EARLY DETECTION OF CHRONIC KIDNEY DISEASE USING MACHINE LEARNING

PROJECT REPORT

TEAM ID: PNT2022TMID14240

Team Members :

➢ Dincy V.D

➢ Brindha.C

➢ Divya Rani R

➢ Harini.G

1. INTRODUCTION

1.1 PROJECT OVERVIEW

Prediction of chronic kidney disease is one of the most crucial challenges in healthcare analytics. The most fascinating and difficult jobs in daily life because millions of people die each year due to lack of access to inexpensive treatment for chronic kidney disease (CKD), which affects one third of the adult population. If chronic kidney disease is addressed early on, it may be cured. The major goal of the research is to use diagnostic measurements like albumin and blood pressure to quickly, accurately, and painlessly determine if a patient has chronic kidney disease or not. Based on the information provided by the model, suitable treatment can then be administered.

1.2 PURPOSE

The project's goal is to warn medical professionals of kidney illness early on, ensuring a quick recovery or kidney disease prevention. The goal of this project is to use machine learning to develop a model for the early diagnosis of chronic kidney disease. Flask and the output are combined. The same model is placed into IBM cloud, and the front end created in HTML is utilized to take user input on various criteria required to decide on the early identification of kidney illness.

2. LITERATURE SURVEY:

2.1 EXISTING PROBLEM:

On either side of the spine, the kidneys are located in the abdominal cavity. They typically weigh five times as much as their body weight yet only receive 20% of the heart's blood supply. Each kidney excretes urine into the urinary bladder, which is located in the pelvic region, through a separate urethra. Because it regulates fluid balance, electrolyte balance, and other factors that keep the body's internal environment constant and comfortable, the kidney is the most crucial organ in the human body. Conditions known as renal disorders affect the way that the kidneys work. Kidney failure can result from advanced renal diseases.

The functioning of the kidneys is impacted by renal disorders. When kidneys are hurt, they are unable to function as they should. The term for this is chronic renal disease (CKD). A chronic kidney illness can strike anyone.

Nephrologists typically use two main assays to detect CKD in medical studies. a urine test to measure albumin and a blood test to measure glomerular filtration rate (GFR) [1]. Age, genetics, diabetes, obesity, hypertension, and other variables can all affect CKD. The Kidney Disease Outcomes Quality Initiative (KDOQI) and KDIGO (Kidney Disease Improving Global Outcome) of the US National Kidney Foundation and other international standards organizations provide important information and updates on CKD According to the KDIGO CKD and English National Institute for Health and Care Excellence (NICE) CKD recommendations, the renal patient is identified by two tests, both of which are blood tests to check the kidneys' ability to filter out creatinine, a result of normal muscle breakdown. An examination of the urine, in contrast, will reveal that protein is still present.The kidney filter typically does not allow protein (albumin), a blood component, to enter the urine. Albumin in the urine indicates a problem with the kidney filters and may be a sign of chronic renal illness. A glomerular filtration rate (GFR) of less than 60 ml/min/1.73 m2 for more than three months is considered chronic kidney disease (CKD), which has major health consequences.

Prognosis of CKD by GFR and Albuminuria Categories: KDIGO 2012

GFR categories (ml/min/ 1.73 m²) Description and range				Persistent albuminuria categories Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				< 30 mg/g < 3 mg/mmol	30-300 mg/g 3-30 mg/mmol	> 300 mg/g > 30 mg/mmol
	G1	Normal or high	≥ 90			
	G2	Mildly decreased	60-89			
	G3a	Mildly to moderately decreased	45-59			
	G3b	Moderately to severely decreased	30-44			
	G4	Severely decreased	15-29			
	G5	Kidney failure	< 15			

GFR and Albuminurea categories KDIGO 2012.

In medical research, nephrologists typically employ two key tests to identify CKD. A blood test is used to determine GFR, whereas a urine test is used to determine albumin. Genetics, high blood pressure, diabetes, obesity, age, and other factors can all have an impact on CKD. International kidney disease development guidelines and standards foundations like the US National Kidney Foundation Kidney Disease Outcomes Quality Initiative (KDOQI) and KDIGO (Kidney Disease Improving Global Outcome) provide significant information on CKD facts and developments.

Two blood tests that assess how effectively the kidneys filter blood to remove creatinine are used to identify the renal patient, in accordance with KDIGO CKD and English National Institute for Health and Care Excellence (NICE) CKD guidelines. a side effect of muscle breakdown On the other hand, a urine test will show that protein is still present in the urine. A component of blood called protein (albumin) is typically not eliminated by the kidney filter. Finding albumin in the urine is a sign that the kidney filters are malfunctioning and may indicate chronic renal disease. A glomerular filtration rate (GFR) of less than 60 ml/min/1.73 m2 for more than three months is referred to as chronic kidney disease (CKD), which has serious health consequences.

By utilizing machine learning techniques to identify CKD at an early stage and concentrating on applying various machine learning classification algorithms to a dataset of 400 patients and 24 CKD-related characteristics, N.A. Almansour et al. hope to contribute to the prevention of CKD. Artificial neural networks and support vector machines are used as classification techniques, and any missing values in the dataset are substituted by the appropriate features. The final models of the two suggested strategies were built using the best parameters and traits that had been gathered. The results of the experiment demonstrated that ANN outperformed SVM, with accuracy rates of 99.75 percent and 97.75 percent, respectively.

2.2 REFERENCES:

1) G. Chen et al., “Prediction of Chronic Kidney Disease Using Adaptive Hybridized Deep Convolutional Neural Network on the Internet of Medical Things Platform,” IEEE Access, vol. 8, pp. 100497–100508, 2020, Doi: 10.1109/ACCESS.2020.2995310.

2) P. T. Coates et al., “KDIGO 2020 Clinical Practice Guideline for Diabetes Management in Chronic Kidney Disease,” Kidney Int., vol. 98, no. 4, pp. S1– S115, 2020, doi: 10.1016/j.kint.2020.06.019.

3) L. Chen, “Overview of clinical prediction models,” Ann. Transl. Med., vol. 8, no. 4, pp. 71–71, 2020, Doi: 10.21037/atm.2019.11.121.

4) H. Kriplani, B. Patel, and S. Roy, Prediction of chronic kidney diseases using deep artificial neural network technique, vol. 31. Springer International Publishing, 2019.

5) T. O. Ayodele, “Atherosclerotic Cardiovascular Disease,” Atheroscler. Cardiovasc. Dis., 2012, Doi: 10.5772/711.

6) Abdi, “Three types of Machine Learning Algorithms List of Common Machine Learning Algorithms,” no. November 2016, Doi: 10.13140/RG.2.2.26209.10088.

7) S. Y. Yashfi et al., “Risk Prediction of Chronic Kidney Disease Using Machine Learning Algorithms,” 2020 11th Int. Conf. Comput. Commun. Netw. Technol. ICCCNT 2020, 2020, Doi:

10.1109/ICCCNT49239.2020.9225548.

8) N. A. Almansour et al., “Neural network and support vector machine for the prediction of chronic kidney disease: A comparative study,” Comput. Biol. Med., vol. 109, no. October 2018, pp. 101–111, 2019, doi:10.1016/j.compbiomed.2019.04.017.

9) Sobrinho, A. C. M. D. S. Queiroz, L. Dias Da Silva, E. De Barros Costa, M. Eliete Pinheiro, and A. Perkusich, “Computer-Aided Diagnosis of Chronic Kidney Disease in Developing Countries: A Comparative Analysis of Machine Learning Techniques,” IEEE Access, vol. 8, pp. 25407–25419, 2020, Doi: 10.1109/ACCESS.2020.2971208.

10) N. V. Ganapathi Raju, K. Prasanna Lakshmi, K. G. Praharshitha, and C. Likhitha, “Prediction of chronic kidney disease (CKD) using Data Science,” 2019 Int. Conf. Intell. Comput. Control Syst. ICCS 2019, no. Iciccs, pp. 642–647, 2019, Doi: 10.1109/ICCS45141.2019.9065309.

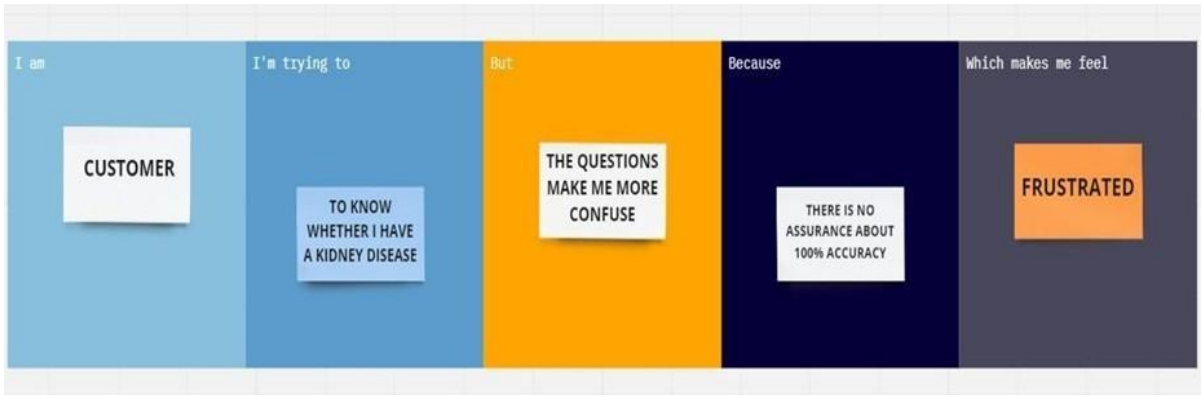
11) P. Kotturu, V. V. S. Sasank, G. Supriya, C. S. Manoj, and M. V. Maheshwarredy, “Prediction of chronic kidney disease using machine learning techniques,” Int. J. Adv. Sci. Technol., vol. 28, no. 16, pp. 1436–1443, 2019, Doi: 10.17148/IJARCCE.2018.71021.

12) Deep Learning,” 2018 Int. Conf. Innov. Eng. Technol. ICIET 2018, pp. 1–6, 2019, Doi: 10.1109/CIET.2018.8660844.

2.3 PROBLEM STATEMENT DEFINITION:

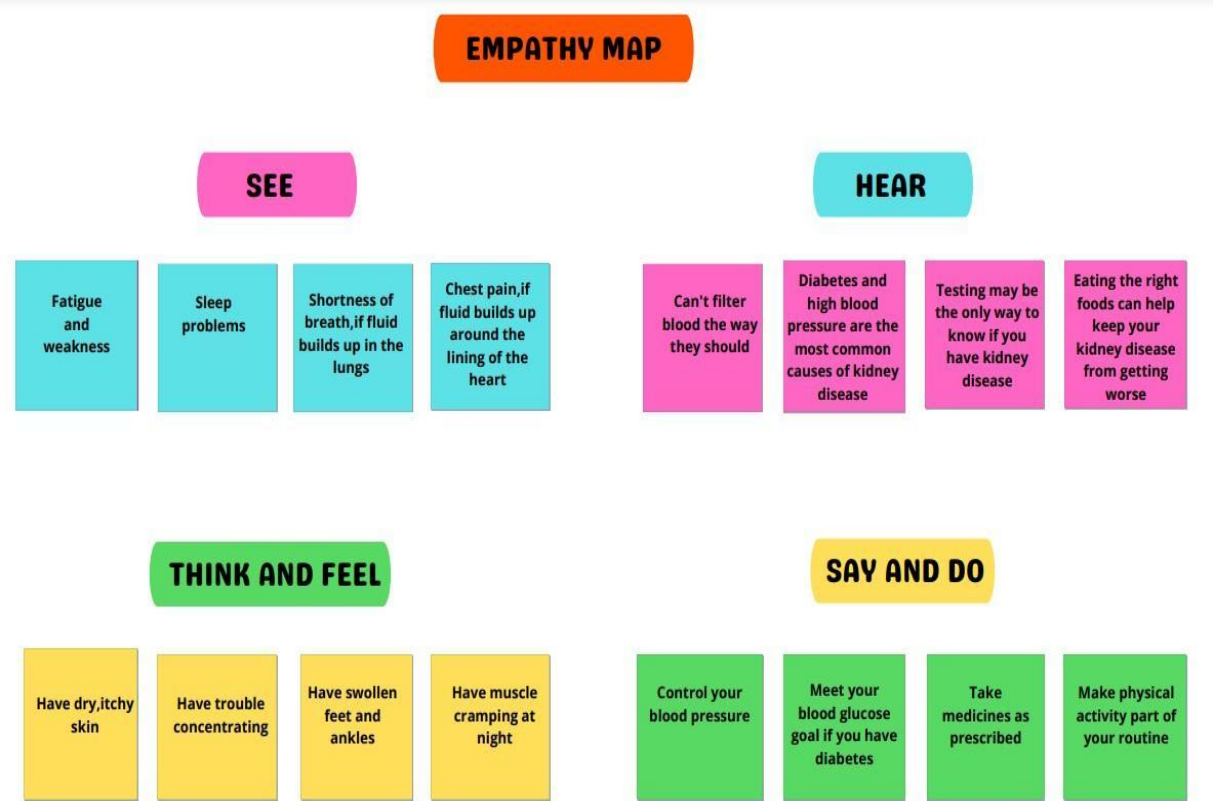
1. CHRONIC KIDNEY DISEASE (CKD) is a disorder that disrupts the normal kidney function that is among the top 20 causes of death worldwide and it affects approximately 10% of the world’s adult population.Due to the increasing number of people with CHRONIC KIDNEY DISEASE, effective predictions measures for the early diagnosis of CKD are required.

2. The goal is to diagnose CKD in its earliest stages using a diagnostic algorithm.The major problem that we are facing is the lack of ability to implement the huge datasets at the same time most of the algorithm will fail to give 100 percent accuracy about the prediction.

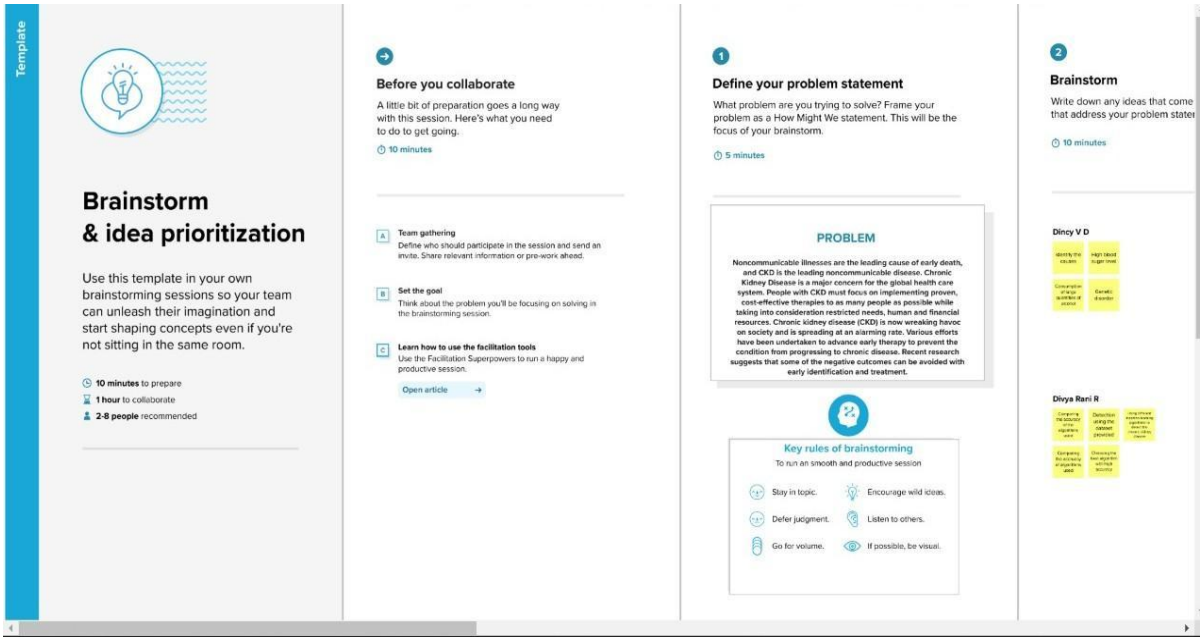


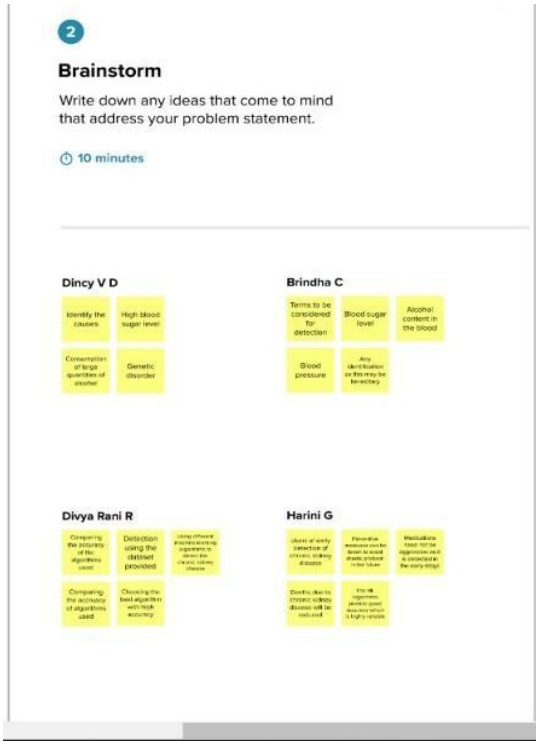
3. IDEATION AND PROPOSED SOLUTION:

3.1 EMPATHY MAP CANVAS



3.2 IDEATION AND BRAINSTORMING:



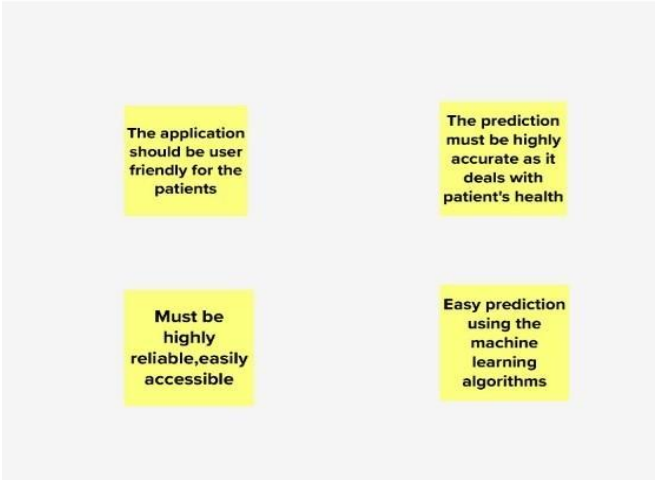


3

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

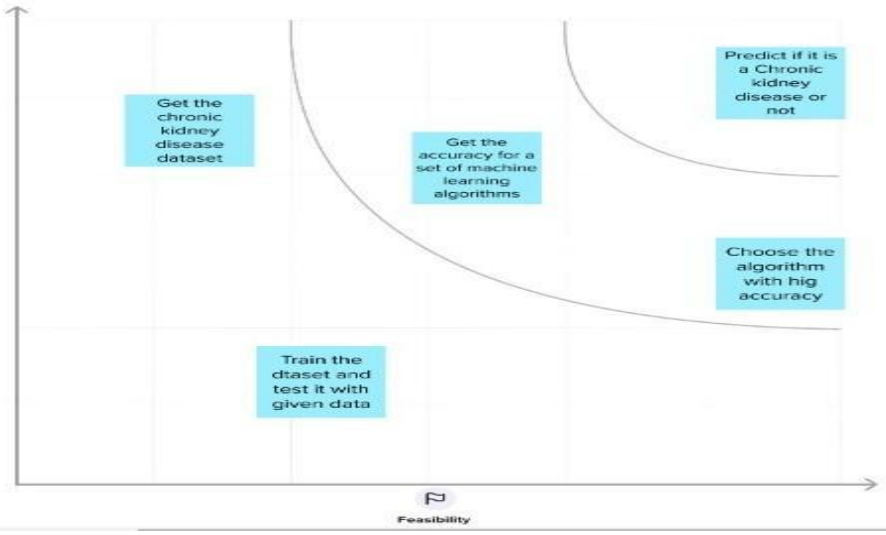


4

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



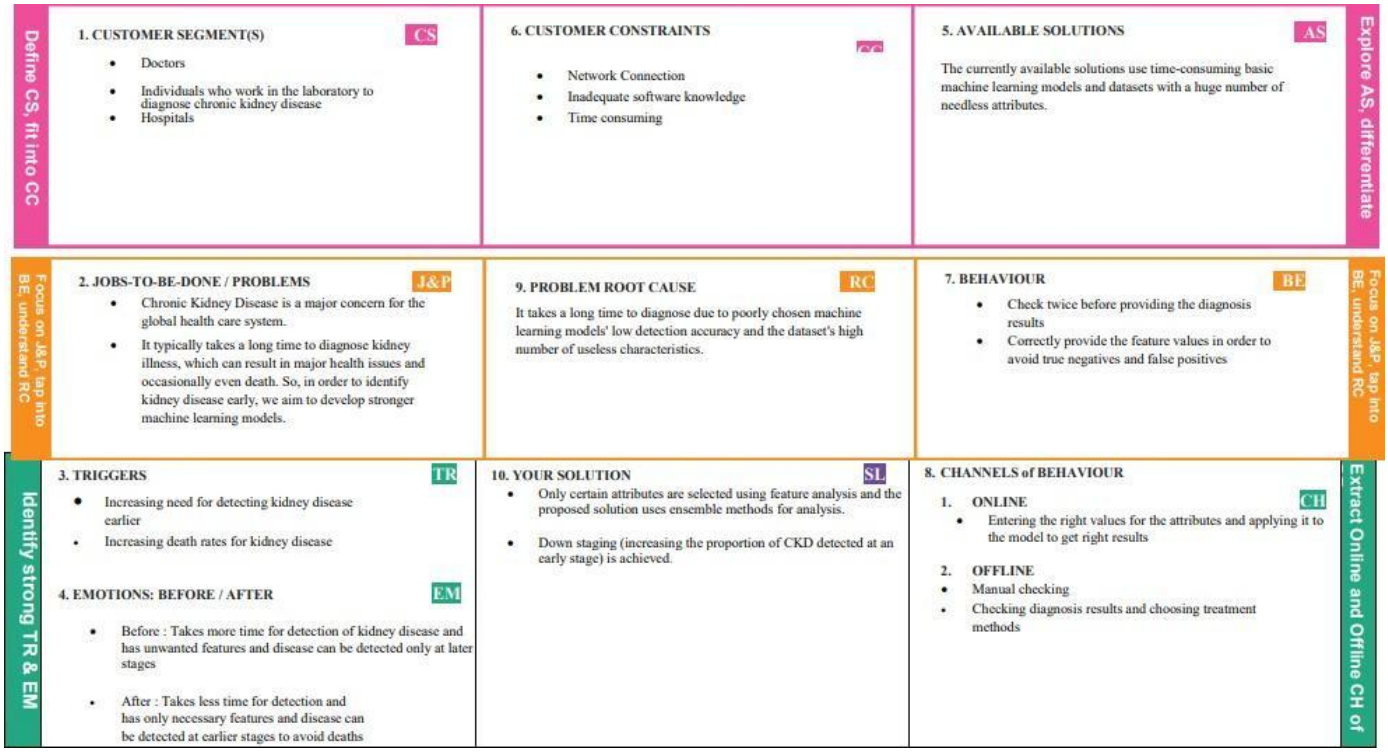
3.3 PROPOSED SOLUTION

s.no	Parameter	Description
1.	Problem Statement (Problem to be solved)	The primary cause of premature death is non-communicable disease, and CKD is the most prevalent one. The worldwide health care system is extremely concerned about chronic kidney disease. Individuals with CKD must concentrate on providing as many people as possible with effective, cost-proven medicines while taking into account their limited needs, human, and financial resources. The rise of chronic kidney disease (CKD), which is currently wreaking havoc on society, is frightening. Numerous initiatives have been made to develop early therapy in an effort to stop the problem from turning into a chronic disease. With early detection and treatment, some of the detrimental effects can be prevented.
2.	Idea / Solution description	The current diagnostic method relies on the analysis of urine with the aid of serum creatinine levels. This is accomplished using a variety of medical techniques, including ultrasonography and screening. Patients who have hypertension, a history of cardiovascular disease, a current illness, or who have had renal disease in a family member are all screened during the screening process. The suggested method includes measuring the urine albumin-to-creatinine ratio and estimating GFR from serum creatinine levels (ACR). In order to increase prediction accuracy, this research focuses on machine learning approaches such ACO, SVM, and ensemble methods by reducing the features and choosing the best features.

3.	Novelty / Uniqueness	The suggested solution uses ensemble methods for analysis and restricts the selection of attributes to a subset utilizing feature analysis. It is accomplished to downstage (increase the percentage of CKD recognised at an early stage).

4	Social Impact / Customer Satisfaction	Patients with CKD who gradually lose kidney function may develop end-stage kidney disease (ESKD), necessitating kidney replacement therapy (KRT). The quality of life for CKD patients with a high risk of developing ESKD may be improved with prompt management, which may also lower morbidity, mortality, and healthcare expenditures associated with KRT.
5.	Business Model (Revenue Model)	Can make money from direct customers and can work with the care industry to make money from their clients.
6.	Scalability of the Solution	The vast majority of physicians and other medical professionals still do not find an automated virtual approach to define CKD to be totally compelling or conclusive. A future of automated artificial medical assistants, however, may become a reality with more data, greater effectiveness, and greater accuracy. As a system of law built on expertise, the information-driven approach may be employed in the future to eliminate uncertainty.

3.4 PROBLEM SOLUTION FIT:



4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	New user will register through Login page
FR-2	User Confirmation	Confirmation via Email Confirmation via Mobile number
FR-3	User Requirements	Account has to be created go through the content and provide necessary data and perform other action

FR-4	Business Requirements	A System allowing patients to identify CKD in around time of 15 minutes with proper network connection
FR-5	User Authentication	Challenges the user to validate Credentials (Ex: Username and password)
FR-6	User Authorization	Once the server receives the request with correct authorization. It will grant you access to the resources

4.2 NON FUNCTIONAL REQUIREMENT:

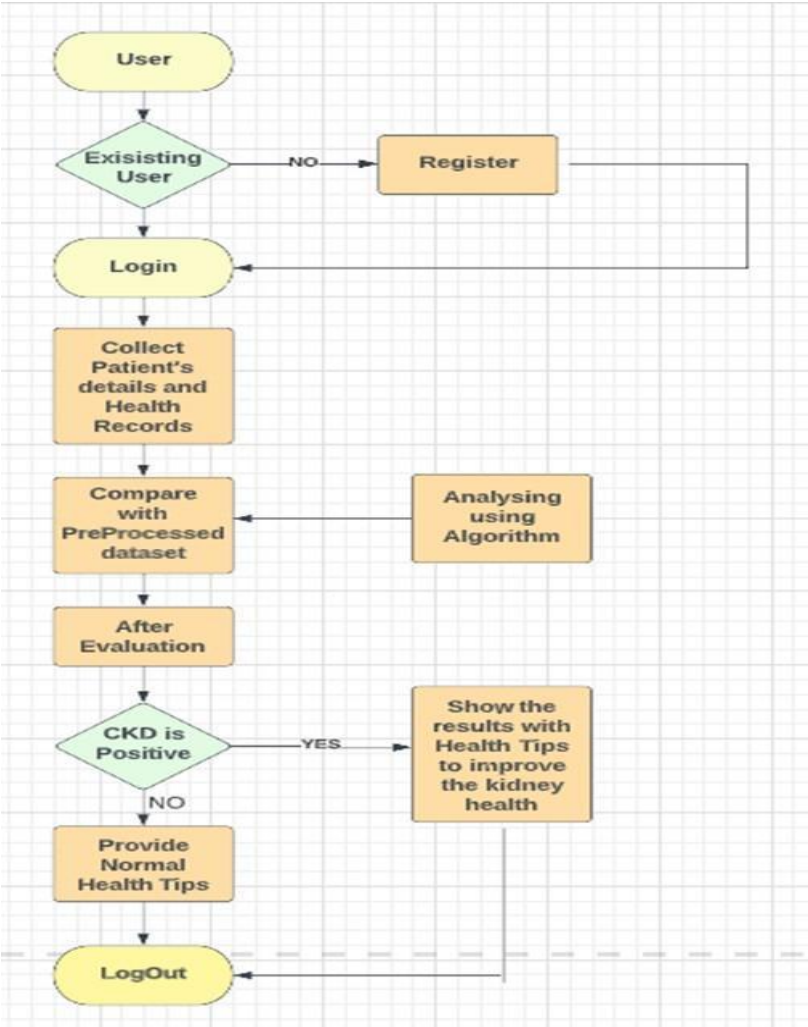
FR No.	**Functional Requirement (Epic)**	**Sub Requirement (Story / Sub-Task)**
FR-1	User Registration	New user will register through Login page
FR-2	User Confirmation	Confirmation via Email Confirmation via Mobile number
FR-3	User Requirements	Account has to be created go through the content and provide necessary data and perform other action
FR-4	Business Requirements	A System allowing patients to identify CKD in around time of 15 minutes with proper network connection

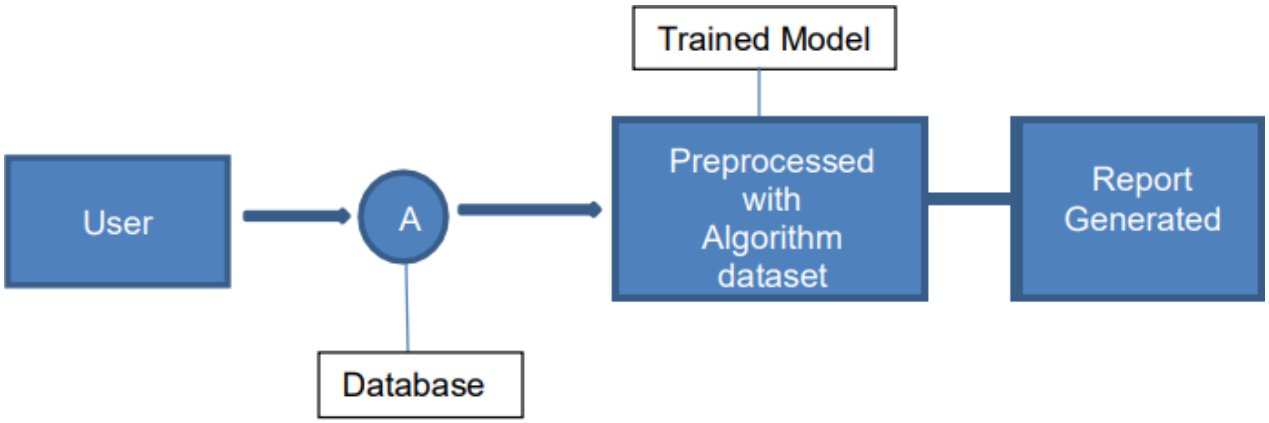
FR-5	User Authentication	Challenges the user to validate Credentials (Ex: Username and password)
FR-6	User Authorization	Once the server receives the request with correct authorization. It will grant you access to the resources

5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

A 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





FLOW:

1. User enter into the System by giving Login credentials and start the app
2. User will Give medical records to the trained model
3. Trained model analyzes the user data by Machine learning algorithm
4. The result will be Published based on the trained model.

5.2 SOLUTION AND TECHNICAL ARCHITECTURE

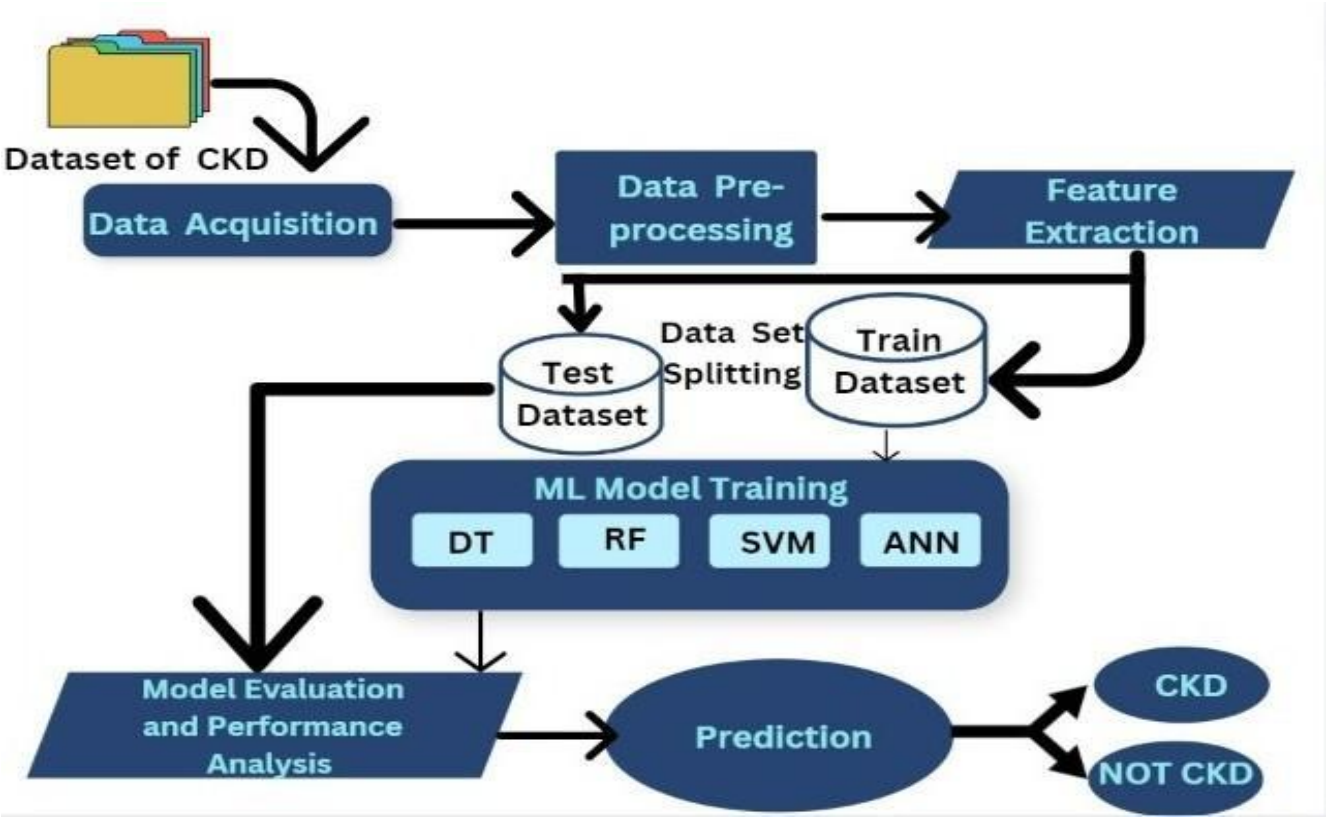


TABLE-1 : COMPONENTS & TECHNOLOGIES:

S.No	Component	Description	Technology
1	User Interface	How user interacts with application	HTML, CSS,Python Flask
2	Application Logic-1	Get input from the user	HTML,CSS,Python Flask
3	Application Logic-2	Predicts based on the provided input	Python
4	Application Logic-3	Displays the predicted Result	Python,HTML,CSS,Flask
5.	Machine Learning Model	Random Forest,Regression techniques,Decision tree and SVM	Classification Algorithms

TABLE-2: APPLICATION CHARACTERISTICS

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Google colab,Jupyter notebook,IBM cloud and Flask.
2.	Scalable Architecture	Model can be scalable	Python
3.	Availability	It is used as a website(UI) or available in cloud	IBM cloud
4.	Performance	High accuracy	Machine Learning Classification techniques

5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story/Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	New user enters into the System He/She can register into the Application by entering mail Id and Password.	User can get access to account/Dashboard	High	Sprint-1
		USN-2	The user will receive conformation Email	By receiving Conformation email the User Click confirm	High	Sprint-1
	Login	USN-3	After Successful registration the user can Login to the application by entering the registered Mail Id and Password	Once the verification is successful the Dashboard will immediately displayed	Low	Sprint-2
	Dashboard	USN-4	User can get into the Dashboard onlywhen the Verification Successful. After the user can access the displayed information in the Dashboard	User can access all the details in Dashboard	Medium	Sprint-1
Customer (Web user)	Sign-in	USN-5	User can access the system at anytime and from any where by using User Login Credentials	User can access the Application	High	Sprint-2
Customer Care Executive	Clarification	USN-6	The problems which are faced by the user while using the application can be clarified	The detailed explanation can be given to thenuser	Medium	Sprint-2
Administrator	Quality assurance	USN-7	As a user they have some credibility issues while using application.	We can give 100% assurance to that application	High	Sprint-3

6. PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

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

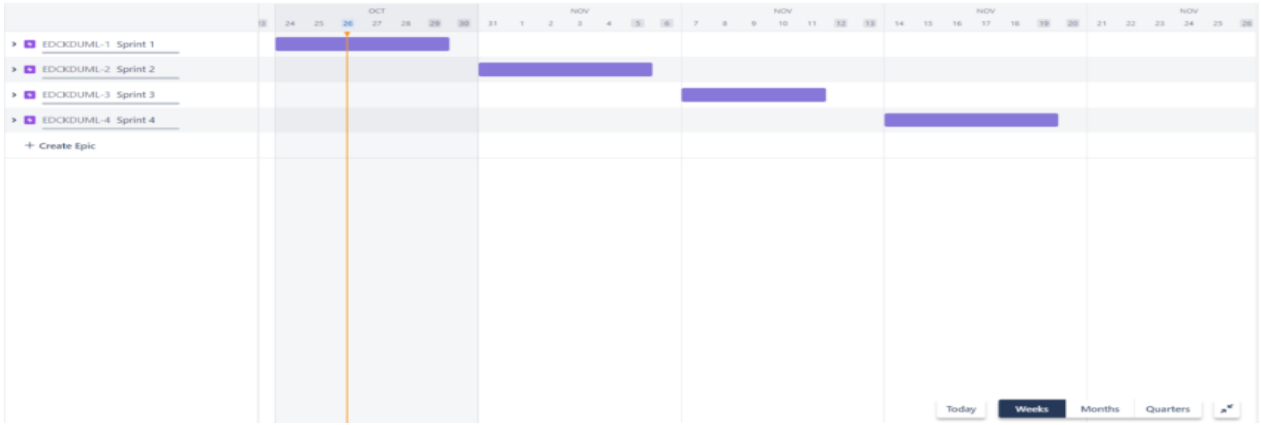
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Collection of Datasets	USN-1	Collect dataset from google and clean the datasets	5	High	Dincy V D
Sprint-1	Model	USN-2	Create, test and save the model	5	High	Harini G Divya Rani R
Sprint-2	Home Page	USN-3	The user can enter into the home page	6	Medium	Brindha C
Sprint-2	Quiz	USN-4	User can take up the quiz to know the prediction result.	4	High	Dincy V D
Sprint-3	Result	USN-5	The user will get the output	3	High	Brindha C Divya Rani R
Sprint-3	Remedies	USN-6	The user will get the remedies according to their symptoms.	7	Medium	Harini G
Sprint-4	Doctor's Appointments	USN-7	The users also get Doctor's appointment if needed	4	Medium	Dincy V D Harini G
Sprint-4	Deployment	USN-8	Deploy into IBM Cloud	6	High	Brindha C Dincy V D

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	31-Oct 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	07-Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	14-Nov 2022

6.3 REPORTS FROM JIRA



7. CODING AND SOLUTIONING

7.1 Feature 1

- IBM Watson Platform
- Web UI
- Python Code
- HTML
- CSS
- JS

7.2 Feature 2

- Cloudant DB
- Neural Network
- NLP
- Artificial Intelligence

7.3 HTML

Code

homepage.html

```
<!DOCTYPE html>
<html lang="en">
<!--divinectorweb.com-->
<head>
 <meta charset="UTF-8">
 <title>Renal fit</title>
 <link href="static/style.css" rel="stylesheet">
</head>
<body>
 <div class="menu-area">
```

Renal fit
<ul class="nav">

```
                    <li>                    <a
                                            href="#home"><b>Home</b></a>
                    </li>
                    <li>
                                            <a
                    </li>                   href="#about"><b>About</b></a>
                    <li>

                    </li>                   <a href="#takeatest"><b>Take a
                    <li>                    Test</b></a>

                    </li>
                    <li>                    <a
                                            href="#Treatments"><b>Treatment
                    </li>                   </b></a>
                    </ul>
</div>
                                            <a
                                            href="#contact"><b>Contact</b></
                                            a>
        <section id="home">
            <div class="content">
                <h1>Chronic Kidney Disease Prediction</h1>
                <p><b>CKD is a condition in which the kidneys are damaged and cannot filter blood as well as they should. 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.</b></p>
            </div>
        </section>
        <section id="about">
            <div class="content">
                <h1>About</h1>
                <p>Chronic kidney disease includes conditions that damage your kidneys and decrease their ability to keep you healthy by filtering wastes from your blood. If kidney disease worsens, wastes can build to high levels in your blood and make you feel sick.</p>

            </div>
        </section>
        <section id="take a test">
            <div class="content">
                <h1>Take a Test</h1>
                <p>Test if you have kidney disease or not!!! </p>
                <form action="{{ url_for('index') }}" method="POST">
                <button type="submit">Take Test</button>
                </form>
            </div>
        </section>
        <section id="Treatments">
            <div class="content">
                <h1>Treatment</h1>
                <p>The main treatments are:</p>

    <ul>
    <li>lifestyle changes – to help you stay as healthy as possible</li>
    <li>medicine – to control associated problems, such as high blood pressure and high cholesterol</li>
```

dialysis – treatment to replicate some of the kidney's functions, which may be necessary in advanced (stage 5) CKD

```
<li>kidney transplant – this may also be necessary in advanced (stage 5) CKD</li>
</ul>
    </div>
 </section>
 <section id="contact">
    <div class="content">
        <h1>Contact</h1>
        <p>For any further details contact : 9856321479</p>
        <p> You can also mail us at : renalfit@gmail.com</p><br>
        <p><i><b>Exercise</b></i> to be fit, <b> <i>Eat</i> </b>to nourish your body
and always <b><i>Ignore</i></b> the haters & unhealthy examples that were once feeding you.
<b><i>You</i></b> are worth more than you realise.</p>

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

index.html

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

<head>
   <meta charset="UTF-8">
   <title>Renal fit</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">
        <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>


          </form>
        </div>




    <style>

    /* Background Image */
    body
    {
                                                                    background-image:
url(https://www.diabetescarecommunity.ca/wp-content/uploads/2020/10/kidney-treatment.jpg);
        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;
}

.heading_font{
   color: #black;
    font-family: 'Pacifico', cursive;
    font-size: 50px;
    font-weight: normal;
}



/* 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>
</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>𝔎𝔢𝔫𝔞𝔩 𝔣𝔦𝔱</title>
</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>

                    {% elif prediction==0 %}
                        <h1><span    class='safe'>🎉  Congratulation!
🎉<br><br>You DON'T have Chronic Kidney Disease.</span></h1>
                    {% endif %}
                </div>
        </form>

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

    </div>


<style>

/* Background Image */
body
{
background-image:
url(https://static.scientificamerican.com/sciam/cache/file/50DFB6AE-4562-4A9F-AFF2417D742
9B6B0_source.jpg?w=590&h=800&DC08B8D2-8C15-4CD7-A556D194CE6D03E1);
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;
}

.heading_font{
   color: #black;
     font-family: 'Pacifico', cursive;
     font-size: 50px;
     font-weight: normal;
}



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

</style>


</body>

</html>
```

7.4 CSS Code

homepage.css

```
html {
    scroll-behavior: smooth;
}
body {
    margin: 0;
    padding: 0;
    font-family: montserrat;
}
.menu-area {
    position: fixed;
    display: flex;
    justify-content: center;
    align-items: center;
    flex-direction: row;
    flex-wrap: wrap;
    color:#000000;
    background-color: rgba(224, 228, 231, 0.2);
    width: 100%;
    height:  70px;
    z-index: 1;
}
.nav {
    display: flex;
    justify-content: right;
    list-style: none;
    margin-right: 15%;
}
.logo {
    flex: 1 1 auto;
    margin-left: 10%;
    text-transform: uppercase;
    letter-spacing: 1px;
    font-weight: bold;
    font-size: 25px;
}
a {
    margin: 15px;
    color: #ff0000;
    text-decoration: none;
    text-transform: uppercase;
}
a:hover {
    color: #000;
}
#home {
    position: relative;
    background-image:
url(https://www.worldkidneyday.co.uk/wp-content/uploads/KTF-650x650-1.jpg);
    width: 100%;
```

```
    height: 100vh;
    background-repeat: no-repeat;
    background-size: cover;
    background-position: center center;
    text-align: center;
}
#home .content {
    width: 100%;
}
#home .content h1 {
    font-size: 60px;
    margin: 10px 0;
    color: #000
;
}
#home .content p {
    width: 50%;
    margin: auto;
    line-height: 1.6;
    color: #000
;
}
#about, #takeatest, #Treatments, #contact {
    position: relative;
    display: flex;
    justify-content: space-around;
    align-items: center;
    flex-wrap: wrap;
    flex-direction: row;
    width: 100%;
    height: 100vh;
}
.content {
    width: 80%;
    height: 100%;
    padding: 15% 0;
}
.content h1 {
    font-size: 30px;
    text-transform: uppercase;
}
.content p {
    font-size: 24px;
    line-height: 50px;
}

.content li {
font-size: 24px;
    line-height: 50px;
}
```

```
.content button {
  background-color: #4CAF50;
  border: none;
  color: white;
  padding: 15px 32px;
  text-align: center;
  text-decoration: none;
  display: inline-block;
  font-size: 16px;
  margin: 4px 2px;
  cursor: pointer;
}
```

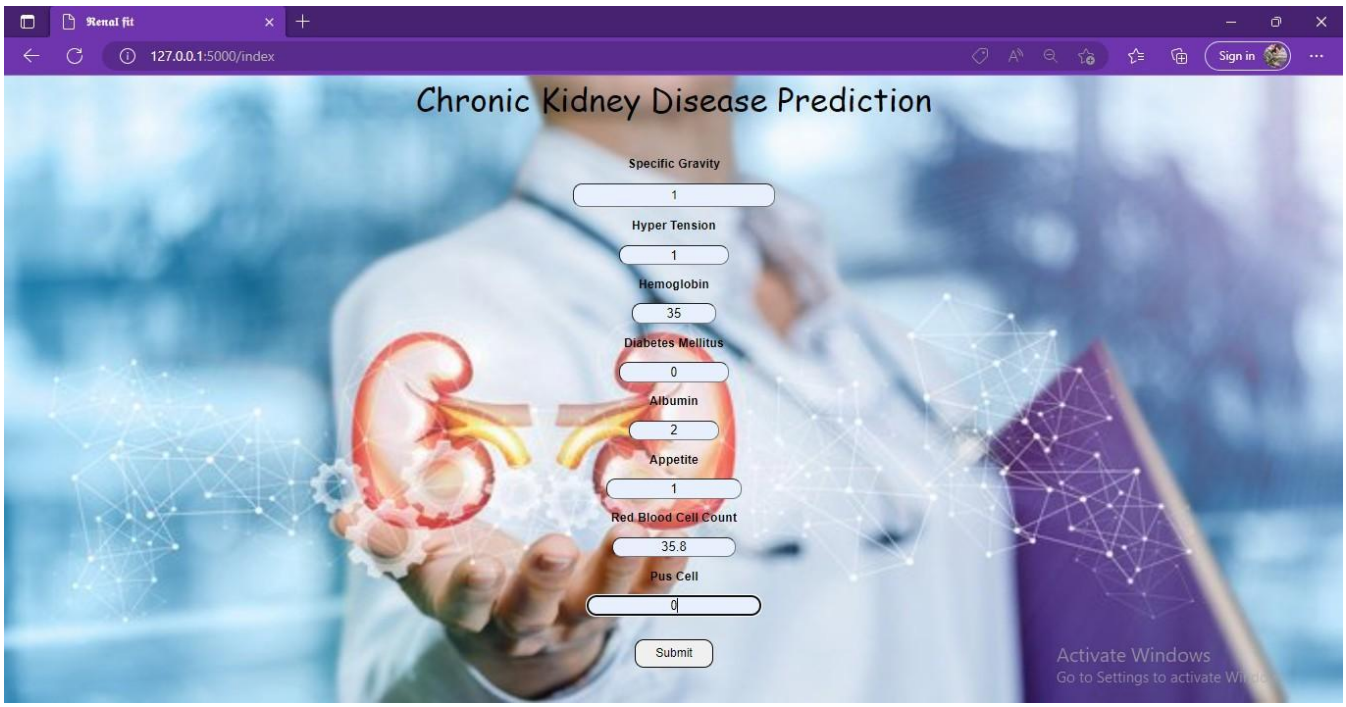
homepage.css

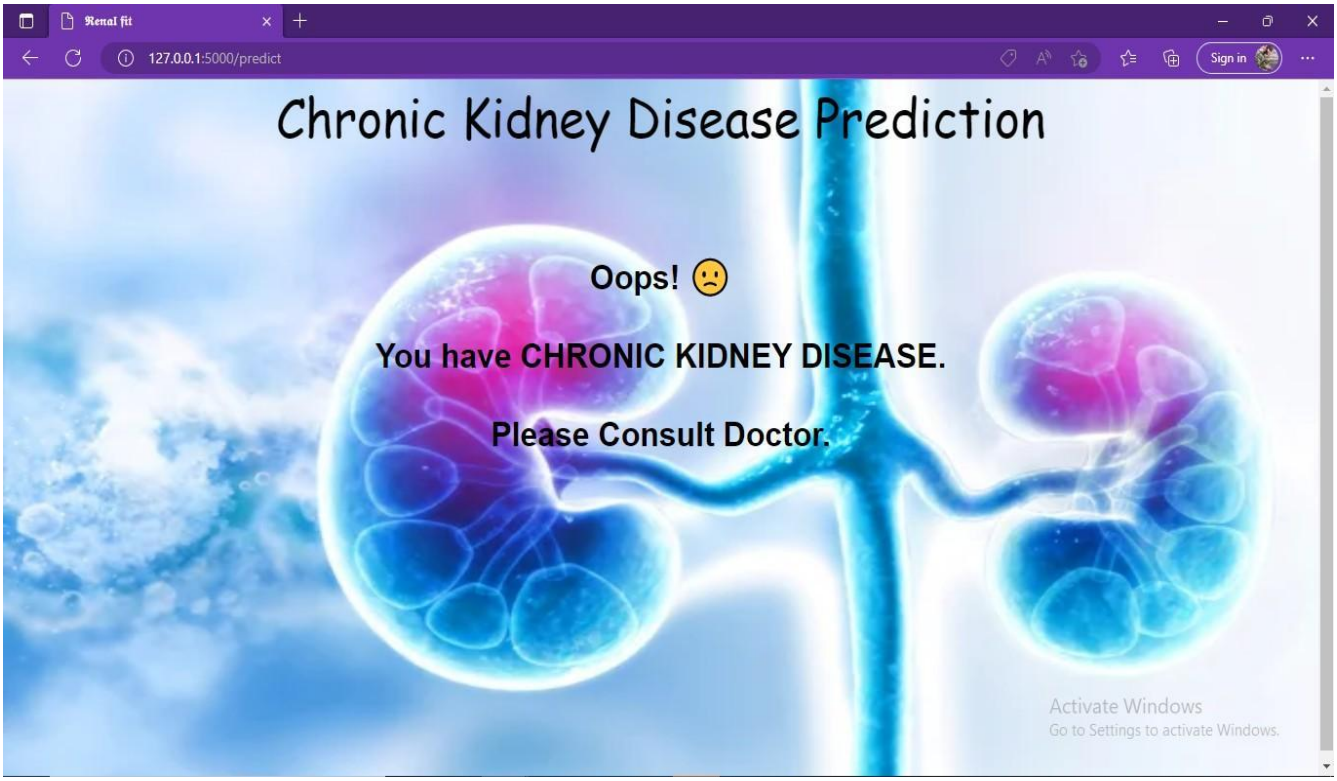
```
@media (max-width: 800px) {
    .logo {
                                        text-align: center;
    }
    .nav {
                                        margin: 0;
                                        padding: 0;
    }

    .nav a {
            font-size: 10px;
            margin: 10px;
    }
    #home .content h1 {
            font-size: 30px;
    }
    #home .content p {
            width: 90%;
            font-size: 16px;
    }
    .content {
            padding: 50% 0;
    }
    #about, #takeatest, #Treatments, #contact {
            flex-direction: column;
            padding: 180px 0;
    }
    #TakeaTest .content {
            padding: 96px 0;
    }}
```

8. TESTING

8.1 TEST CASES





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 [ProductName] project at the time of the release to User Acceptance Testing (UAT).

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	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	0	0	0	0
Totals	10	4	4	3	21

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
Home Screen	1	0	0	1
User Input	3	0	0	3
Chronic Kidney Disease testing	2	0	0	2
No Chronic Kidney Disease testing	2	0	0	2
Version Control	2	0	0	2

9. RESULTS

9.1 PERFORMANCE METRICS

```
Accuracy: 0.975
[[55  3]
 [ 0 62]]
              precision    recall  f1-score   support

           0       1.00      0.95      0.97        58
           1       0.95      1.00      0.98        62

    accuracy                           0.97       120
   macro avg       0.98      0.97      0.97       120
weighted avg       0.98      0.97      0.97       120
```

10. ADVANTAGES & DISADVANTAGES

Advantages:

Due to its rising prominence, chronic kidney disease (CKD) is one of the most serious health issues. It is sometimes referred to as chronic renal disease, a disorder marked by a progressive decline in kidney function over time. Using a machine learning system would be a superior testing method that might possibly detect CKD in its early stages.

- Higher chances of recovery.
- Greater cost savings in hospitals for testing.
- Aids in early disease identification

Disadvantages:

The CKD prediction model online programme has many benefits, but it also has certain drawbacks, some of which are listed below.The least amount of times that a prediction will be incorrect, which can lead to issues. A sizable feature in the dataset on the identification of the disease's time course renders the model ineffective to maintain metrics.Since it is a web application, scaling web apps is necessary to manage concurrent requests once a specific threshold has been reached.

11. CONCLUSION

The benefit of this approach is that the prediction process takes far less time doctors to initiate treatment at the earliest for patients with CKD and further to classify larger populations of patients within a shorter span. Because the dataset used in this paper is tiny with 400 examples, we prefer to work with larger datasets in the future or compare the results of this dataset with a different dataset with the same. In addition, to help minimize the incidence of CKD, we try to predict if a person with this syndrome chances chronic risk factors such as hypertension, family history of kidney failure and diabetes using the appropriate dataset. Early prediction is very crucial for both the experts and the patients to prevent and slow down the progress of chíonic kidney disease to kidney failure.

12. FUTURE SCOPE

Our projects play a major role in predicting chronic kidney disease using machine learning. It is of great importance in the upcoming years.

13. APPENDIX

Chronic renal disease, often known as chronic kidney disease (CKD), has grown significantly in importance. Because a person may only survive without their kidneys for an average of 18 days, dialysis and kidney transplants are in great demand. Effective techniques for CKD early prediction are crucial. Machine learning techniques are useful for predicting CKD. In order to predict CKD status using clinical data, this work suggests a methodology that includes data prepossessing, a mechanism for handling missing values, collaborative filtering, and attribute selection. The additional tree classifier and random forest classifier are demonstrated to produce the highest accuracy and least amount of bias to the characteristics out of the 11 machine learning techniques taken into consideration.The study emphasizes the value of combining domain expertise when applying machine learning for CKD status prediction, as well as practical issues of data collecting.

GITHUB LINK

https://github.com/IBM-EPBL/IBM-Project-33548-1660222578

DEMO LINK

https://drive.google.com/file/d/1WzVq79DO5WOY4kUUwSPnhMlckl-ZGmkk/view?usp=share_link