PROJECT REPORT

TEAMID:PNT2022TMID46390

DETECTION OF CHRONIC KIDNEY DISEASE

IBM PROJECT PREPARED BY

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EARLY DETECTION CHRONIC KIDNEY DISEASES

CONTENT

EARLY DETECTION OF CHRONIC DISEASE USING MACHINE LEARNING

1.Introduction

Chronic Renal Disease is a leisurely loss of kidney function for months or years. Early detection of CKD is crucial and helpful in decreasing medical resources as ESRD patients preserve their health through hemodialysis, peritoneal dialysis or kidney transplantation [1]. An early detection diagnosis for CKD is commonly obtained through blood testing using the blood urea nitrogen (BUN) index and the Creatinine (CR). An analysis of patients via ultrasound images is a technical solution to do diagnosis efficiently. The advantages of ultrasound imaging include various aspects such as non-invasive, radiation-free, low cost and convenience. Besides, ultrasound imaging for obese patients may have less effective prediction ratio because the fat and tissue get deeper, hence its clarity becomes weaker. Ultrasonics rely primarily on the abilities of the technician in their accuracy. However, the CT result offers a higher contrast picture to recognize the interior design, size, density, and structure. CT images will reveal structures inside the body without overlapping structures where each slice of the 2D CT scan reveals the stone shape as shown in.

In recent years work in medical imaging has concentrated on the segmentation of kidney stones and renal cavity. Candidates are freed from the pressure of manual marking by automated segmentation with potential clinical medicine, whereas only quantitative analysis enables precisely to diagnose and model kidney disease [7]. This is not a common clinical practice; however, the segmentation of automatic stones is the segmentation of automatic renal stone remains a well-studied research topic [8]. Automatic stones segmentation is mainly due to the renal stone shape, color, texture, and location of anatomical structures. Based on the stone, Kidney diseases are typically classified as hereditary, congenital, or acquired. Calcification detection within the body is a wide range of study including several diverse areas that are mainly useful for the diagnosis of kidney stone diseases.

The actual kidney stones approximately non-sphérical, although they are dependent on the reverberation time over their duration, the main effect is used to detect a fracture of actual kidney stones. The segmentation of stones from such images is very complex and challenging because powerful speckle and attenuated artifacts occur in abdominal ultrasound pictures. This role is therefore performed using a great deal of previous information such as texture, shape, organ spatial location, etc. In this paper, the Internet of Medical Things (IoMT) has been utilized and the IoMT platform makes seamless, autonomous data collection and integration, saving time and cost for health care providers. The most widely used tool for the treatment of disease is the Artificial Neural Network (ANN) in the present scenario of medical diagnosis research. Due to defect tolerance, generalization, and environmental learning capabilities of artificial neural networks, medical diagnosis fields are becoming more common The feed-forward network, which permits network connection only between nodes on one layer and those on the next layer, is one of the commonly used network architectures. Neural network feedback is used to differentiate between infected individuals.

An experienced radiologist has been checked to separate MR as well as CT scan images of the abdominal into the left and right portion to produce the reference standard for segmentation from the validation and training datasets.

The remainder of the paper is organized as follows: Sections 1 Introduction, 2 Related works discussed the background of Chronic kidney disease and existing methods. Section 3 discussed the problem description and machine learning algorithm to define and segment the kidney disease. In Section 4, the experimental results have discussed. Finally, Section 5 concludes the research article.

1.1 Project Overview

Identification of chronic kidney diseases in their early stages enables prompt treatment that can slow or prevent disease development and debilitating and costly health outcomes.

Early detection of disease enables prompt treatment that can prevent disease progression and costly health outcomes. We report incidence of previously unrecognized disease and investigate the expected effect of early detection and care on health outcomes.

While detecting CKD annual screening found laboratory evidence for 1185 previously unrecognized cases of predicatable, 287 cases of diabetes, 73 cases of chronic kidney disease, and 669 positive colorectal screens per 10,000 people.

- Early identification and appropriate medical care may delay 34 cases of end-stage kidney disease and prevent diabetes-related complications, 210 cases of diabetes, and 3 cases of late-stage colorectal cancer over 5 years per 1000 cases identified.

- Avenues to detect previously unrecognized and early-stage disease may positively affect the health trajectories of many individuals within 1 to 5 years.

- Employers may serve as a conduit to health screening to benefit the health outcomes of employees and manage healthcare costs.

1.2 Purpose of the Project

Early detection or diagnosis of a disease has great importance in the life of any person. If diagnosed at an early stage some diseases can be cured fully or certain disease state can be reversed. Treatment also becomes easier, the quality of life is preserved, and the risks associated with the disease are prevented.

Early detection leads to more cures and longer survival rates.

Early detection and risk assessment of complex chronic disease based on longitudinal clinical data is helpful for doctors to make early diagnosis and monitor the disease progression. Disease diagnosis with computer-aided methods has been extensively studied.

A regular routine check-up is very necessary to detect any malfunctioning going on inside the body. The routine body check-up involves the

2 Literature Survey

Manuscript undertakes a review of current published information (peer-reviewed and grey literature) on Chronic Kidney Disease of Unknown Etiology (CKDu) in Sri Lanka. It attempts to provide an overview of the possible environmentally-induced causal factors that have been implicated in the development of the disease, and identifies the gaps in research and recommends potential areas for future research. The review specifically captures the potential role that agriculture and water resources may play as causal factors in the development of the disease, and calls for a systematic approach and stresses the need for an integrated multi-disciplinary research effort to address the problem.

2.1 Existing Problem

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Abstract

Objective

To help primary care providers, both family physicians and nurse practitioners, identify, detect, and manage patients with and at risk of chronic kidney disease (CKD), as well as outline criteria for appropriate referral to nephrology.

Sources of information

Published guidelines on the topic of CKD and its comorbidities were reviewed. A MEDLINE search was conducted using the MeSH terms *chronic renal insufficiency, family practice,* and *primary health care*. The search was limited to reviews and articles in English. The search covered all relevant articles from 2006 to the present.

Main message

The KidneyWise clinical tool kit, created by the Ontario Renal Network and available at **www.kidneywise.ca**, provides evidence-informed, practical guidance to primary care providers on the diagnosis and management of CKD. A component of this tool is an algorithm that offers a step-by-step approach to diagnosing and managing CKD. This resource will help empower providers to identify those at high risk of this condition, order appropriate diagnostic tests, help prevent further disease progression, and reduce comorbid cardiovascular risk in patients with CKD.

Conclusion

Most patients with CKD can be managed in primary care. Serial follow-up is essential to identify patients at high risk of progression to advanced stages of CKD, including end-stage renal disease. Primary care providers must continue to work together with local nephrologists to improve the lives of those living with CKD.

Case descriptions

Case 1. *A 57-year-old woman with hypertension (HTN) moves to your practice now that her family physician has retired. Her laboratory test results completed in the past year reveal an estimated glomerular filtration rate (eGFR) of 55 mL/min per 1.73 m^2 and a urine albumin-creatinine ratio (ACR) of 5.0 mg/mmol. Does this patient have chronic kidney disease (CKD)?*

Case 2. *A 50-year-old man with newly diagnosed type 2 diabetes mellitus (DM) comes to your office to review his laboratory test results. His hemoglobin A_{1c} (HbA_{1c}) level is 7%. His urine ACR, on 2 occasions (3 months apart), is 10.0 mg/mmol. His blood pressure (BP) is stable at 125/75 mm Hg. He is not taking any medications. What CKD management issues should be discussed with this patient?*

Case 3. *An 85-year-old man is admitted to the nursing home unit where you work. He has HTN and DM, both optimally controlled. Should you screen this patient for CKD?*

Chronic kidney disease, as defined by the Kidney Disease: Improving Global Outcomes (KDIGO) international guidelines, is an abnormality of kidney structure or function that is present for more than 3 months, with implications for health. Criteria required to make a diagnosis of CKD include a persistent reduction in eGFR of less than 60 mL/min per 1.73 m^2 or 1 or more markers of kidney injury (eg, albuminuria, abnormal urine sediment).Between 1.3 and 2.9 million Canadians are estimated to have CKD, and the increasing prevalence can be attributed in part to risk factors such as the growing elderly population and increasing rates of DM and HTN.Chronic kidney disease has been identified as a premature risk factor for death and often coexists with cardiovascular disease, resulting in a substantial burden on the health care system. Furthermore, patients with advanced CKD who progress to end-stage renal disease (ESRD) require dialysis or a kidney transplant to survive. Hemodialysis costs the Canadian health care system approximately $71 000 to $107 000 per patient per year of treatment, depending on whether it is provided at home or in a hospital or clinic setting, respectively, while the initial cost of transplant is estimated to be $100 000.

Given this serious public health dilemma, early detection and prevention of progression of CKD through primary care is essential. Primary care providers (PCPs) are well positioned to manage most CKD cases independently given that

most patients are at low risk of progression to ESRD. Furthermore, as the role of primary care in the treatment of chronic cardiovascular diseases such as DM, HTN, and coronary artery disease has expanded dramatically over the past few years, PCPs are well positioned to manage these CKD comorbidities. For patients with CKD who do progress to advanced stages, prompt referral to nephrology is associated with better patient outcomes and experiences along their care journey.

To help PCPs identify, detect, and manage patients with and at risk of CKD, as well as determine when referral to a nephrologist is appropriate, this article will use a tool created by the Ontario Renal Network to outline a step-by-step approach to diagnosing and managing CKD.

Sources of information

Published guidelines on the topic of CKD and its comorbidities (eg, HTN, DM, hyperlipidemia) were reviewed. A MEDLINE search was conducted using the MeSH terms *chronic renal insufficiency, family practice,* and *primary health care*. The search was limited to reviews and articles in English. The search covered all relevant articles from 2006 to the present.

Main message

The Ontario Renal Network, a provincial government agency that manages the delivery of CKD services in Ontario, created the KidneyWise clinical tool kit (available at **www.kidneywise.ca**) to help PCPs determine which patients are at high risk of developing CKD, and help them properly diagnose and manage the disease in order to reduce the risk of further progression. One of the tool's components is an evidence-based clinical algorithm, which offers a step-by-step approach to the identification and management of CKD, and its steps are further outlined here.

2.2 Reference

1) Review of Literature on Chronic Kidney Disease of Unknown Etiology (CKDu) in Sri Lanka :: IWMI (cgiar.org)

2) Literature survey for Chronic Kidney Disease of uncertain etiology (researchgate.net)

3) https://www.bing.com/ck/a?!&&p=84b7d3aed13e36e5JmltdHM9MTY2ODY0MzIwMCZpZ3VpZD0yZDE5NGJhZi0yOGJkLTY0MjItMzBkNC01OWFhMmNiZDZhOWMmaW5zaWQ9NTIyMw&ptn=3&hsh=3&fclid=2d194baf-28bd-6422-30d4-59aa2cbd6a9c&psq=literature+survey+for+chonic+kidney+disease&u=a1aHR0cHM6Ly9pamFyY2NlLmNvbS9wYXBlcnMvc3VydmV5LW9uLWNocm9uaWMta2lkbmV5LWRpc2Vhc2UtcHJlZGljdGlvbi1zeXN0ZW0v&ntb=1

4) SURVEY ON CHRONIC KIDNEY DISEASE PREDICTION SYSTEM - IJARCCE

5) A Survey on Chronic Kidney Disease Detection Using Novel Methods (researchgate.net)

6) Wang H, Naghavi M, Allen C, Barber RM, Bhutta ZA, Carter A, et al. (GBD 2015 Mortality Causes of Death Collaborators) (October 2016).

7) "Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: a systematic analysis for the Global Burden of Disease Study2015".

8)"Chronic Kidney Disease Tests & Diagnosis". National Institute of Diabetes and Digestive and Kidney Diseases. October 2016. Retrieved 19 December 2017.

9)"Kidney Failure". National Institute of Diabetes and Digestive and Kidney Diseases. Retrieved 11 November2017.

10)"Managing Chronic Kidney Disease". National Institute of Diabetes and Digestive and Kidney Diseases. October 2016.

11)"Eating Right for Chronic Kidney Disease | NIDDK". National Institute of Diabetes and Digestive and Kidney Diseases. Retrieved 5 September 2019.
12)"Anemia in Chronic Kidney Disease". National Institute of Diabetes and Digestive and Kidney Diseases. July 2016. Retrieved 19 December 2017.

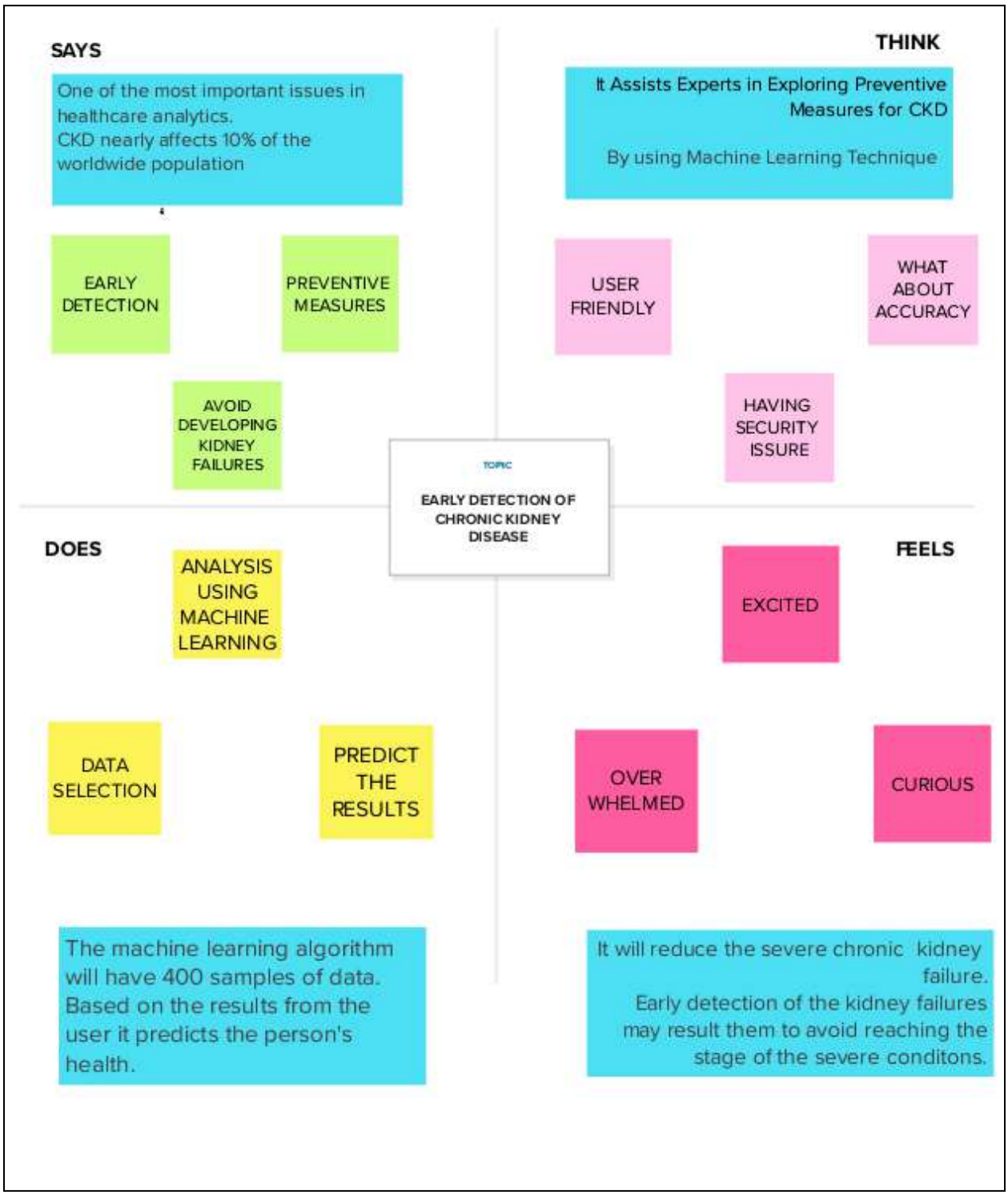
2.3 Problem Statement definition

Kidney disease 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 a higher chance of having a sudden change in kidney function. Diagnosis is by blood tests to measure the estimated glomerular filtration rate, and a urine test to measure albumin ion caused by illness, injury, or certain medicines. 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.

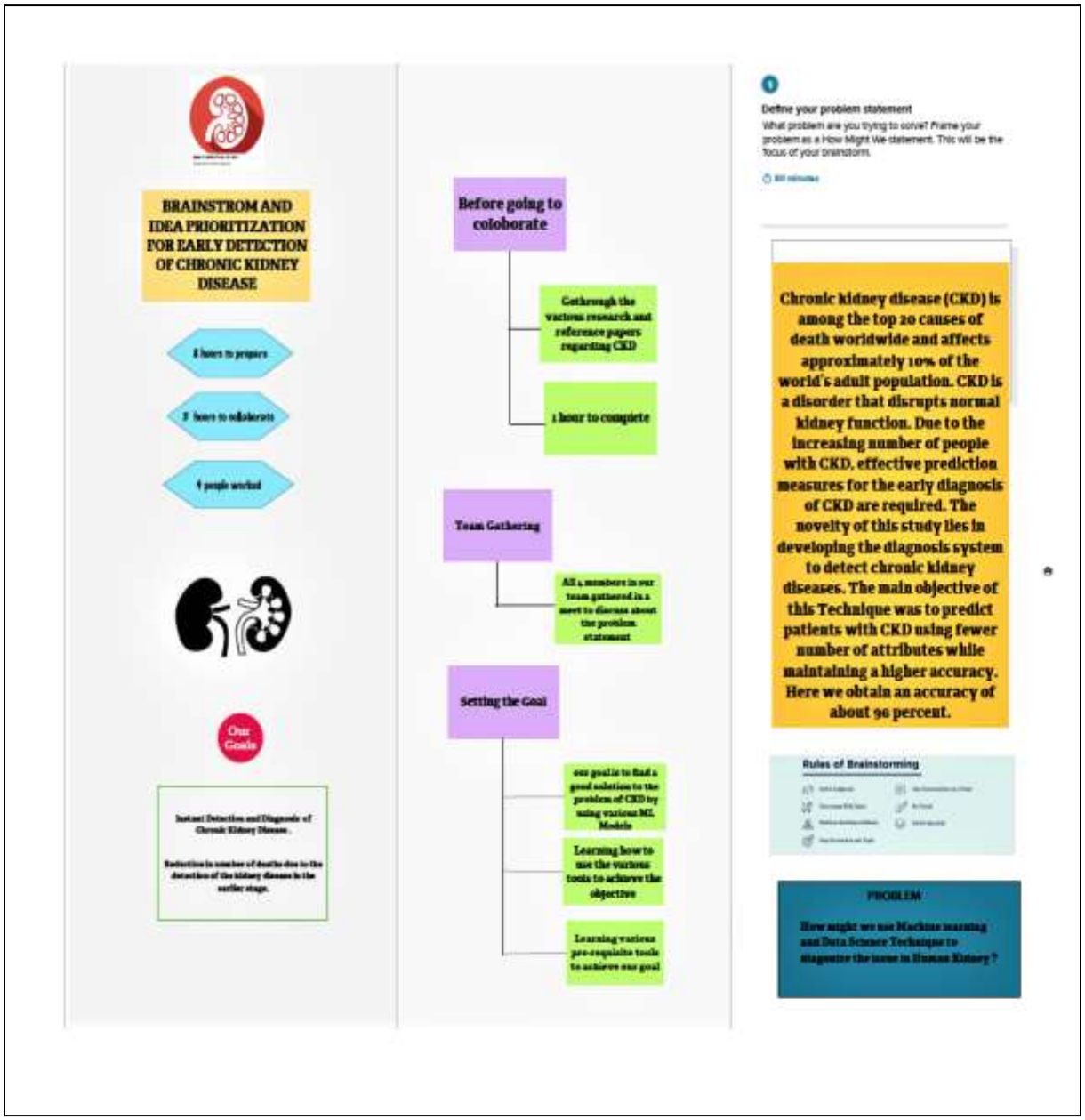
Many people are afraid to learn that they have kidney disease because they think that all kidney disease leads to dialysis. However, most people with kidney disease will not need dialysis. If you have kidney disease, you can continue to live a productive life, work, spend time with friends and family, 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



3.2 Ideation and Brainstorming



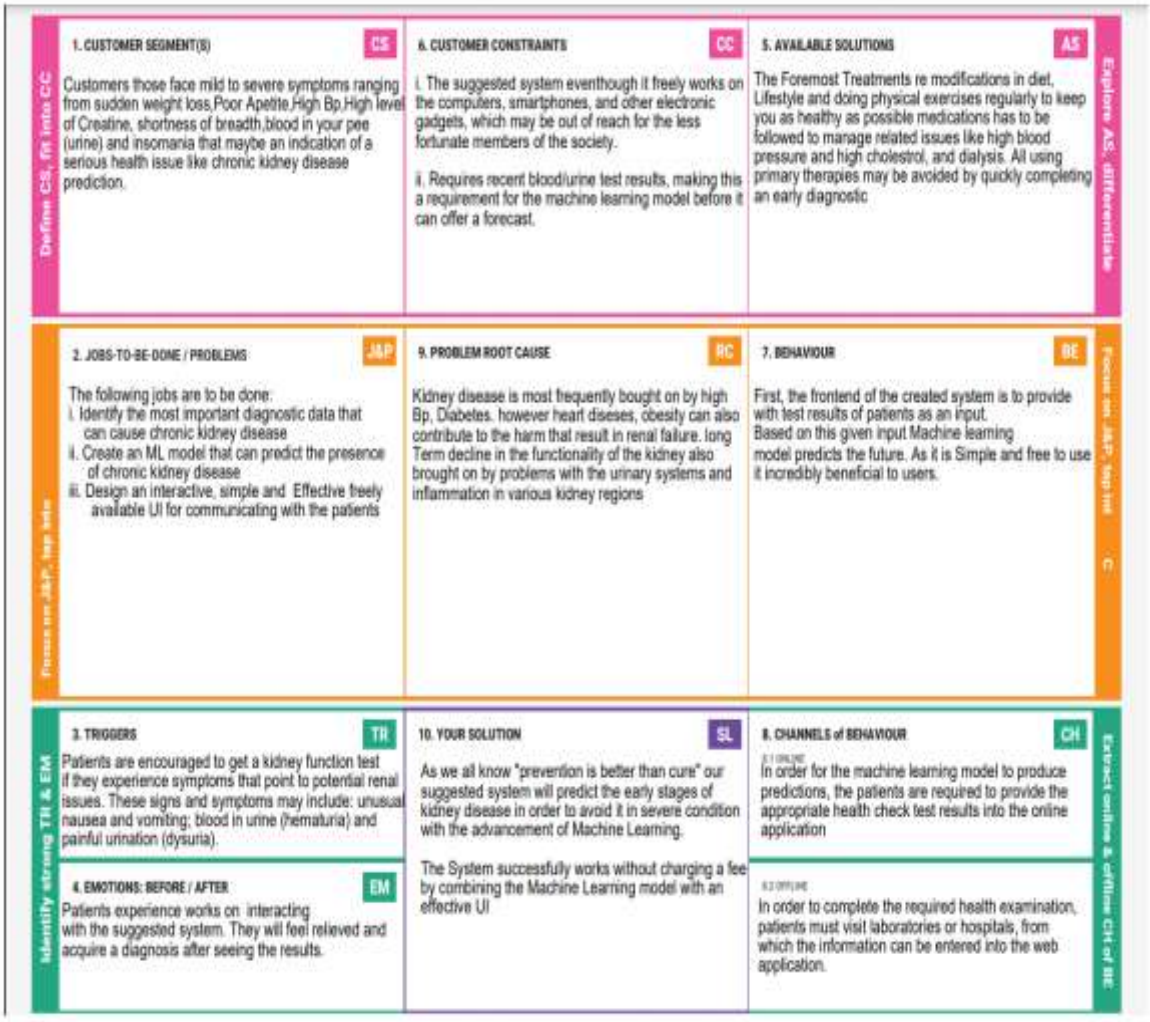
3.3 Proposed solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Early detection of chronic diseases using machine learning.
2.	Idea / Solution description	Strategies that are known to reduce mortality or prevent progressive loss of kidney function in CKD. 1. Control of BP use of an angiotensin -converting enzyme inhibitor or angiotensin Receptorblocker and strain treatment. 2. Control of blood glucose and use of sodium-glucose cotransporter inhibitors in people with diabetes. Early detection of CKD should be Beneficial because it enables clinicians to initiate effective treatment of mild prevention loss of kidney function and delaying Or avoiding progression to kidney failure.
3.	Novelty / Uniqueness	Novelty of this project is to predict whether the patient has chronic kidney disease or not, in a more accurate and faster way. Ans also predict deficiency of nutrients of the patients and give the nutrition diet chart that improves their health. Not only providing the nutrition diet chart for chronic kidney disease. That nutrition diet chart helps to improve any other diagnosed severe diseases also.

4.	Social Impact / Customer Satisfaction	Social impacts such as education, unemployment status, income, familiarity and social stress have also a major role in determining chronic diseases both directly and indirectly by increasing susceptibility to behavioral risk factors.
5.	Business Model (Revenue Model)	Can generate revenue through direct customers. Can collaborate with the health care sector and generate revenue from their customers
6.	Scalability of the Solution	In Existing system the severe of kidney disease measured by common symptoms, such as blood in your pee (urine), an increased need to pee particularly at night, difficulty sleeping (insomnia),itchy skin so its takes time to find out the disease.But in our Proposed system to check whether the patient have chronic kidney disease or not, in more accurate and faster way based on certain diagnostic measurements like Blood Pressure (Bp), Albumin(Al) .This helps kidney patients to cure in early stages to take prescribed activities and foods . This method is very helpful for poor people.

3.4 Problem Solution Fit

Template:



4 Requirement Analysis

4.1 Functional Requirement

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form.
FR-2	User Confirmation	Confirmation via retyping password.
FR-3	Obtain Information	The system should be able to get the information for predicting the disease from the user.
FR-4	Displaying Result	The system must be able to display whether the user is affected or not.

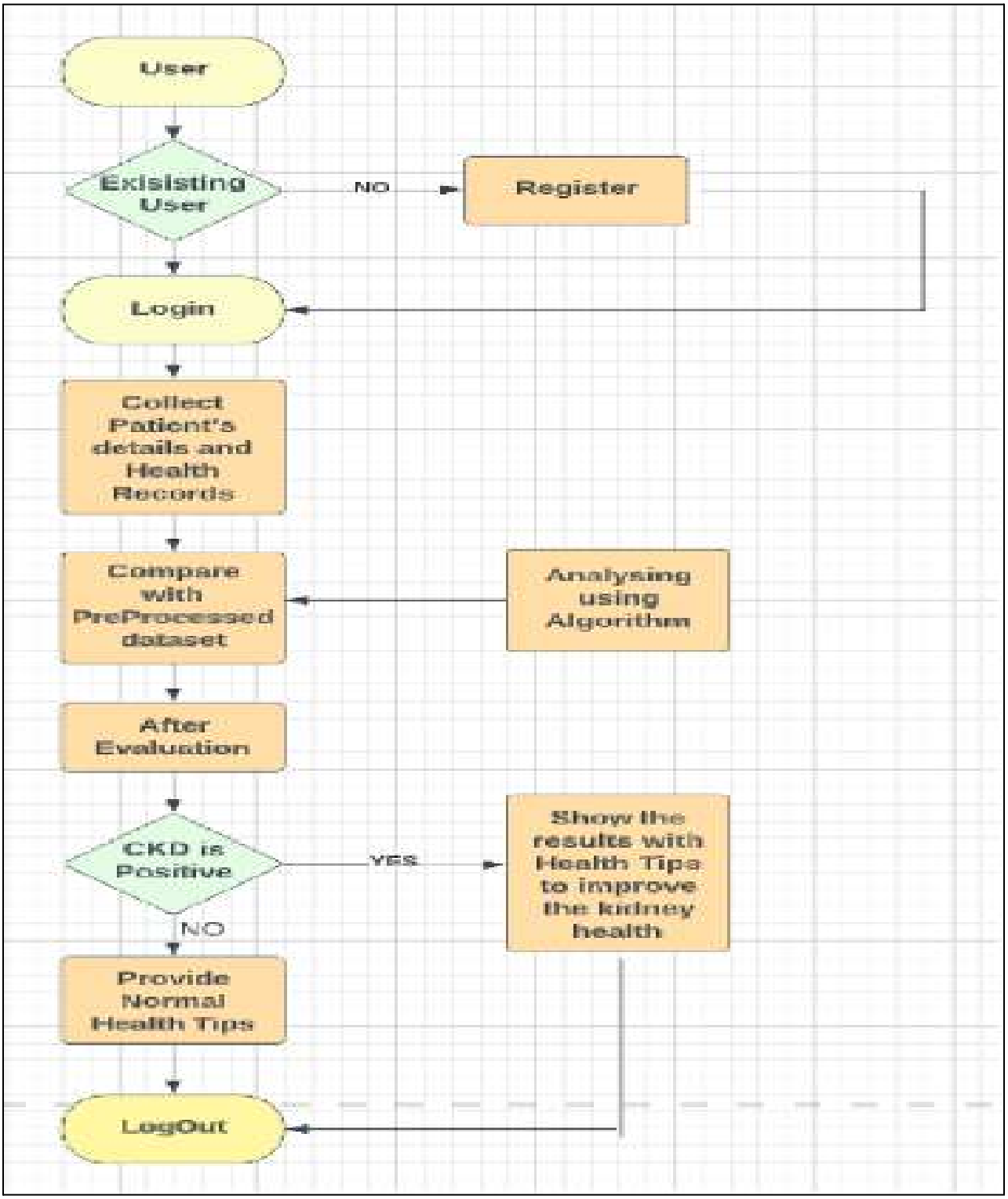
Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

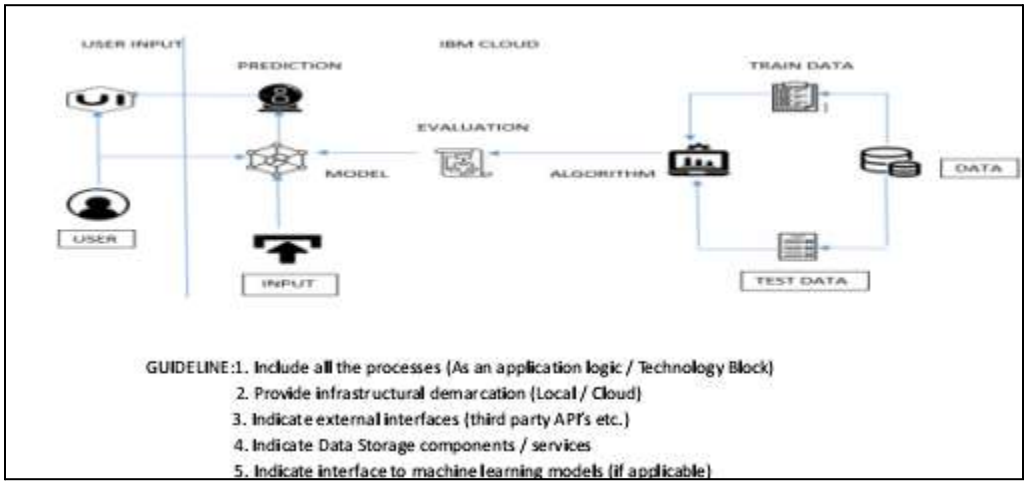
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Access to use the application is permitted only to the registered users.
NFR-2	**Security**	Authentication is done for security process.
NFR-3	**Reliability**	The user gets the correct and predicted value and standard results.
NFR-4	**Performance**	The user gets the results faster accessing the application from remote location.
NFR-5	**Availability**	The application is accessible only when the user is online.
NFR-6	**Scalability**	This application can be used anywhere as it is portable(ie.computer,laptop etc).

5 Project Design

5.1 Dataflow Diagram



5.2 Solution and Technical Architecture



GUIDELINE: 1. Include all the processes (As an application logic / Technology Block)
2. Provide infrastructural demarcation (Local / Cloud)
3. Indicate external interfaces (third party API's etc.)
4. Indicate Data Storage components / services
5. Indicate interface to machine learning models (if applicable)

Table-2: Application Characteristics:

S.No	Characteristics Description	Technology
1.	Open-Source Frameworks International Business Machines.	NIL
2.	Security Implementations Access permission for login page using CAPTCHA	Encryptions.
3.	Scalable Architecture The key of Three tier architecture is improving scalability.	Three Tier architecture.
4.	Availability Load balancer or ADC is the key component that ensures high availability by sending request.	Load balancer.
5.	Performance The system should be able to handle large number of users at the time	Load balancer.

Table-1 : Components & Technologies:

S.No	Component Description	Technology
1.	User Interface User interact with our application through web User Interface.	HTML, CSS and Python flask.
2.	Application Logic-1-Login. When the user click on the login button , he/she is directed to login page, if they are registered already.	HTML ,CSS, Python flask.
3.	Application Logic-Registration When the user click on the Register button , he/she is directed to Register page for further process.	HTML,CSS, Python flask.
4.	Application Logic-Test Vitals Form After Logged in , when the user click on the test vital form button ,he/she directed to the form page to enter the vitals for prediction.	Front end- HTML ,CSS ,MySQL,Pytjon flask Back end-Python
5.	Database Data type - String ,Numeric.	MySQL.
6.	Cloud Database Database Service on Cloud	IBM.
7.	File Storage File storage requirements	NIL
8.	External API-1 Purpose of External API used in the application	NIL
9.	External API-2 Purpose of External API used in the application	NIL
10.	Machine Learning Model Get the data from the user and predict the data with tested and trained dataset models	Data Recognition Model, etc.
11.	Infrastructure (Server / Cloud) Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	NIL

5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story/ Task	Acceptance criteria	Priority	Release
	Registration	USN-1	Registering the email Id for the software	I can access my account / dashboard	High	Sprint 1
		USN-2	Gets OTP to register email	I will receive confirmation email	High	Sprint- 1
		USN-3	As a user, I can register for the software through my Gmail	I can register and access the dashboard with my Gmail Login	Low	Sprint- 4
	Login	USN-4	As a user, I can log into the application by entering my email.	I can login and access past records	High	Sprint- 1
	Dashboard	USN - 5	As a user, I can see my past records and activities	I can access the functionality as diagnosing tool	High	Sprint- 3
	Entry form	USN - 6	As a user, I must enter my pre-diagnostic test results	I can use the form to input test results	High	Sprint- 2
	Report	USN - 7	As a user, I can view the report generated by the tool	I can view negative/ positive results produced after diagnosis	High	Sprint- 3

Customer Care Executive	Remedies	USN - 8	As a user, I will receive initial steps to treat my symptom	I can cure my symptoms with the remedies suggested	Medium	Sprint- 3
	Queries	USN - 9	As a customer care executive, I must assist users that face problems through Q&A	I will provide 24/7 support for the tool	Low	Sprint- 4
Administrator	Feedback	USN - 10	As a customer care executive, I should get input for the tool's enhancement from users	I must work on improving tool's performance	Low	Sprint- 4
	Feature importance	USN - 11	As an administrator, I should identify the most significant factors that lead to CKD based on the present trend	I must identify important features	High	Sprint- 2
	Train model	USN - 12	As an administrator, I must use the most suitable ML model for detection of CKD	I should efficiently train the ML model	High	Sprint- 2

6 Project Planning and Designing

6.1 Sprint planning and Estimation

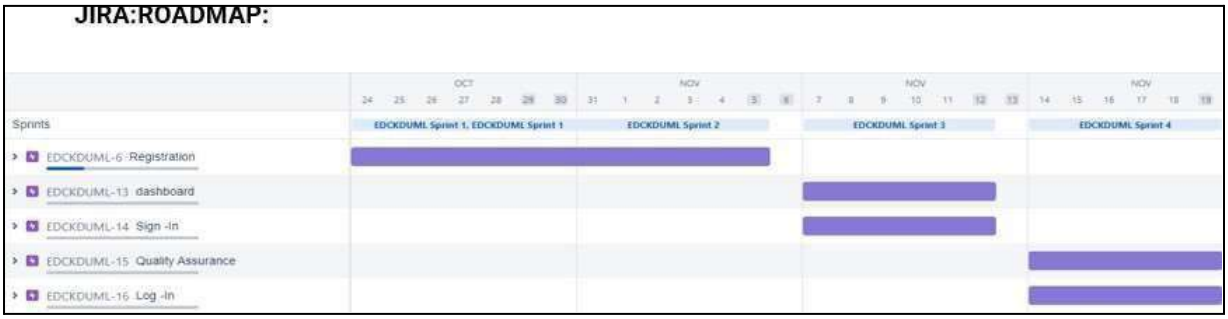
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority
Sprint-1	Collection Of Data	USN-1	Collect the dataset and clean the dataset	5	High
Sprint-1		USN-2	Create, test and save the model	5	High
Sprint-2	Home page	USN-3	The user can enter into the homepage.	6	High
Sprint-2		USN-4	The user can click the prediction button to enter into the prediction page	4	Medium
Sprint-3	Prediction Page	USN-5	The user will be presented with the prediction page where he can enter the values of report	3	Medium
Sprint-3		USN-6	User should enter the bloodglucose parameters	7	High
Sprint-4	Result	USN-7	The user will get the output	4	Medium
Sprint-4		USN-8	Deploy into IBM CLO JD	6	High

6.2 Sprint delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	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 Now 2022
Sprint-4	20	6 Days	14 Nov 2022	18 Nov 2022	20	18 Nov 2022

6.3 Reports from JIRA

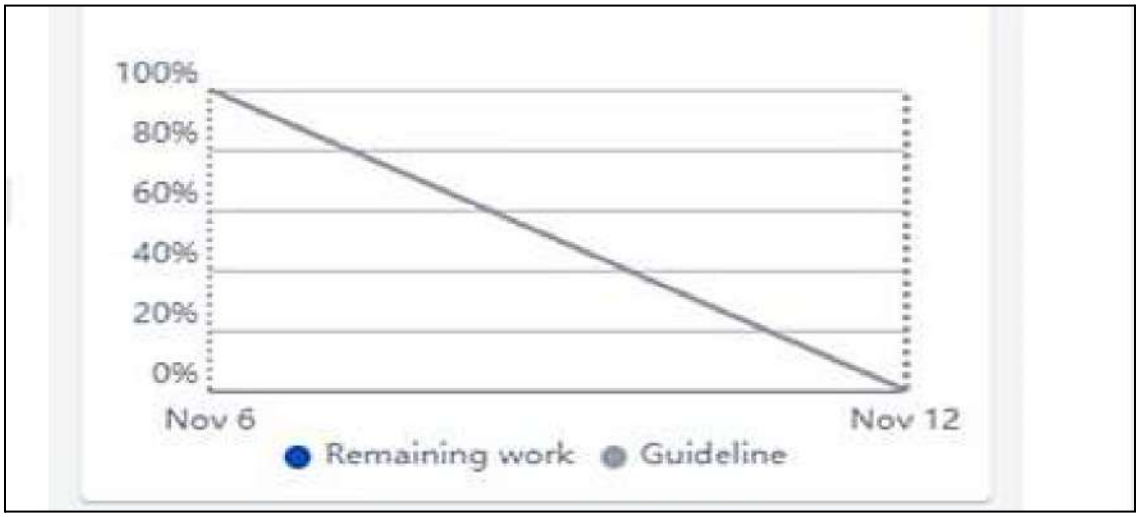
JIRA:ROADMAP:



SPRINT 1:

SPRINT 2:

SPRINT 3:



SPRINT 4:

7.CODING AND SOLUTIONING

7.1 FLASK DEPLOYMENT

Using Flask we are locally deploying our machine Learning model.Flask acts as a web Framework .There are three html files a home page,index page and a prediction page Additionally we have an app.py file to locally deploy the model.

Homepage.html

```
<html lang="en">
<head>

    <title>Chronic Kidney Disease prediction</title>

   <style>
      .button-box
{
   width:100px;
   margin:35px auto;
   position:relative;

   border-radius:30px;
}
.hero{

   height:100%;
   width:100%;
   color: blue
   background-position:center;
   background-size:cover;
   position:absolute;
}
#btn
    top:0;
```

```
    left:0;
    position:absolute;
    width:110px;
    height:100%;
}

   </style>

</head>
<body style="background-color:lightblue">
   <div class="hero">
    <form action="{{url_for('prediction')}}" method="POST">

     <!--
src='C:\Users\Dell\OneDrive\pythonProject\AnuNew\templates\images\img.png'
width="400" height="200" alt="img.png"-->
       <h1 align="center" style="color:#ff6006"> CHRONIC KIDNEY DISEASE
PREDICTION</h1>
       <h3  align="center" style="color:orange"> "Good Health is the Greatest
Wealth"</h3>
        <div class="button-box">
       <button type="submit" class="button-box" id="btn"
name="submit">Prediction</button>

          <!--<img id="test" src="images\slider5.jpeg" width="1400" height="650"
alt="No image" />-->
        </div>
    </form>
   </div>
     </body>
</html>
```

Index.html

```
<!DOCTYPE html>
<html>
<head>

    <title>Chronic Kidney Disease prediction</title>
<style>
  .form-box{
   width:380px;
   height:480px;
   position:relative;
   margin: 6%  auto;
   background:#ffb6c1;
   padding:5 px;
   overflow: hidden;
   border-style: solid;
   border-color: white;
}
</style>
</head>
<body id="top" style="background-color:lightblue">
<form action="{{url_for('predict')}}" method="POST">
      <h1 align="center" style="color:#ff6006"> CHRONIC KIDNEY DISEASE
PREDICTION</h1>
      <h3  align="center" style="color:orange"> "Good Health is the Greatest
Wealth"</h3>
 <section >
           <div class="form-box">
                  <form id="appointment-form" role="form" method="post"
action="#">

                      <div>
                          <div class="col-md-6 col-sm-6">
                              <label for="name">Blood Urea</label>
```

```
                        <input type="number" class="form-control" id="name"
name="blood_urea" placeholder="Blood Urea Level">
                    </div></br>


                    <div class="col-md-6 col-sm-6">
                        <label for="name">Blood Glucose Random</label>
                        <input type="number" class="form-control" id="name1"
name="blood_glucose_random" placeholder="Blood Glucose Level Random">
                    </div></br>

                    <div class="col-md-6 col-sm-6">
                        <label for="select">Select Anemia</label>
                        <select name = "Anemia">
                            <option value = "yes"> yes</option>
                            <option value = "no">no </option>
                        </select>
                    </div></br>
                    <div class="col-md-6 col-sm-6">
                        <label for="select">Select Coronary Artery
Disease</label>
                        <select name = "coronary_artery_disease">
                            <option value = "yes"> yes</option>
                            <option value = "no">no </option>
                        </select>
                    </div></br>

                    <div class="col-md-6 col-sm-6">
                        <label for="select">Select Pus Cell</label>
                        <select name = "pus_cell">
                            <option value = "yes"> yes</option>
                            <option value = "no">no </option>
                        </select>
                    </div></br>
```

```
                        <div class="col-md-6 col-sm-6">
                            <label for="select">Select Red Blood Cell</label>
                            <select name = "red_blood_cell">
                                <option value = "yes"> yes</option>
                                <option value = "no">no </option>
                            </select>
                        </div></br>

                          <div class="col-md-6 col-sm-6">
                            <label for="select">Select Diabetics Mellitus</label>
                            <select name = "diabetics_mellitus">
                                <option value = "yes"> yes</option>
                                <option value = "no">no </option>
                            </select>
                        </div></br>

                        <div class="col-md-6 col-sm-6">
                            <label for="select">Select Pedal Edema</label>
                            <select name = "pedal_edema">
                                <option value = "yes"> yes</option>
                                <option value = "no">no </option>
                            </select>
                        </div></br>
                        <div class="col-md-12 col-sm-12">
                            <button type="submit" class="form-control"
id="cf-submit" name="submit">predict</button>

                        </div>
                    </div>
                         </form>
    </div>
    </section>

  </body>
</html>
```

Result.html

```
<!DOCTYPE html>
<html lang="en">
<head>
   <style>
.form-box{
 width:380px;
   height:480px;
   position:relative;
   margin: 6%  auto;
   background:#ffb6c1;
   padding:5 px;
   overflow: hidden;
   border-style: solid;
   border-color: white;
}
   </style>
  </head>
<body id="top" style="background-color:lightblue">
        <h1 align="center" style="color:#ff6006"> CHRONIC KIDNEY DISEASE
PREDICTION</h1>
       <h3  align="center" style="color:orange"> "Good Health is the Greatest
Wealth"</h3>
           <section>
         <div class="container">
            <div class="row">
               <div class="form-box">
                <div class="col-md-8 col-sm-7">
                   {{prediction_text}}
                   {% if prediction_text==1%}

                   <div >
                       <h2>Medical Result</h2>
                       <p>Your Condition is normal.</p>
```

```
                    <blockquote>You are not having chronic kidney
disease.</blockquote>
                                <!--<img src="images\result1.jpg" width="300"
height="300"/>-->
                    <p></p>

                </div>
                {%else%}
                <div >
                    <h2>Medical Result</h2>
                    <p>Your Condition is abnormal.</p>
                    <blockquote>You are having chronic kidney
disease.</blockquote>
                    <!--<img src="images\result2.jpeg" width="300"
height="300"/>-->
                    <p></p>

                </div>
                {% endif %}

            </div>

            <div class="col-md-4 col-sm-5">
                <div class="news-sidebar">

                </div>
            </div>
            </div>
        </div>
    </section>


</body>
</html>
```

App.py

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

app = Flask(__name__,template_folder='templates')
model = pickle.load(open('CKD1.pkl', 'rb'))


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


@app.route('/Prediction', methods=['POST', 'GET'])
def prediction():
    return render_template('indexnew.html')


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


@app.route('/predict', methods=['POST'])
def predict():
    #input_features = ([int(x) for x in request.form.values()])
    blood_urea = request.form["blood_urea"]
    blood_glucose_random = request.form["blood_glucose_random"]
    anemia = request.form["Anemia"]
    if (anemia == "no"):
        anemia = 0
    if (anemia == "yes"):
```

```
        anemia = 1
    coronary_artery_disease = request.form["coronary_artery_disease"]
    if (coronary_artery_disease == "no"):
        coronary_artery_disease = 0
    if(coronary_artery_disease == "yes"):
        coronary_artery_disease = 1

    pus_cell = request.form["pus_cell"]
    if (pus_cell == "no"):
        pus_cell = 0
    if (pus_cell == "yes"):
        pus_cell = 1

    red_blood_cell = request.form["red_blood_cell"]
    if (red_blood_cell == "no"):
        red_blood_cell = 0
    if (red_blood_cell == "yes"):
        red_blood_cell = 1

    diabetics_mellitus = request.form["diabetics_mellitus"]
    if (diabetics_mellitus == "no"):
        diabetics_mellitus = 0
    if (diabetics_mellitus == "yes"):
        diabetics_mellitus = 1

    pedal_edema = request.form["pedal_edema"]
    if (pedal_edema == "no"):
        pedal_edema = 0
    if (pedal_edema == "yes"):
        pedal_edema = 1

    input_features =
[int(blood_urea),int(blood_glucose_random),int(anemia),int(coronary_artery_disea
se),int(pus_cell),int(red_blood_cell),int(diabetics_mellitus),int(pedal_edema)]
```

```
    #input_features =
[int(red_blood_cell),int(pus_cell),int(blood_glucose_random),int(blood_urea),int(p
edal_edema),int(anemia),int(diabetics_mellitus),int(coronary_artery_disease)]
    print(input_features)
    features_value = [np.array(input_features)]


    #features_name = ['red_blood_cells','pus_cell','blood glucose
random','blood_urea','pedal_edema','anemia','diabetesmellitus','coronary_artery_dis
ease']
    features_name = ['blood_urea','blood glucose
random','anemia','coronary_artery_disease','pus_cell','red_blood_cells','diabetesmel
litus','pedal_edema' ]
    df = pd.DataFrame(features_value, columns=features_name)
    output = model.predict(df)
    return render_template('result.html', prediction_text=output)


# Press the green button in the gutter to run the script.
if __name__ == '__main__':
    app.run(host='localhost', debug=True)

# See PyCharm help at https://www.jetbrains.com/help/pycharm/
```

7.1 IBM DEPLOYMENT

Now after Locally deploying our machine Learning model we deployed our model into IBM deployment.

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

import requests

# NOTE: you must manually set API_KEY below using information retrieved from your IBM Cloud account.
API_KEY = "lnGNzrv2bw-dDd4nlvW07gP2oG4W1XeWqDKt9_ScPkg1"
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__)


# model = pickle.load(open('CKD.pkl', 'rb'))


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


@app.route('/Prediction', methods=['POST', 'GET'])
```

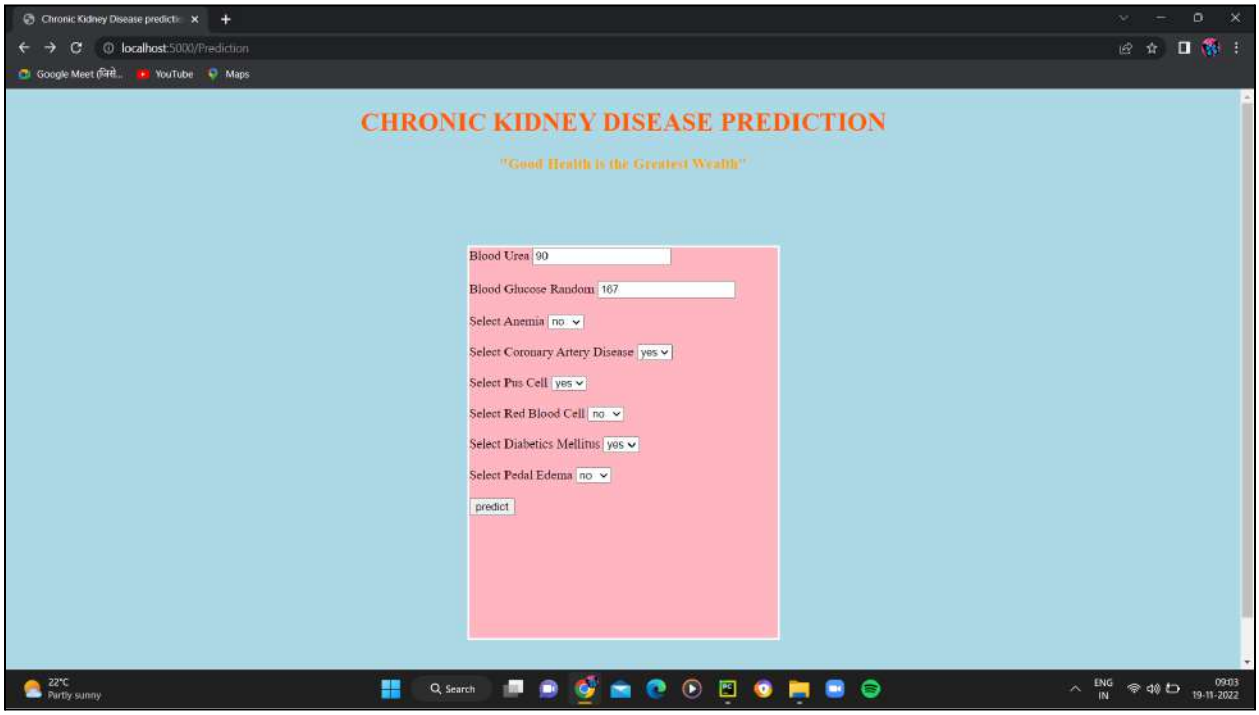
```
def prediction():
    return render_template('indexnew.html')


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


@app.route('/predict', methods=['POST'])
def predict():
    # input_features = ([int(x) for x in request.form.values()])
    blood_urea = int(request.form["blood_urea"])
    blood_glucose_random = int(request.form["blood_glucose_random"])
    anemia = request.form["Anemia"]
    if (anemia == "no"):
        anemia = 0
    if (anemia == "yes"):
        anemia = 1
    coronary_artery_disease = request.form["coronary_artery_disease"]
    if (coronary_artery_disease == "no"):
        coronary_artery_disease = 0
    if (coronary_artery_disease == "yes"):
        coronary_artery_disease = 1

    pus_cell = request.form["pus_cell"]
    if (pus_cell == "no"):
        pus_cell = 0
    if (pus_cell == "yes"):
        pus_cell = 1

    red_blood_cell = request.form["red_blood_cell"]
    if (red_blood_cell == "no"):
        red_blood_cell = 0
    if (red_blood_cell == "yes"):
```

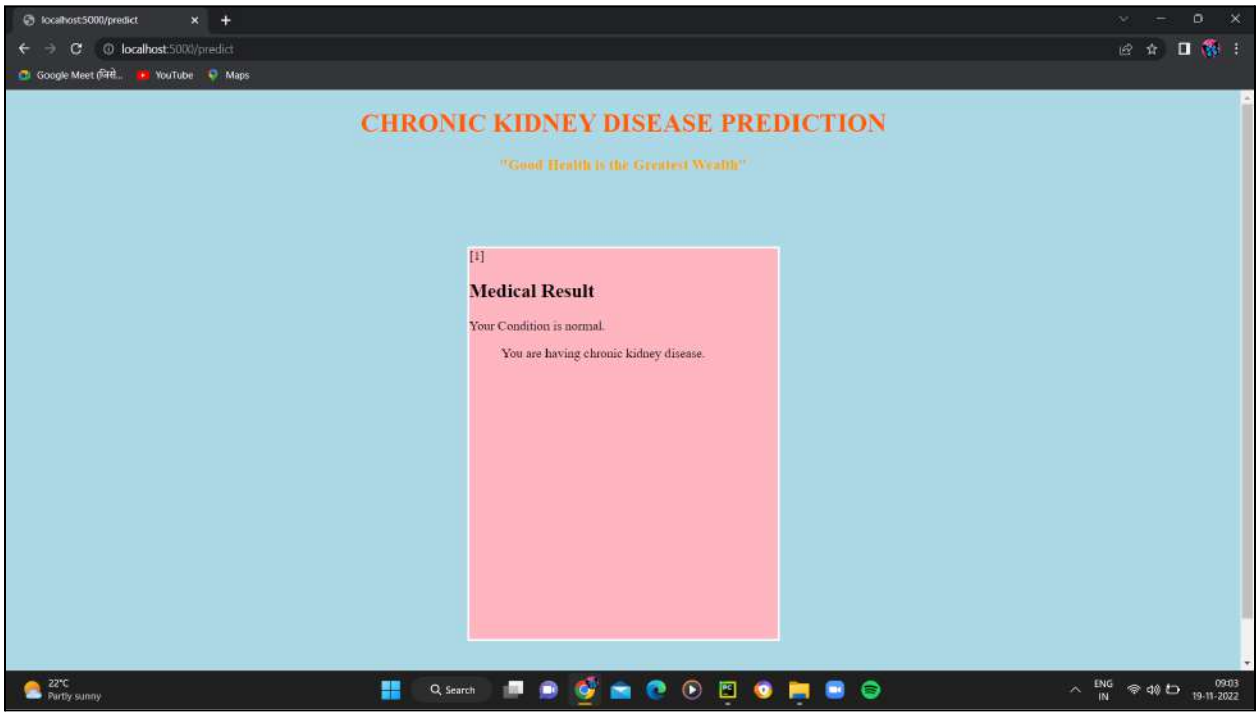
```
        red_blood_cell = 1

    diabetics_mellitus = request.form["diabetics_mellitus"]
    if (diabetics_mellitus == "no"):
        diabetics_mellitus = 0
    if (diabetics_mellitus == "yes"):
        diabetics_mellitus = 1

    pedal_edema = request.form["pedal_edema"]
    if (pedal_edema == "no"):
        pedal_edema = 0
    if (pedal_edema == "yes"):
        pedal_edema = 1

    input_features = [int(blood_urea), int(blood_glucose_random), int(anemia),
int(coronary_artery_disease),
                      int(pus_cell), int(red_blood_cell), int(diabetics_mellitus),
int(pedal_edema)]
    # input_features =
[int(red_blood_cell),int(pus_cell),int(blood_glucose_random),int(blood_urea),int(p
edal_edema),int(anemia),int(diabetics_mellitus),int(coronary_artery_disease)]
    print(input_features)
    features_value = [np.array(input_features)]

    payload_scoring = {"input_data": [{"field": [
        ['blood_urea', 'blood_glucose_random', 'anemia', 'coronary_artery_disease',
'pus_cell', 'red_blood_cell',
         'diabetics_mellitus', 'pedal_edema']], "values": features_value}]}

    response_scoring = requests.post(

'https://us-south.ml.cloud.ibm.com/ml/v4/deployments/f887afa8-65fa-40e0-849b-5
b180653e583/predictions?version=2022-11-02',
        json=payload_scoring, headers={'Authorization': 'Bearer ' + mltoken})
    print(response_scoring)
```

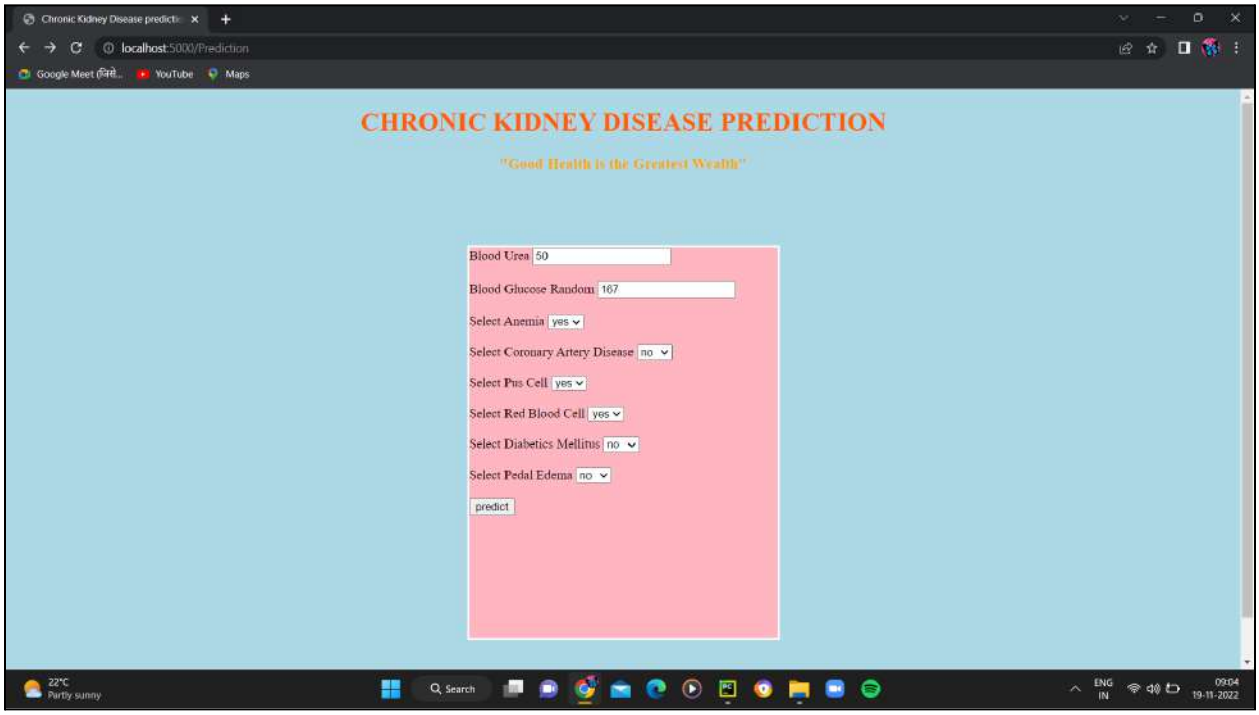
```
    predictions = response_scoring.json()
    predict = predictions['predictions'][0]['values'][0][0]
    print("Final prediction :", predict)

    # features_name = ['red_blood_cells','pus_cell','blood glucose
random','blood_urea','pedal_edema','anemia','diabetesmellitus','coronary_artery_dis
ease']
    features_name = ['blood_urea', 'blood glucose random', 'anemia',
'coronary_artery_disease', 'pus_cell',
                     'red_blood_cells', 'diabetesmellitus', 'pedal_edema']
    df = pd.DataFrame(features_value, columns=features_name)
    # output = model.predict(df)
    return render_template('result.html', prediction_text=predict)


# Press the green button in the gutter to run the script.
if __name__ == '__main__':
    app.run(host='localhost', debug=True)

# See PyCharm help at https://www.jetbrains.com/help/pycharm/
```

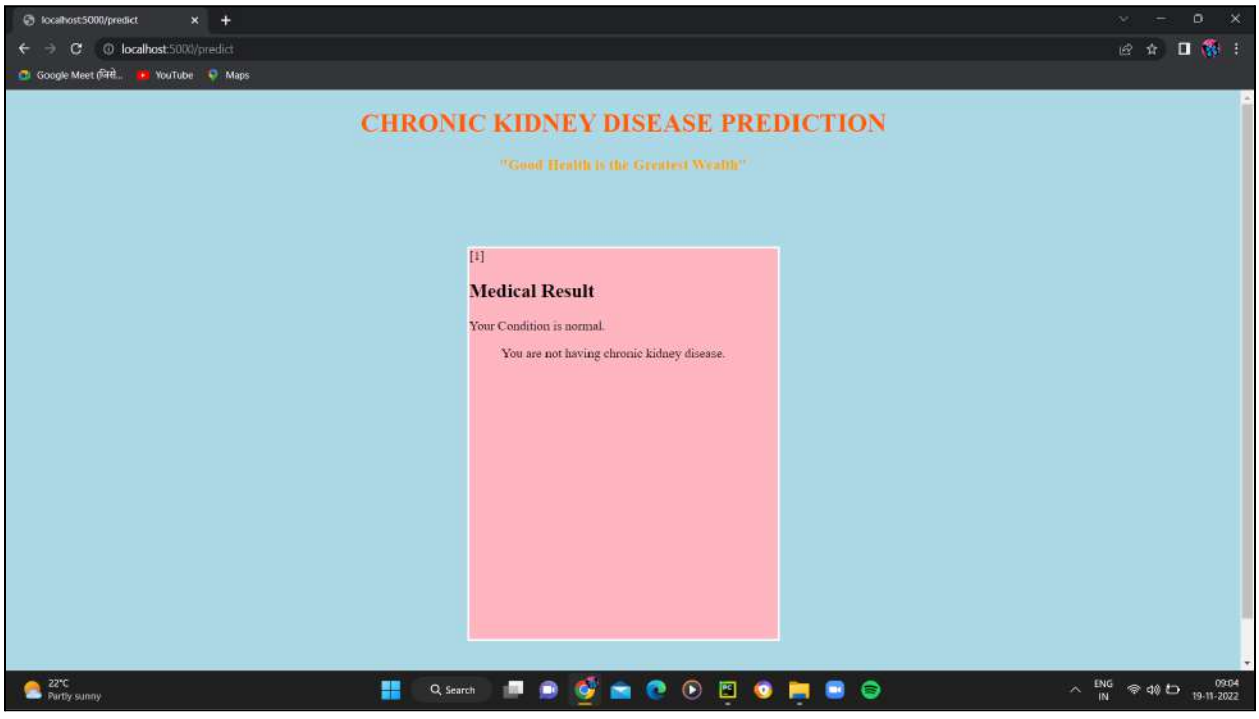
8.TESTING

8.1 TEST CASES



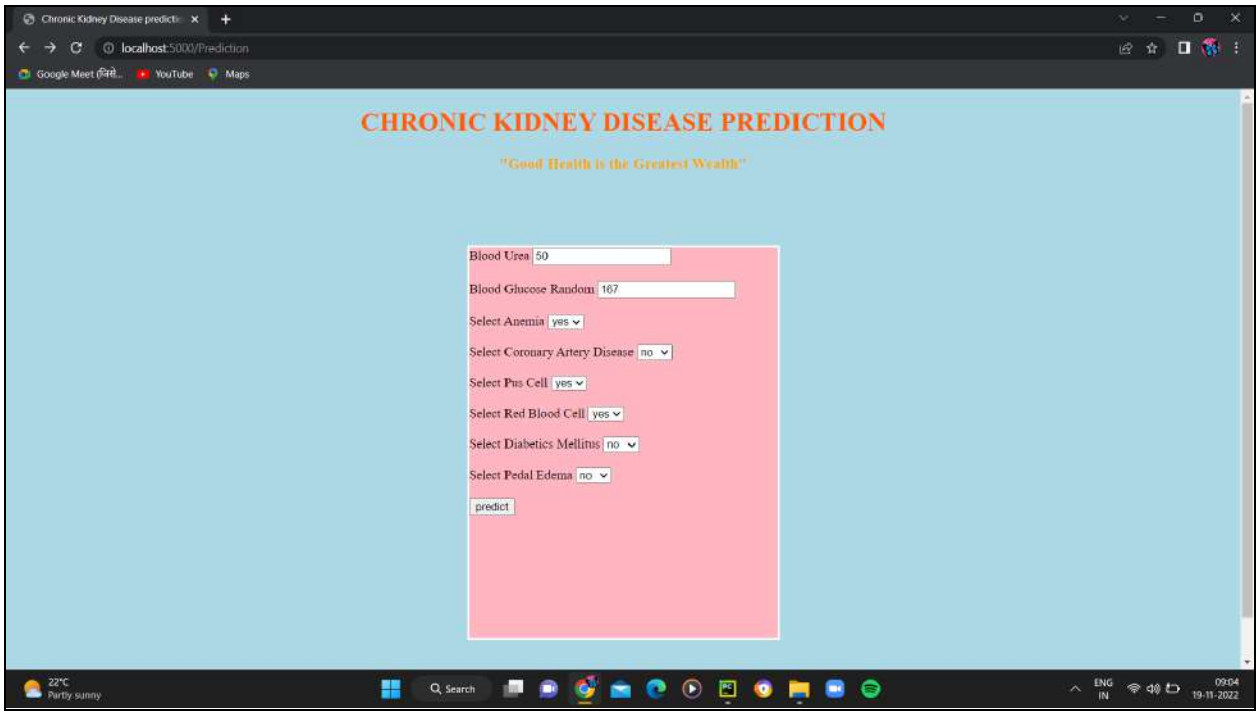


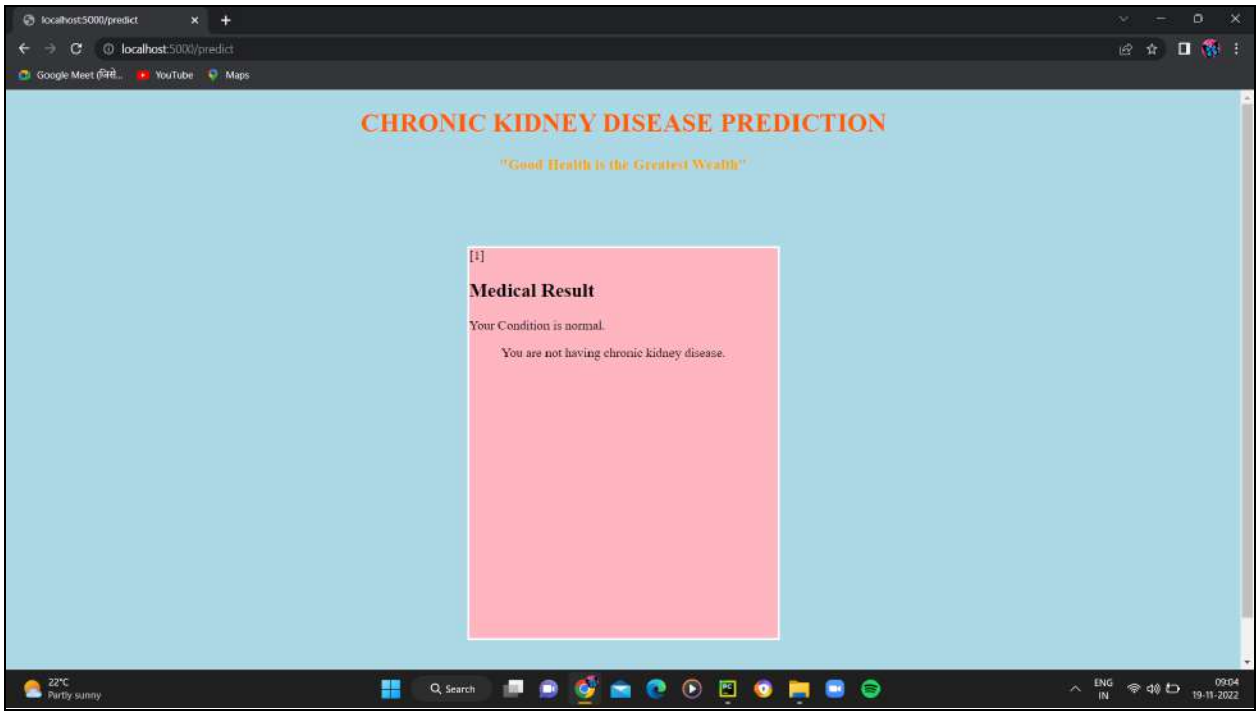

Chronic Kidney Disease predictio
localhost:5000/Prediction
Google Meet (जिसे...
YouTube
Maps
CHRONIC KIDNEY DISEASE PREDICTION
"Good Health is the Greatest Wealth"
Blood Urea 50
Blood Glucose Random 167
Select Anemia yes
Select Coronary Artery Disease no
Select Pus Cell yes
Select Red Blood Cell yes
Select Diabetics Mellitus no
Select Pedal Edema no
predict
22°C
Partly sunny
Search
ENG
IN
09:04
19-11-2022


localhost:5000/predict
localhost:5000/predict
Google Meet (जिसे...
YouTube
Maps
CHRONIC KIDNEY DISEASE PREDICTION
"Good Health is the Greatest Wealth"
[i]
Medical Result
Your Condition is normal.
You are not having chronic kidney disease.
22°C
Partly sunny
Search
ENG
IN
09:04
19-11-2022

				Date	19.11.2022		
				Team ID	PNT2022TMID46390		
				Project Name	Early Detection of Chronic Kidney		
				Maximum Marks	4 marks		
Test case ID	**Feature Type**	**Component**	**Test Scenario**	**Pre-Requisite**	**Steps To Execute**	**Test Data**	**Expected Result**
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 Dataset
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 dataset using machine learning Algorithm
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 Learning Model
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 page on local host server
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	Deploy the project in IBM	Application should show same resut

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	9	3	1	1	18
Fixed	14	4	2	2	12

Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	23	7	3	3	30

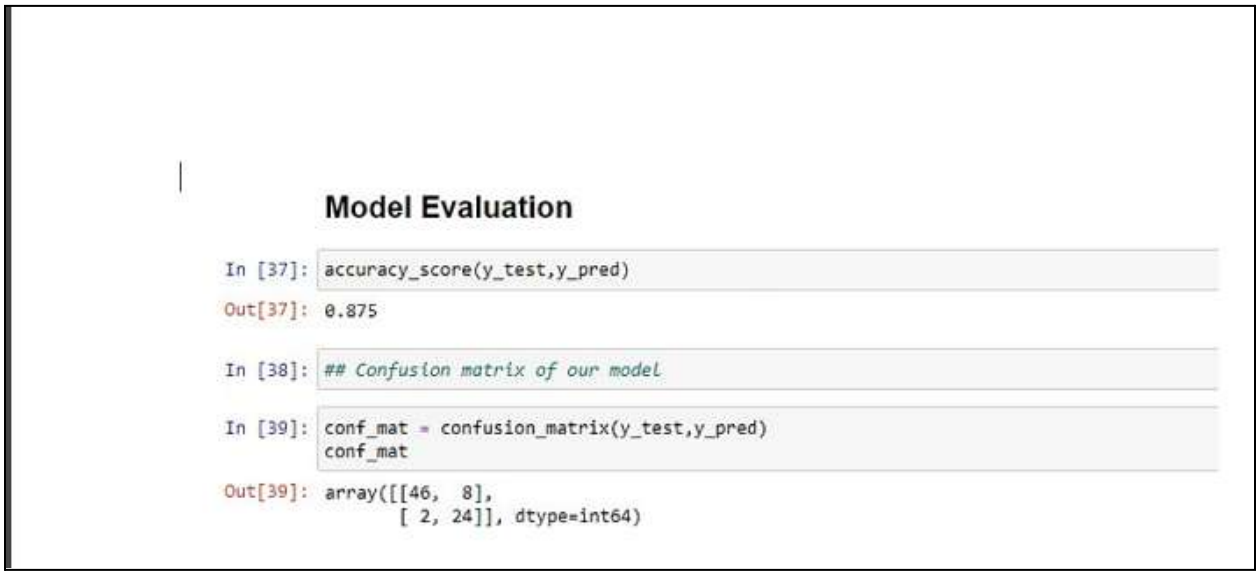
3. Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	13	0	0	13
Client Application	21	0	0	21
Security	2	0	0	2
Exception Reporting	1	0	0	1
Final Report Output	8	0	0	8
Version Control	1	0	0	1

9.RESULTS

9.1 PERFORMANCE METRICS



10. ADVANTAGES AND DISADVANTAGES

Advantages:

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.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. Early detection of chronic kidney disease is the advantage because we can cure in first stage.

Disadvantages:

CKD is associated with increased risks of cardiovascular morbidity, premature mortality, and has severe impact on quality of life (QoL) [4]. Mortality from cardiovascular disease (CVD) is estimated to be at least 8 to 10 fold higher in CKD patients as compared to non-CKD patients.Chronic kidney disease can cause other problems throughout your body including: Heart and blood vessel problems. Anemia (low red blood cell count) Bone problems.

11.CONCLUSION

The benefit of this approach is that the prediction process takes far less time doctors to initiate initiate treatment at the earliest for patients with CKD and further to classify larger population of patients within 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 minimise 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 chronic kidney disease to kidney failure.

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 for chronic renal disease and to make improvements in their lives.

13. APPENDIX

Chronic Kidney Disease(CKD) or chronic renal disease 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 method are effective in CKD prediction. This work proposes a workflow to predict CKD status based on clinical data, incorporating data prepossessing, a 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 are shown to result in the highest accuracy and minimal bias to the attributes. The research also considers the practical aspects of data collection and highlights the importance of incorporating domain knowledge when using machine learning for CKD status prediction.

GITHUB LINK

https://github.com/IBM-EPBL/IBM-Project-44316-1660724017

PROJECT DEMO LINK

https://clipchamp.com/watch/wod13ZG7mwQ