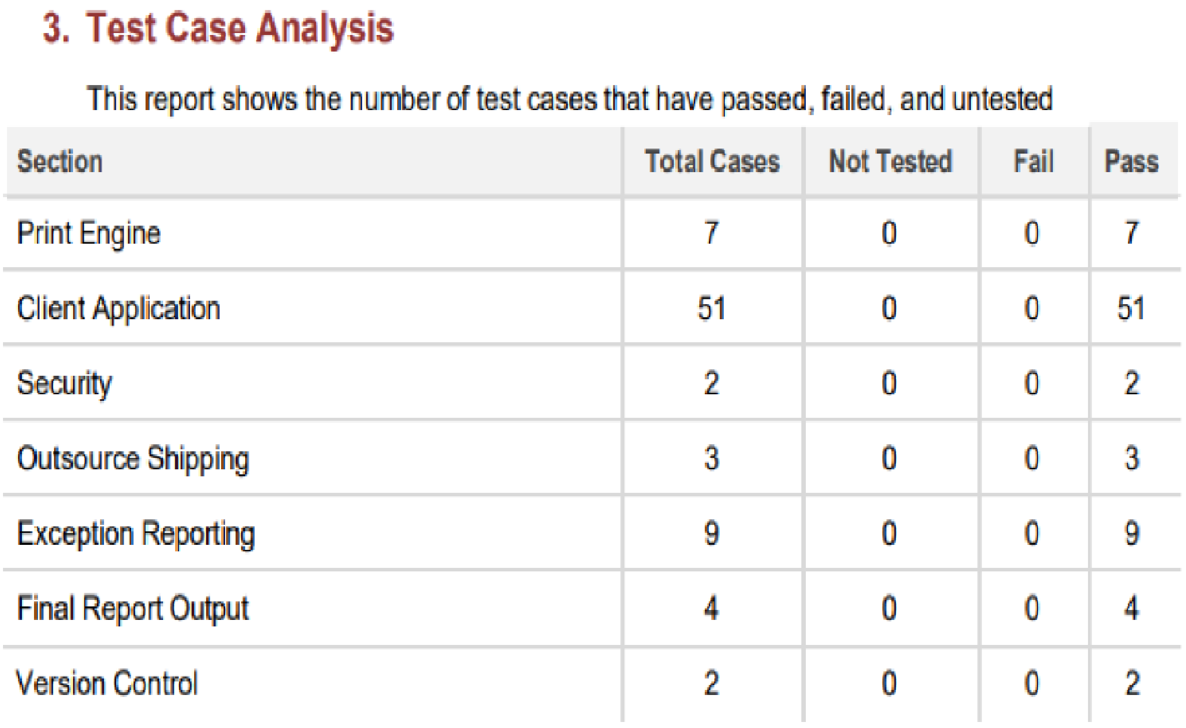


2. Defect Analysis

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	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

3. TEST CASE ANALYSIS:



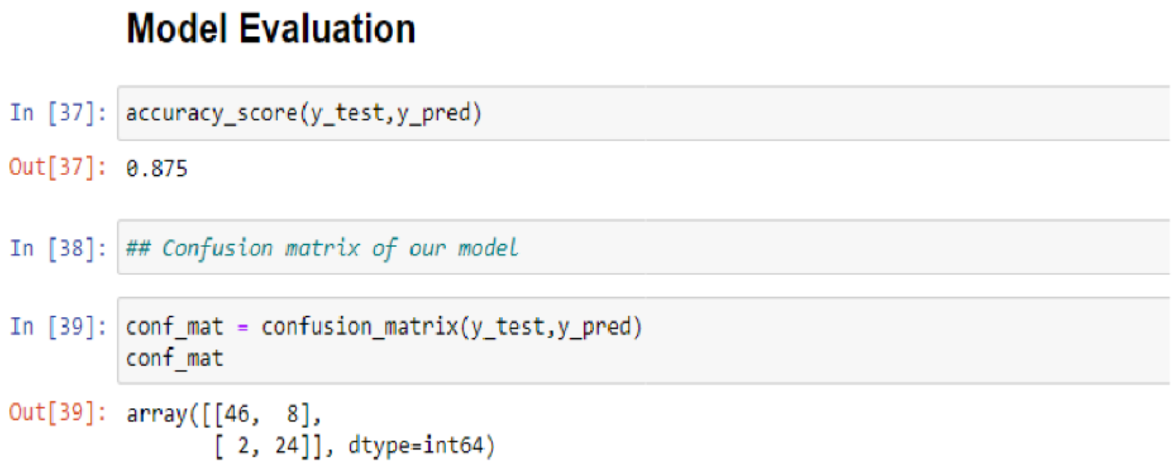
3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9. RESULTS

9.1 PERFORMANCE METRICS:



Model Evaluation

```
In [37]: accuracy_score(y_test,y_pred)

Out[37]: 0.875

In [38]: ## Confusion matrix of our model

In [39]: conf_mat = confusion_matrix(y_test,y_pred)
         conf_mat

Out[39]: array([[46,  8],
                [ 2, 24]], dtype=int64)
```

10. ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

1. Increased recognition of CKD may facilitate implementation of therapeutic strategies to delay progression of kidney function decline or prevent CKD related metabolic complications and CVD.
2. Finally, a uniform disease classification and action plan including all patients irrespective of the need or type of renal replacement therapy (i.e. dialysis or transplantation), may enhance the continuity of patient care.
3. Early detection of chronic kidney disease is the advantage because we can cure in first stage.

DISADVANTAGES:

1 .CKD is associated with increased risks of cardiovascular morbidity , premature mortalitity and severe impact on quality of life (QoL).Mortality from cardiovascular disease(CVD) is estimated to be atleast 8 to 10 fold higher in CKD patients as compared to non-CKD patients.

2. CKD can cause other problems throughout your body including:Heart and blood vessel problems.Anemia (low red blood cell count)Bone problems.

12. FUTURE SCOPE

This work will be considered as basement for the healthcare system for CKD patients.
Also, extension to this work is that implementation of machine learning provides high-quality performance. The hope is that it would encourage people to seek early treatment of chronic renal disease and to make improvements in their lives.

13. APPENDIX

CKD has become a major issue with a steady growth rate. A person can only survive without kidneys for an average time of 18 days,which makes a huge demand for a kidney transplant and dialysis.It is important to have effective methods for early prediction of CKD.Machine learning methods are effective in CKD prediction. This work proposes a workflow a predict CKD status based on clinical data , incorporating data preprocessing , missing value handling method with collaborative,filtering and attributes selection. Out of the 11 machine learning methods considered, the extra tree classifier and random forest classifier as shown to result in the highest accuracy and minimal blas to the attributes.The research also considers the practical aspects of data collectionand highlights the importance of incorporating domain knowledge when using machine learning for CKD status prediction.

GITHUB LINK:
https://github.com/IBM-EPBL/IBM-Project-16972-1659626079

PROJECT DEMO LINK:
https://drive.google.com/file/d/1GJsNyUDmcfbdHUDMBFFHX-K1eiA6Ql4P/view?usp=drivesdk