PROJECT TITLE:

EARLY DETECTION OF CHRONIC KIDNEY DISEASES USING MACHINE LEARNING

TEAM ID:

PNT2022TMID10811

TEAM MEMBERS:

S. ABINAYA

S. DEVADHARSHINI

G. PADMAVATHY

K. PAVUN KAVITHA

G. SASI PRIYA

K. SHANMUGAPRIYA

N. SHIVANI

TABLE OF CONTENTS

1. INTRODUCTION

The human body has two kidneys located at the back of the peritoneal cavity, which are vital organs necessary for its proper functioning. The main function of the kidneys is to regulate the balance of salt, water and other ions and trace elements in the human body, such as calcium, phosphorus, magnesium, potassium, chlorine and acids. At the same time, the kidneys secrete hormones such as erythropoietin, vitamin D and renin. More specifically, erythropoietin stimulates the production and maturation of red blood cells in the bone marrow, while vitamin D regulates calcium and phosphorus in the body, bone structure and many other actions. The kidneys are also the site of the action of hormones that are responsible for regulating blood pressure, fluid balance or bone metabolism and vascular calcifications. Finally, the kidneys eliminate all the useless products of metabolism, as well as drugs and other toxins that enter the body.

Diabetes and high blood pressure are the two main causes of chronic kidney disease. Diabetes is characterized by high blood sugar levels, causing damage to the kidneys and heart, blood vessels and eyes. Moreover, poor control of high blood pressure can be a major cause of heart attack, stroke and chronic kidney disease. Other conditions that affect the kidneys are glomerulonephritis, hereditary diseases, dysplasia, kidney stones, tumor, recurrent urinary tract infections, metabolic diseases, obesity and age.

CKD is a silent disease, as most sufferers have no symptoms until kidney function drops to 15–20% of normal. The main symptoms in the advanced stage of CKD are the feeling of fatigue and lack of energy, concentration problems, decreased appetite, sleep problems, muscle cramps at night, swelling in the legs and ankles, swelling around the eyes, dry skin with intense itching and frequent urination, especially at night.

1.1 Project Overview

Chronic kidney disease (CKD) is a condition characterized by progressive loss of kidney function over time. It describes a clinical entity that causes kidney damage and affects the general health of the human body. Improper diagnosis and treatment of the disease can eventually lead to endstage renal disease and ultimately lead to the patient's death. Machine Learning (ML) techniques have acquired an important role in disease prediction and are a useful tool in the field of medical science. In the present research work, we aim to build efficient tools for predicting CKD occurrence, following an approach which exploits ML techniques. More specifically, first, we apply class balancing in order to tackle the non-uniform distribution of the instances in the two classes, then features ranking and analysis are performed, and finally, several ML models are trained and evaluated based on various performance metrics.

1.2 Purpose

The purpose of the project is to build efficient tools for predicting CKD occurrence, following an approach which exploits ML techniques. More specifically, first, we apply class balancing in order to tackle the non-uniform distribution of the instances in the two classes, then features ranking and analysis are performed, and finally, several ML models are trained and evaluated based on various performance metrics. The derived results highlighted the Rotation Forest (RotF), which prevailed in relation to compared models with an Area under the Curve (AUC) of 100%, Precision, Recall, F-Measure and Accuracy equal to 97.2%.

2. LITERATURE SURVEY

2.1 Existing Problem

A growing number of patients are being identified as having advanced renal illness each year. The hallmark of chronic kidney disease, sometimes referred to as chronic renal disease, is aberrant kidney function or a progressive breakdown of renal function over the course of months or years. People who are known to be at risk for kidney problems, such as those with high blood pressure or diabetes, as well as those who have a chronic kidney disease-affected blood relative, are frequently screened for chronic kidney disease (CKD). As a result, early prognosis is essential for treating the illness and preventing its progression. Renal failure or major kidney injury can only be avoided by early detection and ongoing care. Machine learning (ML) is a key component of the healthcare system and has the potential to effectively support and help with decision-making in medical institutions.

2.2 References

2.2.1 Prediction of Chronic Kidney Diseases Using DeepArtificial Neural Network Technique.

A method to identify chronic kidney illness. Diagnosing chronic kidney disease is a difficult challenge that can lower treatment costs. On the UCI machine learning repository titled chronic kidney illnesses, we looked at 224 records of chronic kidney disease dating back to 2015.Our suggested approach is based on a deep neural network, which has a 97% accuracy rate at predicting whether chronic kidney disease would exist or not. When compared to previous techniques, the model we developed performs better and is implemented using the cross-validation methodology to prevent over fitting.

2.2.2 Chronic Kidney Disease Prediction System Using Machine Learning

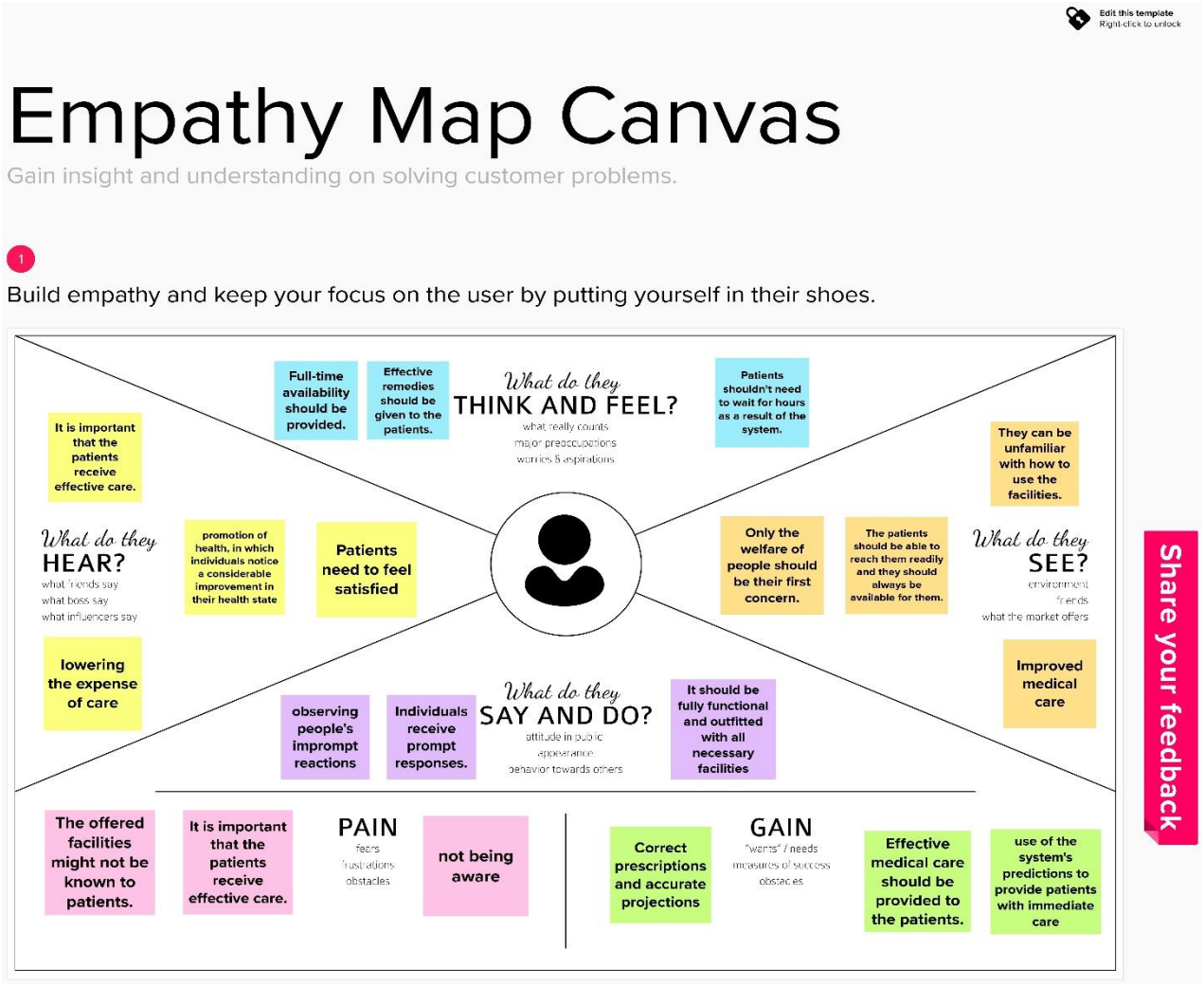
A major global health problem, chronic kidney disease (CKD) has a high rate of morbidity and mortality as well as the start of other diseases. People commonly overlook CKD in its early stages since there are no obvious symptoms. Patients who are diagnosed with CKD early can receive prompt treatment to halt the disease's progression. Doctors can successfully accomplish this goal with thehelp of machine learning models because of their quick and accurate recognition skills. In this research, we suggest a machine learning framework for CKD diagnosis. The data set for CKD was obtained from Kaggle and contains a sizable number of missing values.

2.3 Problem Statement Definition

The number of patients diagnosed with advanced kidney disease is increasing each year. Chronic kidney disease (also called chronic kidney disease) is characterized by abnormal or progressive decline in kidney function over months or years. People who are known to be at high risk for kidney problems, such as people with high blood pressure or diabetes, or who have relatives with chronic kidney disease, are often screened for chronic kidney disease (CKD). Therefore, early prognosis is essential to treat the disease and prevent its progression. Kidney failure or severe kidney damage can only be avoided with early detection and continued care. Machine learning (ML) is a key component of healthcare systems and has the potential to effectively support healthcare decision-making.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming

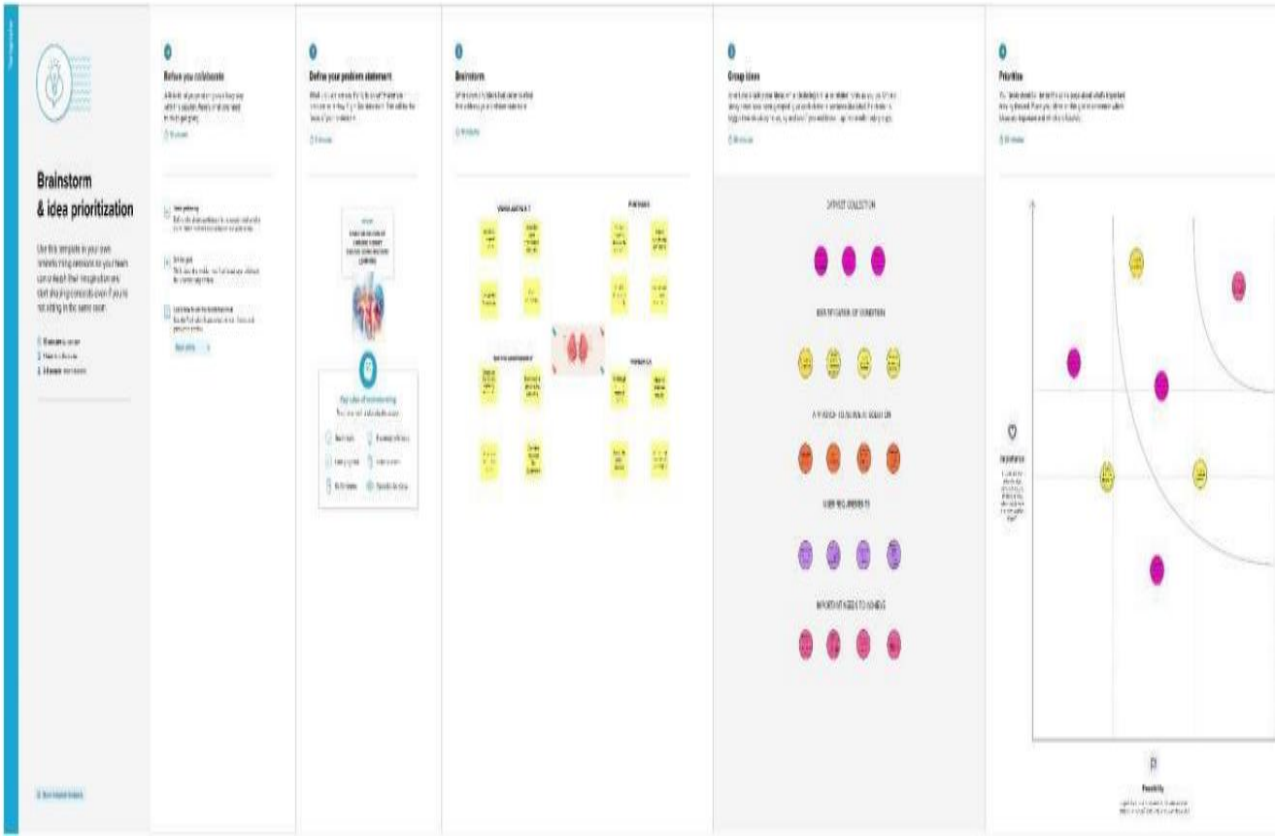
TOP THREE PRIORITIZED IDEAS:

1. The theory is that we may identify the temporal information for the three major components of the data, which comprise diagnoses, procedures, and medications, by using a feature embedding method based on the application of the Word2Vecalgorithm. We can use the

gradient boosting tree technique for the analysis part (XG Boost Algorithm).

2. Traditional diagnostic techniques are thought to be far more dependable and accurate, so there won't be any misunderstandings about their efficacy. We'll receive more precise findings if we statistically analyse the collected data using the visualisation tools.
3. Educating the general public about chronic kidney disease, which frequently occurs asymptomatically and has a nearly asymptomatic character, the patient records also show that diabetes and high blood pressure are responsible for nearly two-thirds of cases of CKD. Therefore, elderly adults need to manage their blood pressure and sugar levels and participate in routine health checks.

Brainstorm:



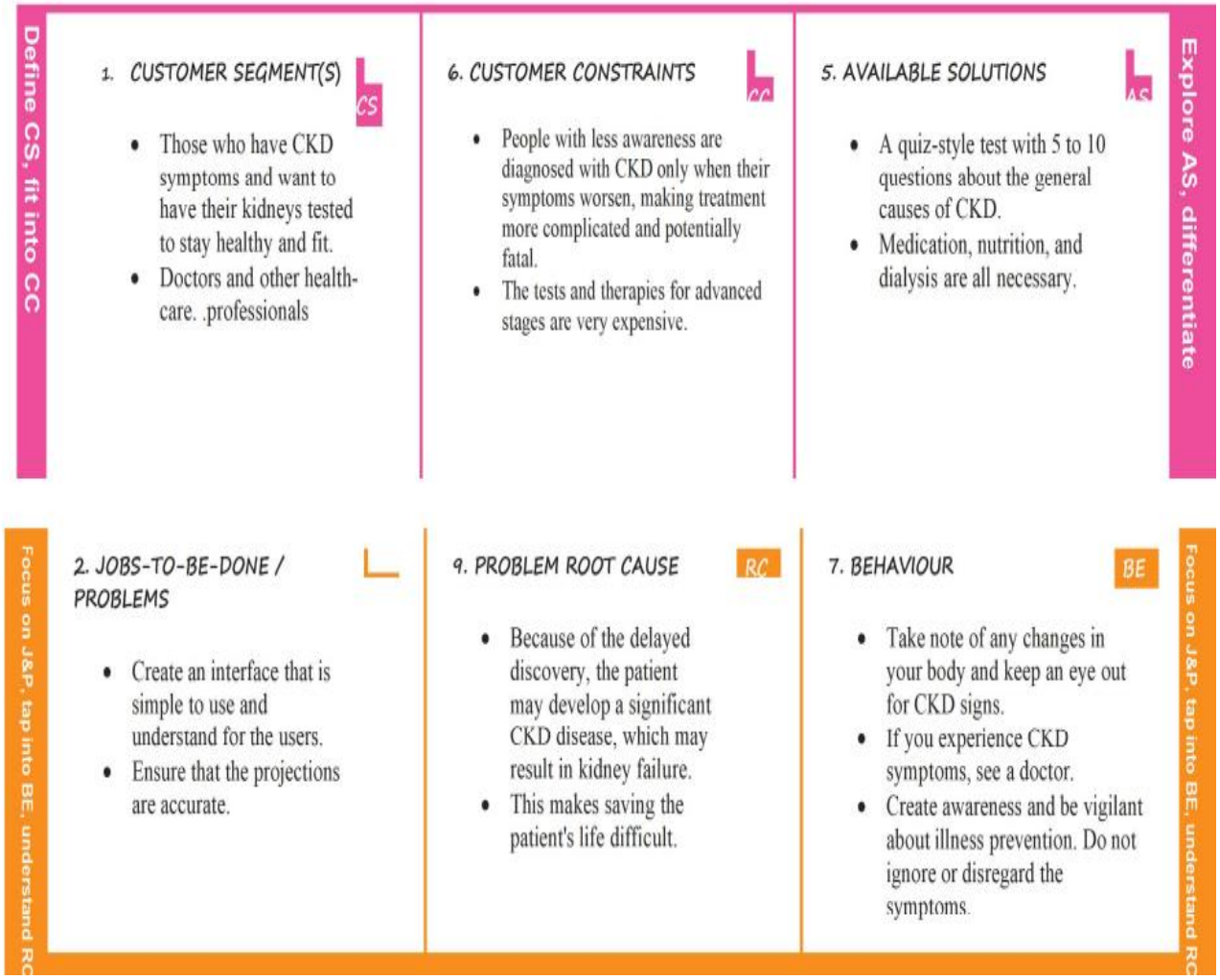
3.3Proposed Solution

S.No.	Parameter	Description
1	**Problem Statement**	• One of the most greatest problem in healthcare analytic is the prediction of chronic kidney disease. • Chronic kidney disease (CKD) affects 10%of people globally, and millions of people pass away each year because they cannot afford treatment • The most interesting and difficult activities in daily life are those involving medical judgment. • If chronic kidney disease is addressed early on, it could potentially be cured.
2	**Idea / Solution description**	• The concept is to process the patient's ECG signal and use machine learning-based classification modelling to identify

		the presence of renal disease. • Recent studies and current research have demonstrated that people with kidney disorders often also experience cardiac issues, which are collectively referred to as the Cardio Renal Syndrome (CRS). • Since chronic kidney illness and cardiovascular diseases are related, people with cardio-vascular issues can also utilize this model to identify whether or not their kidneys have been affected. • The approach is to create an app that requests the user submit his ECG data and asks a series of basic questions regarding his kidney health.
3	**Novelty / Uniqueness**	• The ECG test is inexpensive and

		extremely accurate compared to other kidney function tests • Our app would be the first to use a user uploaded ECG record to detect chronic kidney disease.
4	**Social Impact / Customer Satisfaction**	• The main benefit of this model is that itgives patients an easy, safe, non-invasiveway to assess the health of their kidneys
5	**Buisness Model (Revenue Model)**	• Can work with the healthcare industry tobring in money from their clients. • Can bring in money from direct clients.
6	**Scalability of the Solution**	• The structure will be transportable and expandable. Detecting the phenotype of chronic renal disease to aid in early illness detection.

3.4 Problem Solution Fit



4. REQUIREMENT ANALYSIS

4.1 Functional Requirements

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Home Page	• Chronic Kidney disease description • Information about Test Vitals required for prediction • If new User, REGISTER • If already exist, SIGN IN
FR-2	User Registration	• Enters Mail ID and other personal details required for Registering.
FR-3	User Login	• Uses Mail ID and Password for login
FR-4	Test Vitals Form	• Test Vitals should be entered for prediction
FR-5	Result	• If Positive – Test Result along with the Information about what is to be done next will be displayed. • If Negative – Test result along with preventive measures to prevent themselves from getting Chronic Kidney disease will be displayed.

4.2 Non-functional Requirements:

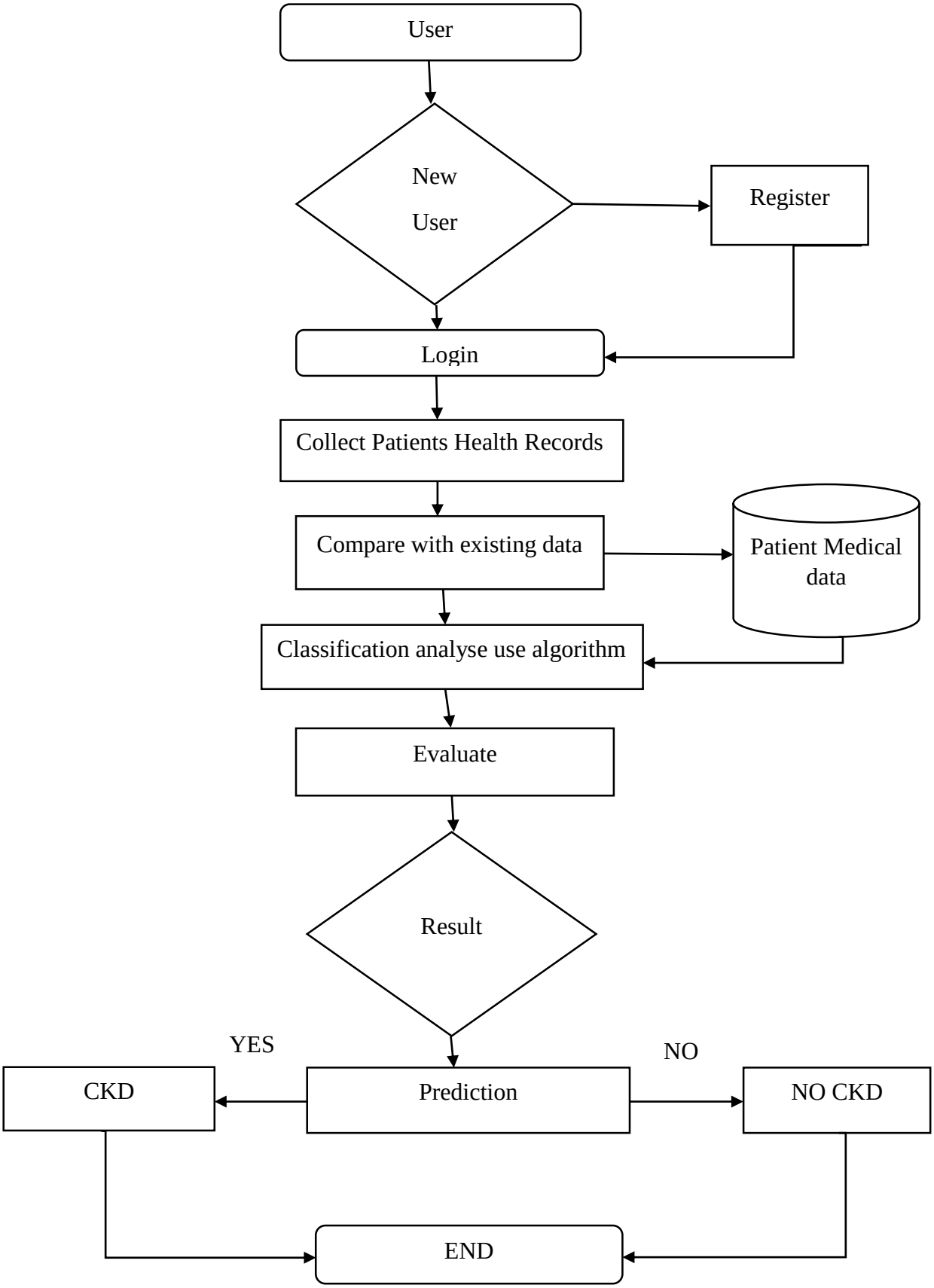
Following are the non-functional requirements of the proposed solution

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Even Illiterates and people with no understanding of computer/mobile should be able to use the product.
NFR-2	Security	Access permission for particular system information may be changed by systems data administration.
NFR-3	Reliability	The database update process must roll back all related updates when any updates fails.
NFR-4	Performance	The Home-page load time must be no more than 2seconds for users that access the website using an LTE mobile connection.
NFR-5	Availability	New Model Deployment must not impact Home page, test page and result page availability and must not take longer than 1 hour.
NFR-5	Scalability	The website Traffic limit must be scalable enough to support 2000,000 users at a time.

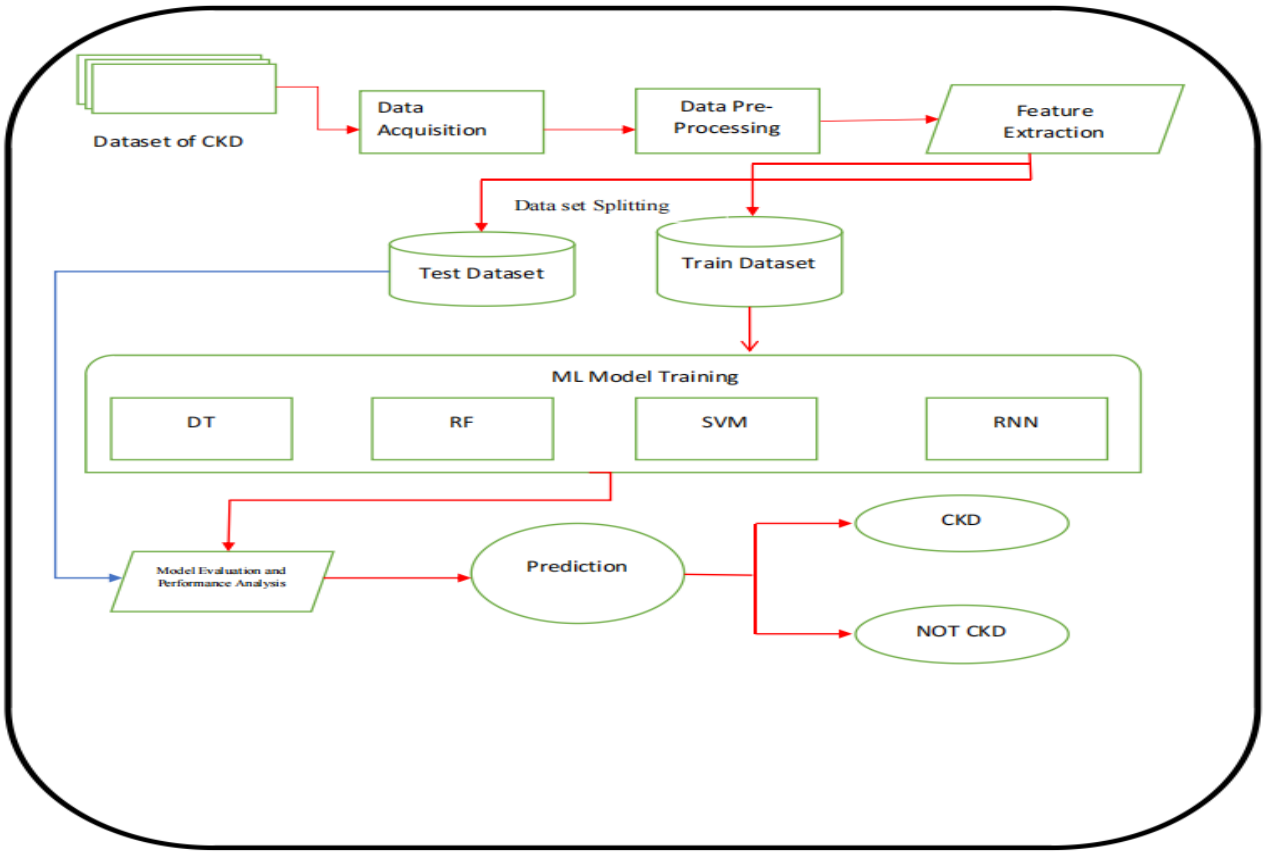
5. PROJECT DESIGN

5.1 Data Flow Diagram

DATA FLOW DIAGRAM



5.2 Solution & Technical Architecture



5.3 User Stories

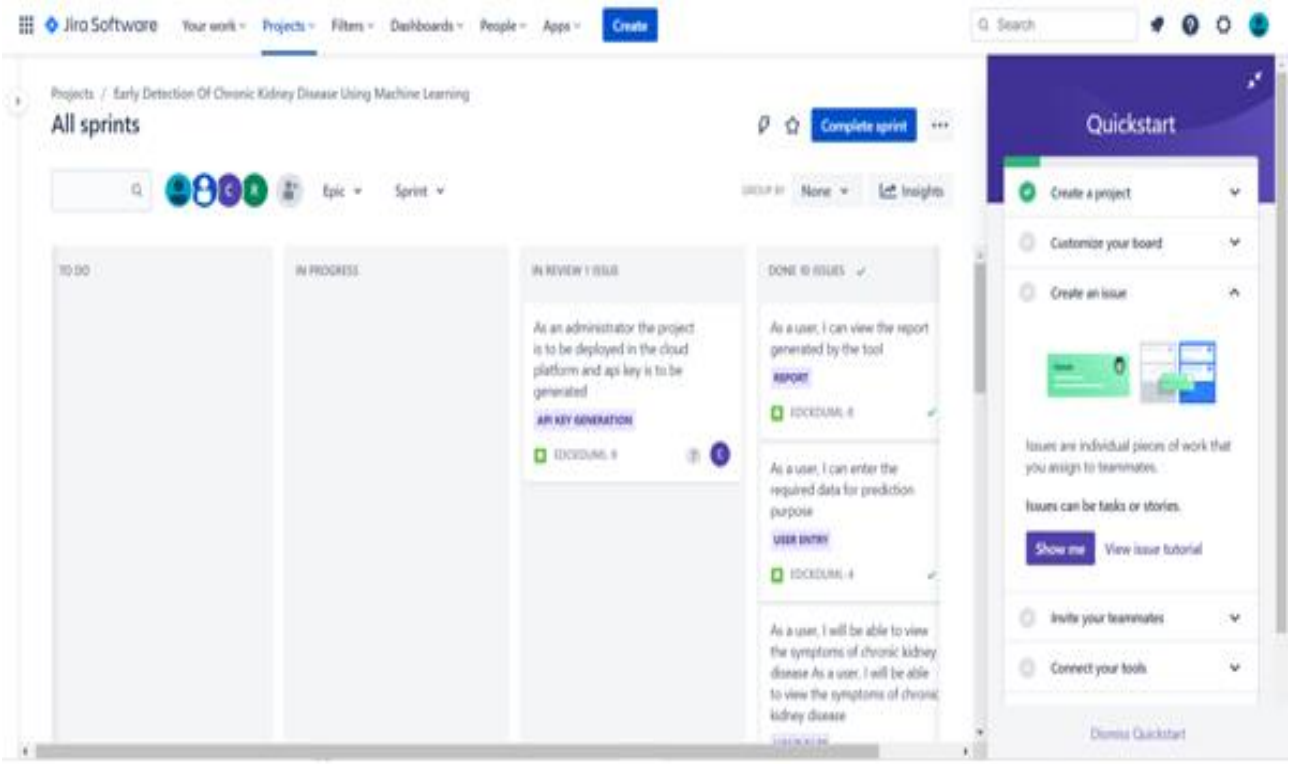
User Type	Functional Requirement	User story Number	User Story/Task	Acceptance Criteria	Priority	Release
Customer (Web User)	Registration	USN-1	As a User, I can register for The application by entering my username and password.	I can access my account /dashboard.	High	Sprint-1
	Login	USN-2	As a User, I will login entering username and password.	I can get entry into my account.	High	Sprint-1
Customer Data entry	Enter Data	USN-3	As a User, Enter data which is numerical value or selection from pull down menu.	I can enter value	High	Sprint-2
Customer Result view	View Result	USN-4	As a User, one can view result	I can view Result	Medium	Sprint-3
Customer Feedback	Enter Feedback	USN-5	As a User, one can give feedback about the software	I can enter feedback	High	Sprint-4

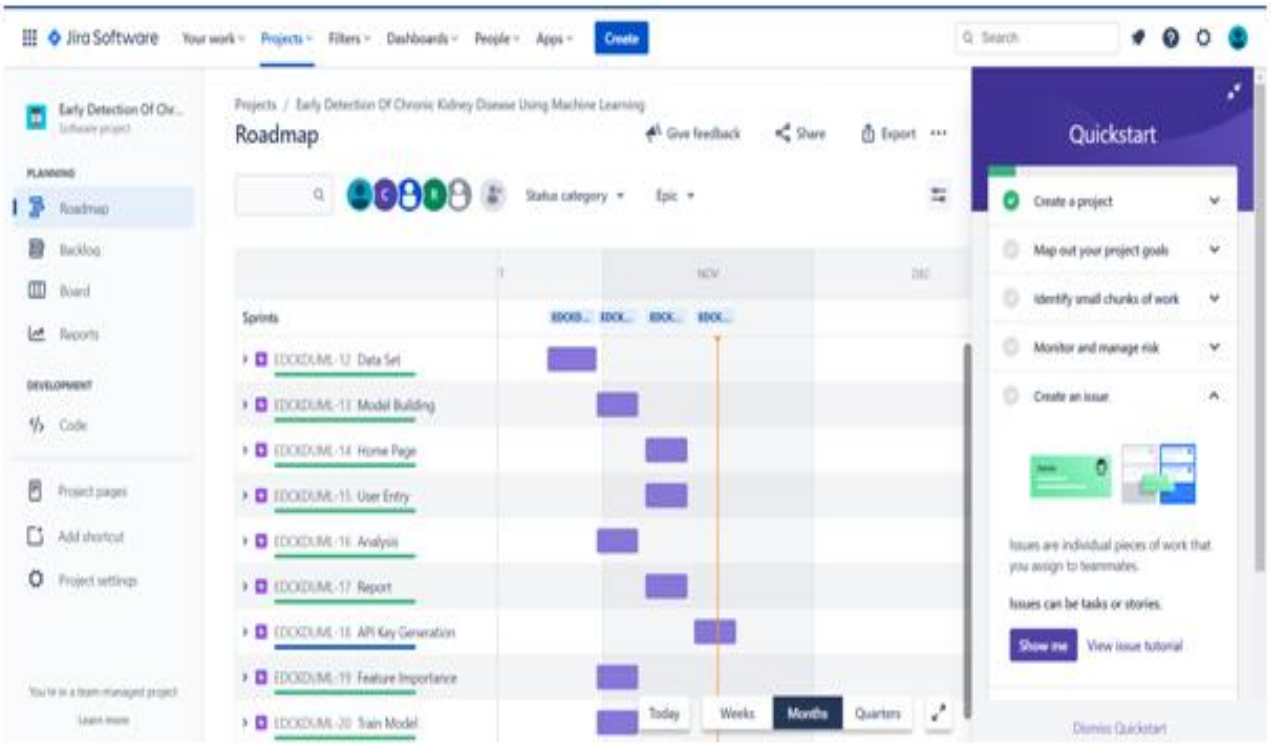
6. PROJECT PLANNING & SCHEDULING

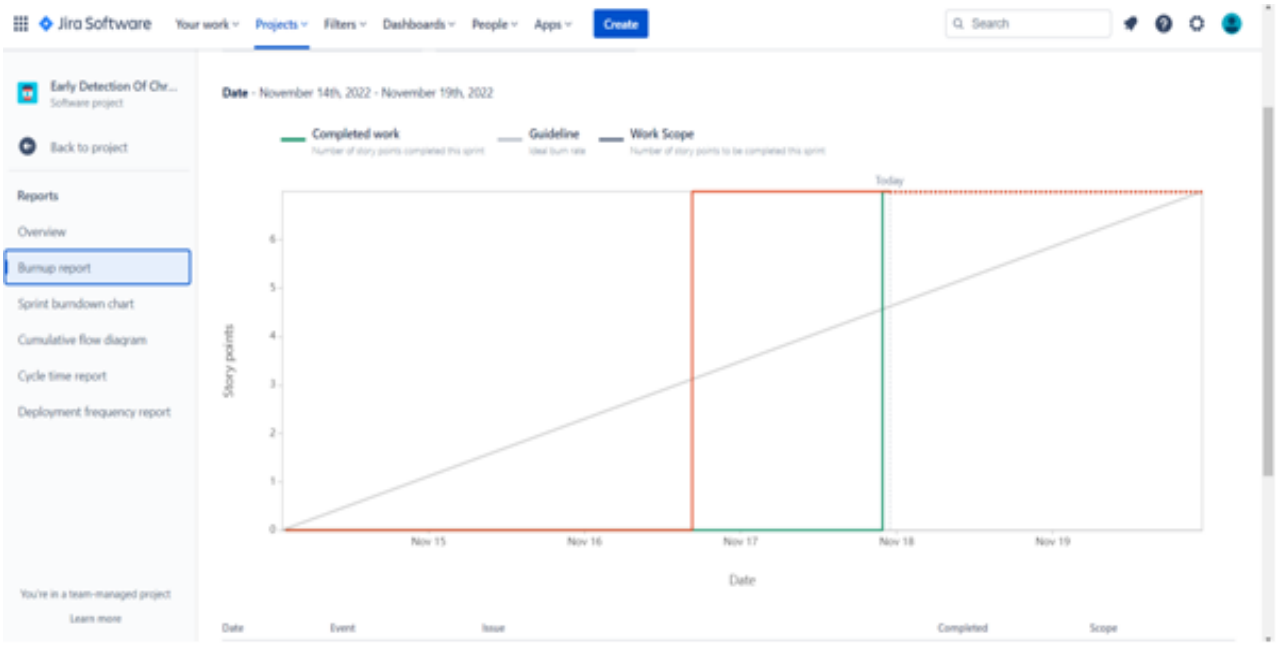
6.1 Sprint Planning, Estimation & Delivery Schedule

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	SHANMUGAPRIYA K DEVADHARSHINI S ABINAYA S
Sprint-2		USN-2	As a user, I can register for the application through Gmail	5	Medium	SHIVANI N SHANMUGAPRIYA K PAVUN KAVITHA K
Sprint-1	User Confirmation	USN-3	As a user, I will receive confirmation email once I have registered for the application	10	High	SHANMUGAPRIYA K DEVADHARSHINI S ABINAYA S
Sprint-2		USN-4	As a user, I will receive confirmation otp to verify the identity.	5	High	SHIVANI N SHANMUGAPRIYA K PAVUN KAVITHA K
Sprint-2	Data Collection	USN-5	As a user, I will enter the input data for disease prediction in the form	10	High	SHIVANI N SHANMUGAPRIYA K PAVUN KAVITHA K
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	DEVADHARSHINI S PADMAVATHY G PAVUN KAVITHA K
Sprint-3	Data Analysis	USN-7	As the admin, I will develop modules to preprocess and store the data.	10	High	DEVADHARSHINI S PADMAVATHY G PAVUN KAVITHA K
Sprint-4	Prediction of disease	USN-8	As the admin, I will build a Machine Learning model to predict the disease	10	High	SHANMUGAPRIYA K SASIPRIYA G ABINAYA S
Sprint-4	Final Delivery	USN-9	Deploy the application in IBM cloud and make it available for use.	10	High	SHANMUGAPRIYA K SASIPRIYA G ABINAYA S

6.2 Reports from JIRA







7. CODING & SOLUTION

7.1 Feature 1

HOMEPAGE.HTML

```
<!DOCTYPE html>

<html lang="en">

<head>

<meta charset="UTF-8">

 <meta http-equiv="X-UA-Compatible" content="IE=edge">

 <meta name="viewport" content="width=device-width, initial-scale=1.0">

 <link rel="stylesheet" href="homepage.css">

 <title>Chronic Kidney Disease</title>

</head>

<body>
```

```
<div class="front">

<img class="background" src="https://images.indianexpress.com/2022/03/kidney-health_1200.jpg" alt="Aleq">

<h1>CHRONIC KIDNEY DISEASE DETECTION</h1>

 <p>Kidney disease does not tend to cause symptoms when it's at an early stage. This is because the body is usually able to cope with a significant reduction in kidney function. Kidney disease is often only diagnosed at this stage if a routine test for another condition, such as a blood or urine test, detects a possible problem. If it's found at an early stage, medicine and regular tests to monitor it may help stop it becoming more advanced.</p>

 <p><b>SYMPTOMS</b>-Nausea and vomiting, muscle cramps, loss of appetite, swelling via feet and ankles, dry, itchy skin, shortness of breath, trouble sleeping, urinating either too much or too little</p>

<a href="form.html">

 <button type="submit" >TAKE TEST</button>

 </a>

</div>

</body>

 </html>
```

HOMEPAGE.CSS

```
body{

overflow: hidden;

 }.
```

```
background{
position: absolute;
left: 0px;
top: 0px;
z-index: -1;
width: 100%;
height: 100%;
-webkit-filter: blur(5px);
filter: blur(5px);
}.
front{
height:100vh;
width: 100%;
text-align: center;
font-size: 200%;
color: rgb(11, 12, 12);
}
button{
background-color: rgb(192, 171, 171);
height: 50px;
width: 200px;
font-size: large;
```

margin-block-end:

auto; bottom: 50px;

}

The Homepage consists of the explanation of chronic kidney disease and the symptoms for chronic kidney disease. It also contains a button name take test. The patient has to click the button to take the test.

7.2 Feature 2

FORM.HTML

```
<!DOCTYPE html>
<html lang="en">
<head> <meta charset="UTF-8">
<meta http-equiv="X-UA-Compatible" content="IE=edge">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<link rel="stylesheet" href="form.css">
<title>Document</title>
</head>
<body>
<div class="container">
<h1>Enter the required details</h1>
<div class="formbox">
<video autoplay loop muted plays-inline id="myvedio">
<source src="images/testing.mp4" type="video/mp4">
</video> <form action="result.html" method="GET">
<!-- <section class="image-1">
```

```
</section>
<section class="image-2">
</section>
<section class="image-3">
</section>
<section class="image-4">
</section> -->
<!-- Name -->
<div>
<h3>Name</h3>
<input type="text" name="fullname" id="fullname">
</div>
<!-- Age -->
<div>
<h3>Age</h3>
<input type="number" name="age" id="age" >
</div>
<!-- Blood Pressure -->
<div>
<h3>Blood Pressure</h3>
<input type="number" name="bp" id="bp">
</div>
<!-- Urinary Specific gravity -->
<div>
<h3>Urinary Specific gravity</h3>
<input type="text" name="sg" id="sg">
</div>
```

```
<!-- Acute leukaemia -->
<div>
<h3>Acute leukaemia</h3>
<input type="number" name="al" id="al">
</div>
<!-- Secretory unit -->
<div>
<h3>Secretory unit</h3>
<input type="number" name="su" id="su">
</div>
<!-- Red Blood Cells -->
<div>
<h3>Red Blood Cells</h3>
<input type="radio" name="rbc" id="rbcn" value="normal">
<label for="rbcn">Normal</label>
<input type="radio" name="rbc" id="rbca" value="abnormal">
<label for="rbca">Abnormal</label>
</div>
<!-- Platelet Count -->
<div>
<h3>Platelet Count</h3>
<input type="radio" name="pc" id="pcn" value="normal">
<label for="pcn">Normal</label>
<input type="radio" name="pc" id="pca" value="abnormal">
<label for="pca">Abnormal</label>
</div>
<!-- prothrombin Complex concentrate -->
```

```
<div>
<h3>Prothrombin Complex Concentrate</h3>
<input type="radio" name="pcc" id="pccp" value="Present">
<label for="pccp">Present</label>
<input type="radio" name="pcc" id="pccn" value="Not Present">
<label for="pccn">Not Present</label>
</div>
<!-- Bronchical Asthma -->
<div>
<h3>Bronchical Asthma</h3>
<input type="radio" name="ba" id="bap" value="Present">
<label for="bap">Present</label>
<input type="radio" name="ba" id="ban" value="Not Present">
<label for="ban">Not Present</label>
</div>
<!-- Blood glucose regulator -->
<div>
<h3>Blood glucose regulator</h3>
<input type="number" name="bgr" id="bgr">
</div>
<!-- Bandelette terms -->
<div>
<h3>Bandelette terms</h3>
<input type="number" name="bt" id="bt">
</div>
<!-- subcutaneous -->
<div>
```

```
<h3>Subcutaneous</h3>
<input type="number" name="sub" id="sub">
</div>
<!-- Segregation of duties -->
<div>
<h3>Segregation of duties</h3>
<input type="number" name="seg" id="seg">
</div>
<!-- Pot -->
<div>
<h3>POT</h3>
<input type="number" name="pot" id="pot">
</div>
<!-- haemoglobin -->
<div>
<h3>Haemoglobin</h3>
<input type="number" name="hemo" id="hemo">
</div>
<!-- Pneumococcal conjugate vaccine -->
<div>
<h3>Pneumococcal conjugate vaccine</h3>
<input type="number" name="pcv" id="pcv">
</div>
<!-- white blood cell count -->
<div>
<h3>White blood cell count </h3>
<input type="number" name="wc" id="wc">
```

```
</div>
<!-- red blood cell count -->
<div>
<h3>RC</h3>
<input type="number" name="rc" id="rc">
</div> <!-- hypertension -->
<div>
<h3>Hypertension</h3>
<input type="radio" name="htn" id="htny" value="yes">
<label for="htny">Yes</label>
<input type="radio" name="htn" id="htnn" value="no">
<label for="htnn">No</label>
</div>
<!-- diabetes mellitus -->
<div>
<h3>DM</h3>
<input type="radio" name="dm" id="dmy" value="yes">
<label for="dmy">Yes</label>
<input type="radio" name="dm" id="dmn" value="no">
<label for="dmn">No</label>
</div>
<!-- coronary artery disease -->
<div>
<h3>Coronary artery disease</h3>
<input type="radio" name="cad" id="cady" value="yes">
<label for="cady">Yes</label>
<input type="radio" name="cad" id="cadn" value="no">
```

```
<label for="cadn">No</label>
</div>
<!-- appetite -->
<div>
<h3>Appetite</h3>
<input type="radio" name="appet" id="appetg" value="good">
<label for="appetg">Good</label>
<input type="radio" name="appet" id="appetp" value="poor">
<label for="appetp">Poor</label>
</div>
<!-- pulmonary embolism -->
<div>
<h3>Pulmonary embolism</h3>
<input type="radio" name="pe" id="pey" value="yes">
<label for="cady">Yes</label>
<input type="radio" name="pe" id="pen" value="no">
<label for="pen">No</label>
</div>
<!-- anemia -->
<div>
<h3>Anemia</h3>
<input type="radio" name="ane" id="aney" value="yes">
<label for="aney">Yes</label>
<input type="radio" name="ane" id="anen" value="no">
<label for="anen">No</label>
</div>
<!-- Classification -->
```

```
<div class="btn">
<button type="submit">Submit</button>
</div>
</form>
</div>
</div>
</body>
</html>
```

FORM .CSS

```
input,label {
cursor: pointer;
margin: .3rem;
padding-right: 5rem;
}
input[type=text],[type=number],[type=submit]
{
width: 100%;
padding: 12px 20px;
margin: 8px 0;
display: inline-block;
border-radius: 4px;
box-sizing: border-box;
font-size: 20px;
}
input[type="radio"]:
```

```
focus {
height: 1rem;
width: 1rem;
margin-right: 0.2rem;
margin-left:10px;
font-size: large;
}
button {
background-color: #4CAF50;
border: none;
color: white;
padding: 10px 20px;
text-align: center;
text-decoration: none;
display: inline-block;
font-size: 16px;
}.
btn{
display: flex;
width: 300px;
text-align: center;
justify-content: center;
padding-top: 20px;
padding-left: 250px;
margin-right: 20px;
}
h1{
```

```
text-align: center;
}
form {
box-sizing: border-box;
padding: 2rem;
border-radius: 15rem;
}
formbox{
max-width: 800px;
margin: auto;
border-radius: 10px;
display: flex;
align-items: center;
box-shadow: 0 0 20px rgba(0, 0, 0, 7);
color: rgb(14, 1, 1);
font-size: larger;
font-weight: 500;
background:rgba(0, 0, 0, 0.1)
}
#myvedio {
width: 100vw;
height: 100vh;
object-fit: cover;
position: fixed;
left: 0;
right: 0;
top: 0;
```

bottom: 0;

z-index: -1;

}

8. TESTING

8.1 Test Cases

1. Verify if user is able to view the homepage.

2. Verify if user is able to navigate to the page which contains form when test button is clicked.

3. Verify if user is able to enter all the required details in the form.

4. Verify user is able to view the result when the form is submitted.

8.2 User Acceptance Testing

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [Product Name] at the time of the release to User Acceptance Testing (UAT).

2. Detect 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	8	3	2	4	17
Duplicate	2	0	1	0	3
External	1	3	0	1	5
Fixed	9	3	2	11	25
Not Reproduced	0	0	1	0	1
Skipped	0	1	0	1	2
Won't Fix	0	4	3	0	7
Totals	20	14	9	17	60

2. Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	8	0	0	8
Client Application	42	0	0	42
Security	3	0	0	3
Outsource Shipping	2	0	0	2
Exception Reporting	8	0	0	8
Final Report Output	3	0	0	3
Version Control	2	0	0	2

9. RESULTS

9.1 Performance Metrics

In order to assess the ML models' performance, we consider the most common metrics in the relevant literature, such as precision, recall, accuracy, F-Measure and AUC. Each metric will help us to evaluate the models. Specifically, accuracy summarizes the performance of the classification task and measures the number of correctly predicted instances out of all the data instances. Recall captures the proportion of instances who suffered from CKD and were correctly categorized as CKD, concerning all CKD instances. Precision indicates how many of those who were diagnosed with CKD belong to this class. F-measure is the harmonic mean of the precision and recall and summarizes the predictive accuracy of a model. The aforementioned metrics are defined as follows

10. ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- The consultation fee is reduced.
- It does not require a doctor's appointment.
- If they have access to the internet it is easy to take test.
- Since the application predicts the chronic kidney disease earlier it will be easy to diagnose.
- It is more efficient and it is not time consuming application.

DISADVANTAGES:

- The user has to enter all the details required to predict in the form manually.

11. CONCLUSION

The study developed an algorithm for predicting CKD at an early stage. The dataset contains input parameters obtained from CKD patients, and the models are trained and validated using the valid parameters. To diagnose CKD, decision tree, random forest, and support vector machine learning models are built. The accuracy of prediction is used to assess the performance of the models. The study's findings revealed that the Random Forest Classifier model outperforms Decision Trees and Support Vector Machines in predicting CKD. As an extension of this research, the comparison may also be done depending on the duration of execution and feature set selection.

12. FUTURE SCOPE

We developed an algorithm to predict CKD at an early stage. The data set contains input parameters obtained from CKD patients, and the model is trained and validated with valid parameters. Decision trees, random forests, and support vector machine learning models are built to diagnose CKD. Prediction accuracy is used to evaluate model performance. The results of this study showed that random forest classifier models outperform decision trees and support vector machines in predicting CKD. As an extension of this study, comparisons can also be made depending on run time and feature set selection.

13. APPENDIX

SOURCE CODE:

HOMEPAGE.HTML

```
<!DOCTYPE html>

<html lang="en">

<head>
```

```
<meta charset="UTF-8">
 <meta http-equiv="X-UA-Compatible" content="IE=edge">
 <meta name="viewport" content="width=device-width, initial-scale=1.0">
 <link rel="stylesheet" href="homepage.css">
 <title>Chronic Kidney Disease</title>
</head>
<body>
<div class="front">
<img class="background" src="https://images.indianexpress.com/2022/03/kidney-health_1200.jpg" alt="Aleq">
<h1>CHRONIC KIDNEY DISEASE DETECTION</h1>
 <p>Kidney disease does not tend to cause symptoms when it's at an early stage. This is because the body is usually able to cope with a significant reduction in kidney function. Kidney disease is often only diagnosed at this stage if a routine test for another condition, such as a blood or urine test, detects a possible problem. If it's found at an early stage, medicine and regular tests to monitor it may help stop it becoming more advanced.</p>
 <p><b>SYMPTOMS</b>-Nausea and vomiting, muscle cramps, loss of appetite, swelling via feet and ankles, dry, itchy skin, shortness of breath, trouble sleeping, urinating either too much or too little</p>
<a href="form.html">
 <button type="submit" >TAKE TEST</button>
 </a>
```

```
</div>
</body>
 </html>
```

HOMEPAGE.CSS

```
body{
overflow: hidden;
 }.
background{
position: absolute;
left: 0px;
top: 0px;
z-index: -1;
width: 100%;
height: 100%;
-webkit-filter: blur(5px);
filter: blur(5px);
}.
front{
height:100vh;
width: 100%;
text-align: center;
font-size: 200%;
```

color: rgb(11, 12, 12);

}

button{

background-color: rgb(192, 171, 171);

height: 50px;

width: 200px;

font-size: large;

margin-block-end:

auto; bottom: 50px;

}

FORM.HTML

```
<!DOCTYPE html>
<html lang="en">
<head> <meta charset="UTF-8">
<meta http-equiv="X-UA-Compatible" content="IE=edge">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<link rel="stylesheet" href="form.css">
<title>Document</title>
</head>
<body>
<div class="container">
<h1>Enter the required details</h1>
<div class="formbox">
<video autoplay loop muted plays-inline id="myvedio">
```

```
<source src="images/testing.mp4" type="video/mp4">
</video> <form action="result.html" method="GET">
<!-- <section class="image-1">
</section>
<section class="image-2">
</section>
<section class="image-3">
</section>
<section class="image-4">
</section> -->
<!-- Name -->
<div>
<h3>Name</h3>
<input type="text" name="fullname" id="fullname">
</div>
<!-- Age -->
<div>
<h3>Age</h3>
<input type="number" name="age" id="age" >
</div>
<!-- Blood Pressure -->
<div>
<h3>Blood Pressure</h3>
<input type="number" name="bp" id="bp">
</div>
<!-- Urinary Specific gravity -->
<div>
```

```
<h3>Urinary Specific gravity</h3>
<input type="text" name="sg" id="sg">
</div>
<!-- Acute leukaemia -->
<div>
<h3>Acute leukaemia</h3>
<input type="number" name="al" id="al">
</div>
<!-- Secretory unit -->
<div>
<h3>Secretory unit</h3>
<input type="number" name="su" id="su">
</div>
<!-- Red Blood Cells -->
<div>
<h3>Red Blood Cells</h3>
<input type="radio" name="rbc" id="rbcn" value="normal">
<label for="rbcn">Normal</label>
<input type="radio" name="rbc" id="rbca" value="abnormal">
<label for="rbca">Abnormal</label>
</div>
<!-- Platelet Count -->
<div>
<h3>Platelet Count</h3>
<input type="radio" name="pc" id="pcn" value="normal">
<label for="pcn">Normal</label>
<input type="radio" name="pc" id="pca" value="abnormal">
```

```
<label for="pca">Abnormal</label>
</div>
<!-- prothrombin Complex concentrate -->
<div>
<h3>Prothrombin Complex Concentrate</h3>
<input type="radio" name="pcc" id="pccp" value="Present">
<label for="pccp">Present</label>
<input type="radio" name="pcc" id="pccn" value="Not Present">
<label for="pccn">Not Present</label>
</div>
<!-- Bronchical Asthma -->
<div>
<h3>Bronchical Asthma</h3>
<input type="radio" name="ba" id="bap" value="Present">
<label for="bap">Present</label>
<input type="radio" name="ba" id="ban" value="Not Present">
<label for="ban">Not Present</label>
</div>
<!-- Blood glucose regulator -->
<div>
<h3>Blood glucose regulator</h3>
<input type="number" name="bgr" id="bgr">
</div>
<!-- Bandelette terms -->
<div>
<h3>Bandelette terms</h3>
<input type="number" name="bt" id="bt">
```

```
</div>
<!-- subcutaneous -->
<div>
<h3>Subcutaneous</h3>
<input type="number" name="sub" id="sub">
</div>
<!-- Segregation of duties -->
<div>
<h3>Segregation of duties</h3>
<input type="number" name="seg" id="seg">
</div>
<!-- Pot -->
<div>
<h3>POT</h3>
<input type="number" name="pot" id="pot">
</div>
<!-- haemoglobin -->
<div>
<h3>Haemoglobin</h3>
<input type="number" name="hemo" id="hemo">
</div>
<!-- Pneumococcal conjugate vaccine -->
<div>
<h3>Pneumococcal conjugate vaccine</h3>
<input type="number" name="pcv" id="pcv">
</div>
<!-- white blood cell count -->
```

```
<div>
<h3>White blood cell count </h3>
<input type="number" name="wc" id="wc">
</div>
<!-- red blood cell count -->
<div>
<h3>RC</h3>
<input type="number" name="rc" id="rc">
</div> <!-- hypertension -->
<div>
<h3>Hypertension</h3>
<input type="radio" name="htn" id="htny" value="yes">
<label for="htny">Yes</label>
<input type="radio" name="htn" id="htnn" value="no">
<label for="htnn">No</label>
</div>
<!-- diabetes mellitus -->
<div>
<h3>DM</h3>
<input type="radio" name="dm" id="dmy" value="yes">
<label for="dmy">Yes</label>
<input type="radio" name="dm" id="dmn" value="no">
<label for="dmn">No</label>
</div>
<!-- coronary artery disease -->
<div>
<h3>Coronary artery disease</h3>
```

```
<input type="radio" name="cad" id="cady" value="yes">
<label for="cady">Yes</label>
<input type="radio" name="cad" id="cadn" value="no">
<label for="cadn">No</label>
</div>
<!-- appetite -->
<div>
<h3>Appetite</h3>
<input type="radio" name="appet" id="appetg" value="good">
<label for="appetg">Good</label>
<input type="radio" name="appet" id="appetp" value="poor">
<label for="appetp">Poor</label>
</div>
<!-- pulmonary embolism -->
<div>
<h3>Pulmonary embolism</h3>
<input type="radio" name="pe" id="pey" value="yes">
<label for="cady">Yes</label>
<input type="radio" name="pe" id="pen" value="no">
<label for="pen">No</label>
</div>
<!-- anemia -->
<div>
<h3>Anemia</h3>
<input type="radio" name="ane" id="aney" value="yes">
<label for="aney">Yes</label>
<input type="radio" name="ane" id="anen" value="no">
```

```
<label for="anen">No</label>
</div>
<!-- Classification -->
<div class="btn">
<button type="submit">Submit</button>
</div>
</form>
</div>
</div>
</body>
</html>
```

FORM .CSS

```
input,label {
cursor: pointer;
margin: .3rem;
padding-right: 5rem;
}
input[type=text],[type=number],[type=submit]
{
width: 100%;
padding: 12px 20px;
margin: 8px 0;
display: inline-block;
border-radius: 4px;
box-sizing: border-box;
```

```
font-size: 20px;
}
input[type="radio"]:
focus {
height: 1rem;
width: 1rem;
margin-right: 0.2rem;
margin-left:10px;
font-size: large;
}
button {
background-color: #4CAF50;
border: none;
color: white;
padding: 10px 20px;
text-align: center;
text-decoration: none;
display: inline-block;
font-size: 16px;
}.
btn{
display: flex;
width: 300px;
text-align: center;
justify-content: center;
padding-top: 20px;
padding-left: 250px;
```

```
margin-right: 20px;
}
h1{
text-align: center;
}
form {
box-sizing: border-box;
padding: 2rem;
border-radius: 15rem;
}
formbox{
max-width: 800px;
margin: auto;
border-radius: 10px;
display: flex;
align-items: center;
box-shadow: 0 0 20px rgba(0, 0, 0, 7);
color: rgb(14, 1, 1);
font-size: larger;
font-weight: 500;
background:rgba(0, 0, 0, 0.1)
}
#myvedio {
width: 100vw;
height: 100vh;
object-fit: cover;
position: fixed;
```

```
left: 0;
right: 0;
top: 0;
bottom: 0;
z-index: -1;
}
```

App.py

```
from flask import Flask, render_template, request
import numpy as np
import pickle
app = Flask(__name__)
model = pickle.load(open('Kidney.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)
        return render_template('result.html', prediction=prediction)
if __name__ == "__main__":
    app.debug=True
    app.run(debug=False)
```

Github & Project Demo Link:

https://github.com/IBM-EPBL/IBM-Project-22070-1659802916