

EARLY DETECTION OF CHRONIC KIDNEY DISEASE

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1.INTRODUCTION :

Engineers and medical researchers are trying to develop machine learning algorithms and models that can identify chronic kidney disease at an early stage. The problem is that the data generated in the health industry is large and complex, making data analysis difficult. However, we can process this data into a data format using data mining technology, and then this data can be translated into machine learning algorithms.

A combination of estimated glomerular filtration rate (GFR), age, diet, existing medical conditions, and albuminuria can be used to assess the severity of kidney disease, but requires more accurate information about the risk to the kidney is required to make clinical decisions about diagnosis, treatment, and referral

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, tumours, recurrent urinary tract infections, metabolic diseases, obesity and age.

1.1 PROJECT OVERVIEW:

Main goal will be to predict whether an individual will have chronic kidney disease or not based on the data provided. There are some symptoms which shows kidneys are beginning to fail like muscle cramps, nausea and vomiting, appetite losses, swelling in your feet and ankles, too much urine or not enough urine, trouble catching your breath, trouble sleeping, fever and vomiting. Risk factors of CKD are diabetes, smoking, lack of sleeping, hypertension, improper diet, etc. Among them diabetes is the more dangerous factor. At the last stage, the patient must take dialysis or do kidney transplantation. One of the best ways to reduce this death rate is early treatment. Therefore, early prediction and proper treatments can possibly stop, or slow the progression of this chronic disease.

1.2.PURPOSE:

To predict diseases, data mining or machine learning models are playing a vital role. By making some mathematical approaches, data mining models extract patterns from data and later these patterns are used for the survival of patients. Multilayer Perceptron (MP), Support Vector Machine (SVM), KNearest Neighbour (KNN), Logistic Regression (LR), Naïve Bayes (NB), Random Forest (RF), etc. are some renowned machine learning methods which were successfully implemented to examine and classify the kidney disease. IN recent times, some researchers have been working on CKD by applying different computational techniques for the prediction and diagnosis of this disease. We are using mean, mode and median based pre-processing techniques for the missing values. Further, we have used K-Nearest Neighbour Classifier, Decision Tree Classifier, Gaussian Naïve Bayes, Logical Regression and Artificial Neural Network to train the model. Then, based on the results of each of these Machine Learning Methods, we can compare and determine which among the following methods can predict the possibility of CKD most accurately

2.LITERATURE SURVEY:

In order to get required knowledge about various concepts related to the present application, existing literature were studied. Some of the important conclusions were made through those are listed below.

1. Prediction of Chronic Kidney Disease using Random Forest Machine Learning Algorithm Author: Prof. Manish Kumar In this paper, CKD is being predicted using a Machine Learning Technique called Random Forest Algorithm. Random Forests are a combination of tree predictors so that all the trees depend on random vector sampled autonomously. Many other algorithms like SVM and Naïve Bayes were also used, but Random Forest was the most accurate.

2. Chronic Kidney Disease Prediction using Machine Learning Models Author: Prof. S. Revathy In this paper, CKD prediction was made using Decision Trees, Random Forrest and Support Vector Machine algorithms. All the three algorithms were tested to check

the highest accurate algorithm. Random Forrest is the most accurate followed by SVM and decision trees.

3. Comparative study of classification Algorithms in Chronic Kidney Disease Author: Prof. Pratibha Devishri S In this paper, CKD prediction is done using performance measures like Kappa statistics, Receiver Operating Characteristic, Mean Absolute Error and Root mean squared Error using WEKA. Classifiers to be examined are created using Decision stump, Rep tree, IBK, K-star, SGD and SMO. It is understood that Decision stump and Rep tree are giving better results.

4. A survey on Chronic Kidney Disease detection using Novel Methods Author: Prof. K Dharmarajan In this paper, CKD is being predicted using multiple Machine Learning Techniques. Some of the techniques are Naïve Bayes, SVM, MBPN, LDA, KNN, etc. This survey confirmed that all these techniques successfully predicted with reasonable margin of error.

5. Rule Induction and Prediction of Chronic Kidney Disease Using Boosting Classifiers, Ant-Miner and J48 Decision Tree Author: Prof. Arif-UI-Islam and Shamim H. Ripon In this paper, CKD is being predicted using Boosting classifiers like AdaBoost and rule induction techniques like Ant-Miners. Boosting algorithm is an ensemble type machine learning algorithm which converts weak classifiers to strong model to achieve a better accuracy. Researches showed that many data mining techniques had been applied for CKD classification. Among those algorithms, AdaBoost classifier and J48 rule induction method performed well.

2.1 EXISTING PROBLEM:

To predict diseases, data mining or machine learning models are playing a vital role. By making some mathematical approaches, data mining models extract patterns from data and later these patterns are used for the survival of patients. Multilayer Perceptron (MP), Support Vector Machine (SVM), KNearest Neighbour (KNN), Logistic Regression (LR), Naïve Bayes (NB), Random Forest (RF), etc. are some renowned machine learning methods which were successfully implemented to examine and classify the kidney disease. In recent times, some researchers have been working on CKD by applying different computational techniques for the prediction and diagnosis of this disease.

2.2 REFERENCES:

- [1] M. P. N. M. Wickramasinghe, D. M. Perera and K. A. D. C. P. Kahandawaarachchi, "Dietary prediction for patients with Chronic Kidney Disease (CKD) by considering blood potassium level using machine learning algorithms," 2017 IEEE Life Sciences Conference (LSC), Sydney, NSW, 2017, pp. 300-303
- [2] U. N. Dulhare and M. Ayesha, "Extraction of action rules for chronic kidney disease using Naïve bayes classifier," 2016 IEEE International Conference on Computational Intelligence and Computing Research (ICICR), Chennai, 2016, pp.1-5.
- [3] R. Devika, S. V. Avilala and V. Subramaniaswamy, "Comparative Study of Classifier for Chronic Kidney Disease prediction using Naïve Bayes, KNN and Random Forest," 2019 3rd International Conference on Computing Methodologies and Communication (ICCMC), Erode, India, 2019, pp. 679-684.

- [4] G. Kaur and A. Sharma, "Predict chronic kidney disease using data mining algorithms in hadoop," 2017 International Conference on Inventive Computing and Informatics (ICICI), Coimbatore, 2017, pp. 973-979.
- [5] Arif-Ul-Islam and S. H. Ripon, "Rule Induction and Prediction of Chronic Kidney Disease Using Boosting Classifiers, Ant-Miner and J48 Decision Tree," 2019 International Conference on Electrical, Computer and Communication Engineering (ECCE), Cox'sBazar, Bangladesh, 2019, pp. 1-6.

2.3 PROBLEM STATEMENT DEFINITION:

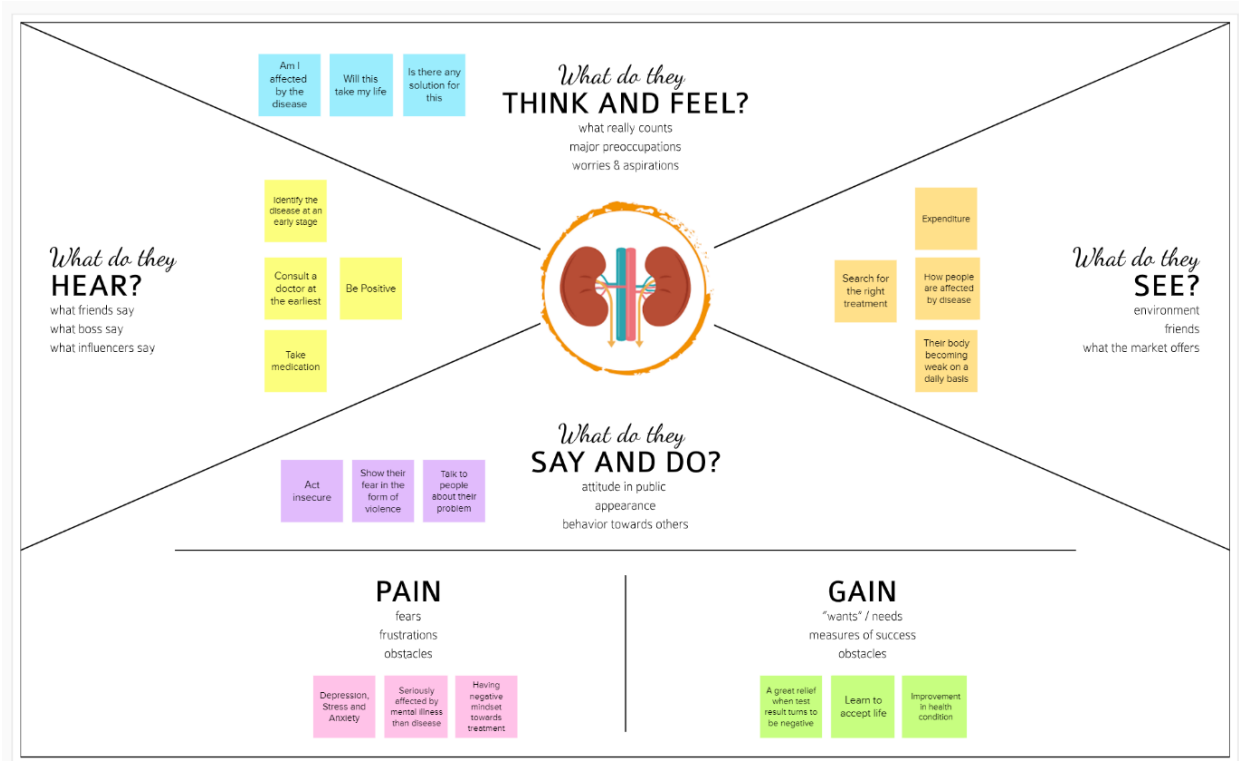
From last 15 years data it has been noticed that increase in number of patient which is suffering from CKD disease and more than 60% patients are not receiving medical attention. CKD ranks number 27 and 18 in 1990 and 2010 respectively as world's prime reason of death. 956,000 people died in 2013 because of CKD. At the last stage, the patient must take dialysis or do kidney transplantation. One of the best ways to reduce this death rate is early treatment. But in developing countries, patients take treatment when they reached in serious state. An automated system can be built in order to detect CKD affected patients before reaching in last stage. Our aim is to compute, analyze and compare between Machine Learning classification approaches to determine which classification approach is the optimal for prediction of chronic kidney disease.

3.IDEATION & PROPOSED SOLUTION:

The steps involved in this implementation are:-

- a) Dataset selection and Data Preprocessing – Selection of the correct dataset and preprocessing the data to remove any noise, fill in empty data etc.
- b) Execution of Algorithms – Implement the algorithms for the given dataset. KNN, Decision Tree, ANN, Logistic regression is used to compare the results and come up with the best method.
- c) Classification of control metrics and predicting the most effective algorithm – Compare the performance of the algorithms based on the several control metrics. Plot the graphs depicting actual and predicted values and determine the most effective algorithm.

3.1 EMPATHY MAP CANVAS:




3.2 IDEATION & BRAINSTROMING

Step-1: Team Gathering, Collaboration and Select the Problem Statement

Brainstorm & Idea Prioritization Template:

Step-1: Team Gathering, Collaboration and Select the Problem Statement



Brainstorm & idea prioritization

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

⌚ 10 minutes to prepare
👥 1 hour to collaborate
👤 3-8 people recommended

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

⌚ 10 minutes

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

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

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

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

⌚ 5 minutes

QUESTION

How might we [your problem statement]?

Key rules of brainstorming
To run an smooth and productive session

⌚ Stop it right.	💡 Encourage wild ideas.
🙅 Defer judgments.	👂 Listen to others.
🗨 Go for quantity.	👁 If possible, be visual.

Step-2: Brainstorm, Idea Listing and Grouping

Step-2: Brainstorm, Idea Listing and Grouping

Brainstorm

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

20 minutes

Sharmishthaa

- Easy to identify
- Quickly start necessary steps
- Reduce the time to find the symptoms

preethi

- Results quickly
- Easy to work
- Increasing scope in future

Subhasree

- ML helps in medical field
- Predicts the accuracy based on algorithms
- Highly beneficial

Lavanya

- Best accuracy
- Provides better to patients
- Possible to diagnose people based on symptoms

Group ideas

Take some starting your ideas while clustering similar or related notes as you go to the end 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than one sticky note, try and subdivide it into smaller sub-groups.

10 minutes

Sharmishthaa
Preethi
Suba shree
Lavanya

Cost efficient for patient

Easy identification using algorithms

User friendly

Save patient time

Step-3: Idea Prioritization

Step-3: Idea Prioritization



3.3 PROPOSED SOLUTION:

We are using mean, mode and median based pre-processing techniques for the missing values. Further we have used K-Nearest Neighbour Classifier, Decision Tree Classifier, Gaussian Naïve Bayes, Logical Regression and Artificial Neural Network to train the model. Then, based on the results of each of these Machine Learning Methods, we can compare and determine which among the following methods can predict the possibility of CKD most accurately.

3.4 PROBLEM SOLUTION FIT:

CKD remains undetected in its early stage and the patients can only realize the severity of the disease when it gets advanced.

- Hence, detecting such disease at earlier stage is a key challenge now
- This project helps to raise awareness among people and to promote early diagnosis.
- Early prediction and proper treatments can possibly stop, or slow the progression of this chronic disease.

4. REQUIREMENT ANALYSIS:

A System Requirement Specification (SRS) is basically an organization's understanding of a customer or potential client's system requirements and dependencies at a particular point prior to any actual design or development work. The information gathered during the analysis is translated into a document that defines a set of requirements. It gives the brief description of the services that the system should provide and also the constraints under which, the system should operate. Generally, SRS is a document that completely describes what the proposed software should do without describing how the software will do it. It's a two-way insurance policy that assures that both the client and the organization understand the other's requirements from that perspective at a given point in time.

4.1 FUNCTIONAL REQUIREMENT:

Functional Requirement defines a function of a software system and how the system must behave when presented with specific inputs or conditions. These may include calculations, data manipulation and processing and other specific functionality. In this system following are the functional requirements:-

All the data must be in the same format as a structured data. 2. The data collected will be vectorized and sent across to the classifier

4.2 NON FUNCTIONAL REQUIREMENT:

Non functional requirements are the requirements which are not directly concerned with the specific function delivered by the system. They specify the criteria that can be used to judge the operation of a system rather than specific behaviors. They may relate to emergent system properties such as reliability, response time and store occupancy.

Non functional requirements arise through the user needs, because of budget constraints, organizational policies, the need for interoperability with other software and hardware systems or because of external factors such as:-

Product Requirements

Organizational Requirements

User Requirements

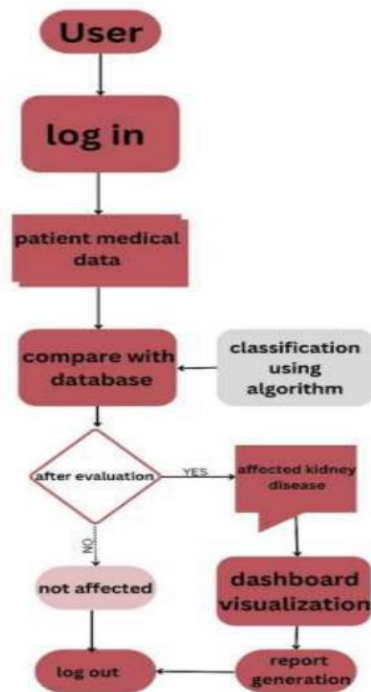
Basic Operational Requirements

5. PROJECT DESIGN:

Design is a meaningful engineering representation of something that is to be built. It is the most crucial phase in the developments of a system. Software design is a process through which the requirements are translated into a representation of software. Design is a place where design is fostered in software Engineering. Based on the user requirements and the detailed analysis of the existing system, the new system must be designed. This is the phase of system designing. Design is the perfect way to accurately translate a customer's requirement in the finished software product. Design creates a representation or model, provides details about software data structure, architecture, interfaces and components that are necessary to implement a system. The logical system design arrived at as a result of systems analysis is converted into physical system design.

5.1 DATA FLOW DIAGRAM :

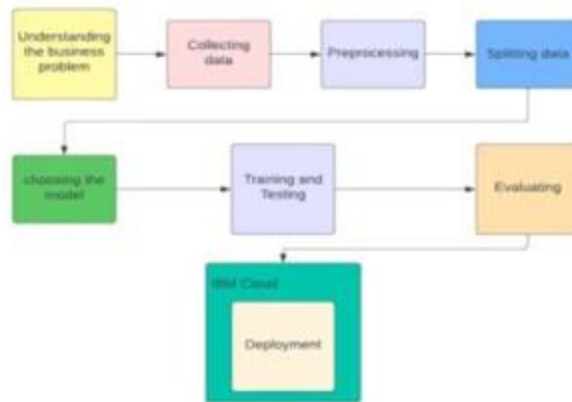
To predict chronic kidney disease, this study employs Decision Tree Classifiers, Random Forest Classifiers, Support Vector Machines, and Artificial Neural Networks. Among these algorithms, we attempt to construct our prediction model, and we choose the best performance by assessing their accuracy.



5.2 SOLUTION & TECHNICAL ARCHITECTURE:

1. Problem Statement : Kidney diseases avert the normal function of the kidney. Early prediction of kidney disease using both classification and regression algorithms are an effective task that can help the doctors to diagnose the disease within a short duration of time.
2. Idea / Solution description One of the easiest solutions to predict the kidney disease using Machine Learning techniques.
3. Novelty / Uniqueness This project provides the best accuracy for predicting the kidney disease.
4. Social Impact / Customer Satisfaction It helps to identify the kidney disease in effective way, reduce the cost and user friendly.
5. Scalability of the Solution This project can be improved by giving medical suggestion for patients.

Technical Architecture:



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	As a user can register for the application by entering my email, password, and confirming password.	user can access account / dashboard	High	Sprint-1
		USN-2	As a user will receive confirmation email once have registered for the application	User can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user can register for the application through Login page	User can register & access the dashboard with Login page	Low	Sprint-2
		USN-4	As a user can verify the signup credentials of the application through mail	User can receive the registration conformation email	Medium	Sprint-1
	Login	USN-5	As a user can log into the application by entering email & password	dashboard was immediately directed	High	Sprint-1
	Dashboard	USN-6	User can access my dashboard whenever want as a user by utilising user login information	User can access all the details in my dashboard	Medium	Sprint-1
Customer (Web user)	Sign-in	USN-7	User can use the application as a user at any time and from any location by using user login credentials	User can utilize my time & access the application	High	Sprint-2
Customer Care Executive	Clarification	USN-8	As a user, they need to clarify some related problems while using the application	Web application give detailed explanation to user 24/7	Medium	Sprint-2

6.PROJECT PLANNING & SCHEDULING:

1. Define the problem

The problem that we are trying to solve is how to predict the likelihood of chronic kidney disease (CKD) in patients.

2. Collect and explore the data We will collect data on patients with CKD and explore the data to look for patterns.

3. Train a machine learning model

We will train a machine learning model on the data to learn how to predict the likelihood of CKD.

4. Evaluate the model

We will evaluate the machine learning model to see how accurate it is in predicting the likelihood of CKD.

6.1 SPRINT PLANNING AND ESTIMATION:

TITLE	DESCRIPTION	DATE
Literature Survey & Information Gathering	Literature survey on the selected project & gathering information by referring the technical papers, research publications , journals etc.	1 SEPTEMBER 2022
Prepare Empathy Map	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem Statements that are to be solved by this project.	5 SEPTEMBER 2022
Ideation	List the ideas by organizing a brainstorming session and prioritize the top 3 ideas based on the feasibility & importance.	9 SEPTEMBER 2022
Proposed Solution	Prepare the proposed solution document, which includes novelty, feasibility of idea, revenue model, social impact, scalability of solution, etc.	21 SEPTEMBER 2022
Problem Solution Fit	Prepare problem - solution fit document.	29 SEPTEMBER 2022
Solution Architecture	Prepare solution architecture document.	30 SEPTEMBER 2022

Customer Journey	Prepare the customer journey maps to understand the user interactions & experiences with the application (entry to exit).	14 OCTOBER 2022
Functional Requirement	Prepare the functional requirement document.	15 OCTOBER 2022
Data Flow Diagrams	Draw the data flow diagrams and submit for review.	15 OCTOBER 2022
Technology Architecture	Prepare the technology architecture diagram.	14 OCTOBER 2022
Prepare Milestone & Activity List	Prepare the milestones & activity list of the project.	21 OCTOBER 2022
Project Development - Delivery of Sprint-1, 2, 3 & 4	Develop & submit the developed code by testing it.	IN PROGRESS..

6.2 SPRINT DELIVERY PLAN SCHEDULE:

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

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Home page	USN-1	New user enters the system. He/she can enter into the application by clicking the get started button	4	High	Sri Sharmishthaa S Preethi A SubaShree k Lavanya M
Sprint-1		USN-2	As a user, I can see all the other pages in the application	2	Medium	Sri Sharmishthaa S Preethi A SubaShree k Lavanya M
Sprint-1		USN-3	Detecting the kidney disease	2	High	Sri Sharmishthaa S Preethi A Suba Shree k Lavanya M
Sprint-1	Data collection and pre processing	USN-4	Downloading the dataset and pre-processing	2	High	Sri Sharmishthaa S Preethi A SubaShree k

						Lavanya M
Sprint-2	Model building	USN-5	Model building and generating the pickle file	2	High	Sri Sharmishthaa S Preethi A SubaShree k Lavanya M

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	Take Test	USN-6	Creating html files and css files for application	2	High	Sri Sharmishthaa S Preethi A SubaShree k Lavanya M
Sprint-2		USN-7	Creating the python file and installing flask integrating with the application	3	High	Sri Sharmishthaa S Preethi A SubaShree k Lavanya M
Sprint-2		USN-8	User can take the test.	8	High	Sri Sharmishthaa S Preethi A Subashree k Lavanya M
Sprint-3	Result Prediction	USN-9	Results will be Predicted. If the user is found with the symptom of the disease, We suggest -CARE TO BE TAKEN.	5	High	Sri Sharmishthaa S Preethi A Subashree k La.anya M
Sprint-3		USN-10	Design, develop the application in such a way that the best user interface and maintenance should be taken care of	5	High	Sri Sharmishthaa S Preethi A Subashree k Lavanya M
Sprint-4	contact	USN-11	The users can contact the admin for further clarifications	2	Medium	Sri Sharmishthaa S Preethi A Subashree k

						Lavanya M
Sprint-4		USN-12	The website is responsive on all the devices and the screen sizes	2	High	Sri Sharmishthaa S Preethi A Subashree k Lavanya M
Sprint-4		USN-13	The updates should be on time with the solutions of the raised queries	2	High	Sri Sharmishthaa S Preethi A Subashree k Lavanya M

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	14	6 Days	24 Oct 2022	29 Oct 2022	29 Oct 2022
Sprint-2	16	6 Days	31 Oct 2022	05 Nov 2022	05 Nov 2022
Sprint-3	15	6 Days	07 Nov 2022	12 Nov 2022	12 Nov 2022
Sprint-4	15	6 Days	14 Nov 2022	19 Nov 2022	19 Nov 2022

Velocity:

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

$$AV = \text{Sprint duration} / \text{velocity} = 20 / 6 = 3.33$$

6.3 REPORTS FROM JIRA:

localhost x IBM-Project x (37) WhatsApp x Microsoft V x Kidney Can x IBM x Project Plan x Project Plan x kidney dise x IBM-EPBL x + -

chronic123.atlassian.net/jira/software/projects/KD/boards/1/roadmap

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LM Status category Epic

	T	NOV	DEC	JAN '23
Sprints				
KD-1 Sprint-1 - Home page	DONE			
KD-2 Sprint-2 - Take test	DONE			
KD-3 Sprint-3 - Contact				
KD-4 Sprint-4 - Access records				
+ Create Epic				

Today Weeks Months Quarters Quickstart

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localhost x IBM-Project x (37) WhatsApp x Microsoft V x KCP Demo x IBM x Project Plan x Project Plan x kidney dise x IBM-EPBL x + -

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Projects / kidney disease

Backlog

LM Epic Insights

Epic x

Issues without epic

> Sprint-3 - Contact

> Sprint-4 - Access records

+ Create Epic

0 1 0 Complete sprint

KD Sprint-3-contact 11 Nov - 12 Nov (2 issues)

KD-5 As a user i contact through providing my personal details IN PROGRESS

KD-6 user can ask their queries TO DO

+ Create issue

0 1 0 Complete sprint

KD Sprint-4-Access records 11 Nov - 19 Nov (1 Issue)

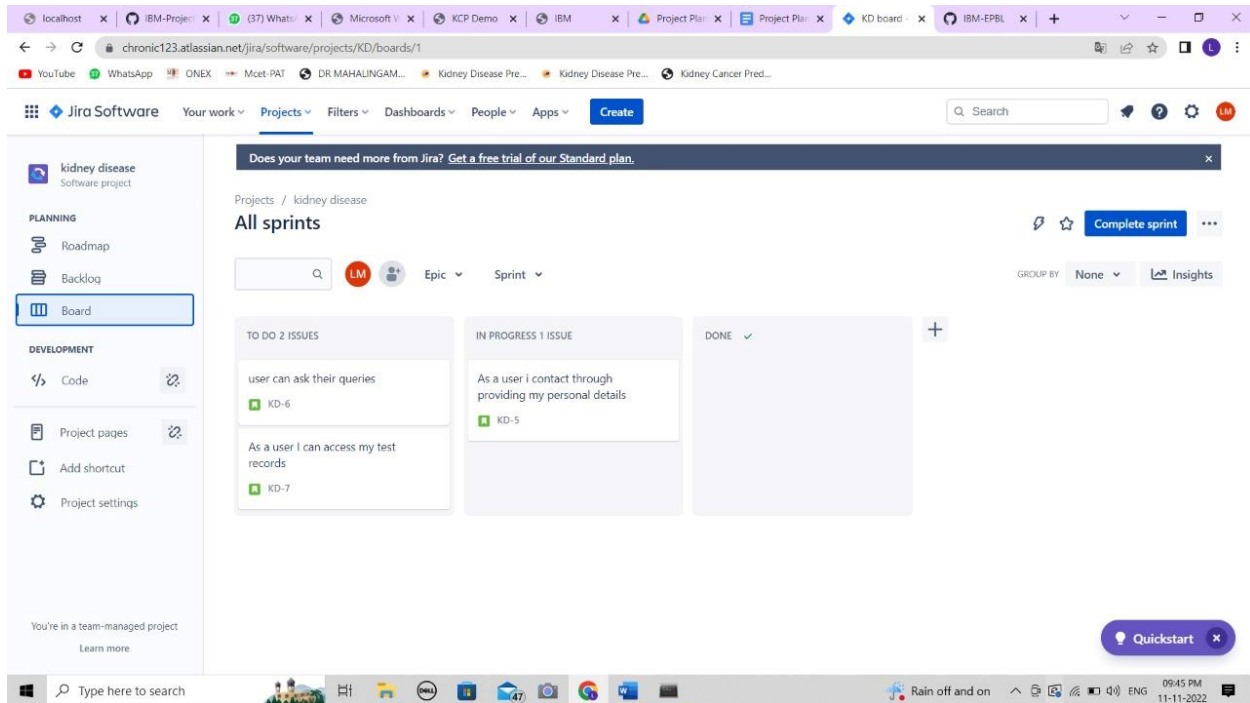
KD-7 As a user I can access my test records TO DO

+ Create issue

0 1 0 Create sprint

Backlog (0 issues)

Type here to search Rain off and on 09:45 PM 11-11-2022



7. CODING & SOLUTION:

7.1 FEATURE 1 :

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
```

```
# For Filtering the warnings
import warnings
warnings.filterwarnings('ignore')
```

```
data = pd.read_csv('kidney_disease.csv')
```

```
data.head()
```


The screenshot shows a Visual Studio Code window with a Python file named 'Kidney_Disease_Prediction.ipynb'. The code in the cell is as follows:

```
data.head()

... pcv    wt    rc    htn    dx    cad    appet    pe    ans    classification
0    ...  44  7800  5.2  yes  yes    no    good    no    no            ckd
1    ...  38  6000  NaN    no    no    no    good    no    no            ckd
2    ...  31  7500  NaN    no    yes    no    poor    no    yes          ckd
3    ...  32  6700  1.5  yes    no    no    poor    yes    yes          ckd
4    ...  75  7300  4.6    no    no    no    good    no    no            ckd

[5 rows x 26 columns]
```

Below the code, the output of `data.info()` is shown, indicating that the output exceeds the size limit and has been truncated. The output shows the first few rows of the dataset, including columns like `id`, `age`, `bp`, `sg`, `al`, `su`, `rbc`, `pc`, `pcv`, `wt`, `rc`, `htn`, `dx`, `cad`, `appet`, `pe`, `ans`, and `classification`.

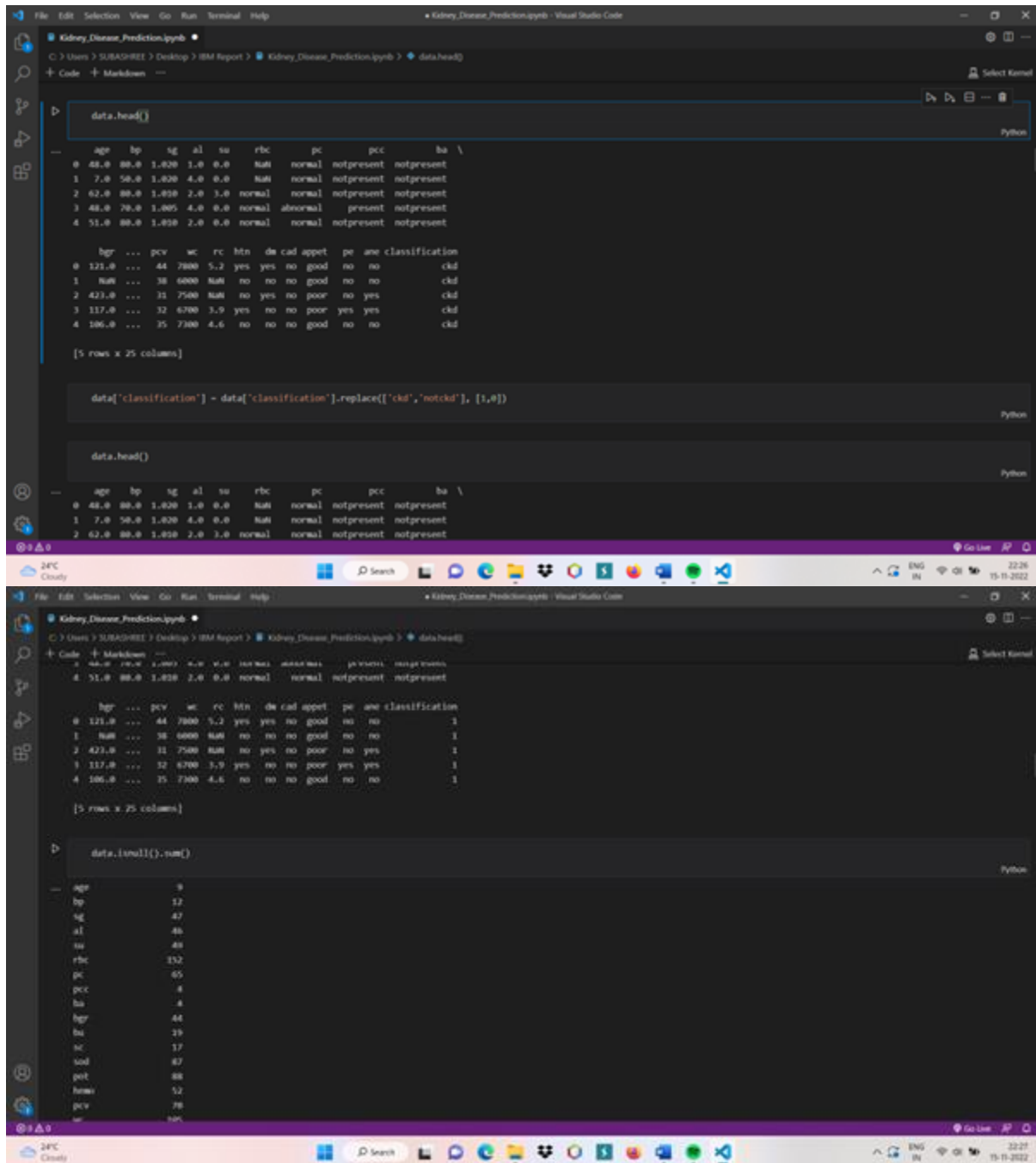
The screenshot shows the same Visual Studio Code window, but now the full output of `data.info()` is visible. The output is as follows:

```
Output exceeds the size limit. Open the full output data in a text editor
class 'pandas.core.frame.DataFrame'
RangeIndex: 400 entries, 0 to 399
Data columns (total 26 columns):
 #   column                non-null count  dtype
---  ---
0   id                    400 non-null    int64
1   age                  391 non-null    float64
2   bp                   398 non-null    float64
3   sg                   353 non-null    float64
4   al                   354 non-null    float64
5   su                   355 non-null    float64
6   rbc                  248 non-null    object
7   pc                   335 non-null    object
8   pcv                  396 non-null    object
9   wt                   396 non-null    object
10  hgt                  356 non-null    float64
11  bu                   381 non-null    float64
12  scr                  383 non-null    float64
13  sud                  333 non-null    float64
14  pot                  332 non-null    float64
15  homo                 348 non-null    float64
16  pcv                  338 non-null    object
17  wt                   295 non-null    object
18  rc                   370 non-null    object
19  htn                  398 non-null    object
...
23  pe                   399 non-null    object
24  ans                  399 non-null    object
25  classification       400 non-null    object
dtypes: float64(11), int64(1), object(14)
```

```
data.classification.unique()
array(['ckd', 'ckd\t', 'notckd'], dtype=object)
data.classification=data.classification.replace("ckd\t","ckd")
```

```
data.classification.unique()
array(['ckd', 'notckd'], dtype=object)
data.drop('id', axis = 1, inplace = True)
```

data.head()



The first screenshot shows a Python script in Visual Studio Code. The script defines a dictionary of data, replaces 'ckd' with 'notckd' in the 'classification' column, and prints the first five rows. The data is as follows:

	age	bp	sg	al	su	rbc	pc	pcc	ba	\
0	45.0	80.0	1.020	1.0	0.0	nan	normal	notpresent	notpresent	
1	7.0	50.0	1.020	4.0	0.0	nan	normal	notpresent	notpresent	
2	62.0	80.0	1.010	2.0	3.0	normal	normal	notpresent	notpresent	
3	48.0	70.0	1.005	4.0	0.0	normal	abnormal	present	notpresent	
4	51.0	80.0	1.010	2.0	0.0	normal	normal	notpresent	notpresent	

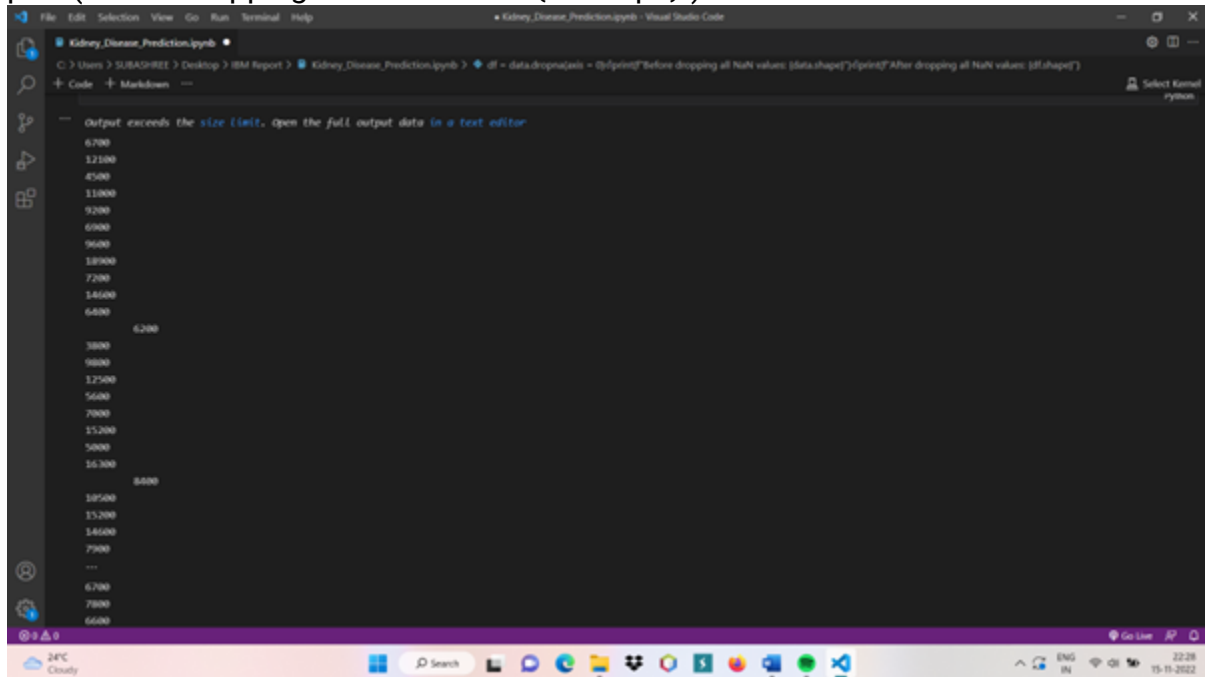
The second screenshot shows the same script after dropping rows with missing values. The output shows the first five rows of the resulting data frame:

	age	bp	sg	al	su	rbc	pc	pcc	ba	\
0	45.0	80.0	1.020	1.0	0.0	nan	normal	notpresent	notpresent	1
1	7.0	50.0	1.020	4.0	0.0	nan	normal	notpresent	notpresent	1
2	62.0	80.0	1.010	2.0	3.0	normal	normal	notpresent	notpresent	1
3	48.0	70.0	1.005	4.0	0.0	normal	abnormal	present	notpresent	1
4	51.0	80.0	1.010	2.0	0.0	normal	normal	notpresent	notpresent	1

```
df = data.dropna(axis = 0)
print(f"Before dropping all NaN values: {data.shape}")
print(f"After dropping all NaN values: {df.shape}")
```

```
df = data.dropna(axis = 0)
print(f"Before dropping all NaN values: {data.shape}")
```

```
print(f"After dropping all NaN values: {df.shape}")
```



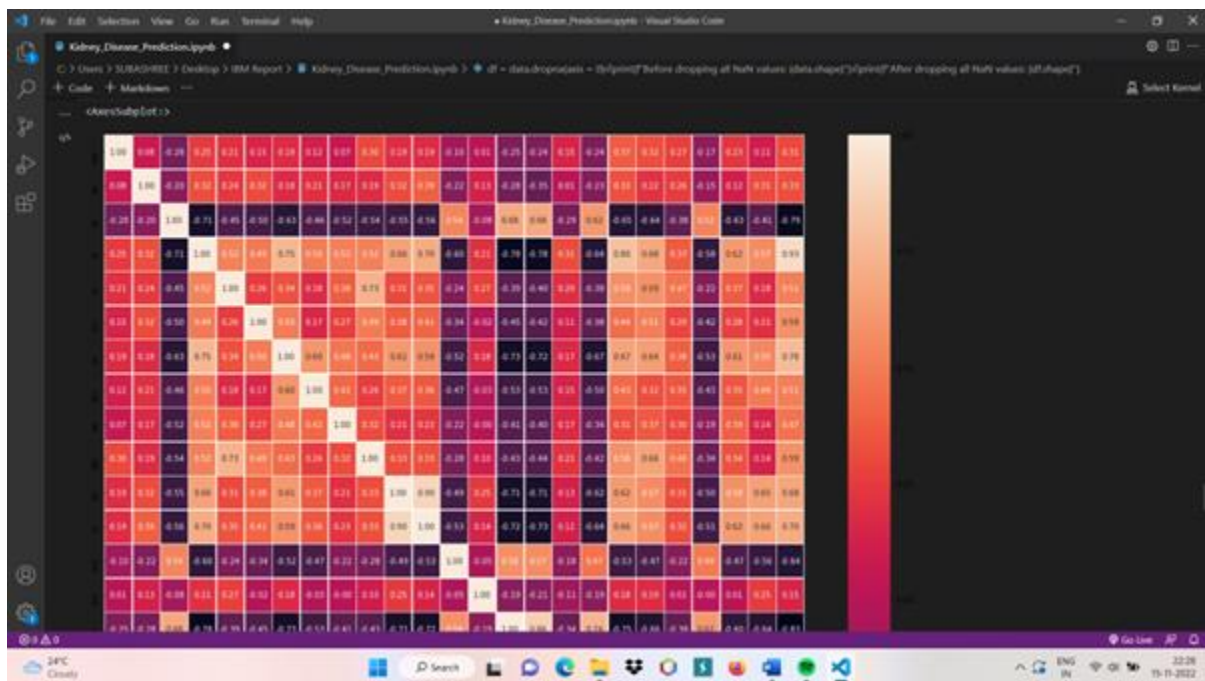
```
File Edit Selection View Go Run Terminal Help
Kidney_Disease_Prediction.ipynb - Visual Studio Code

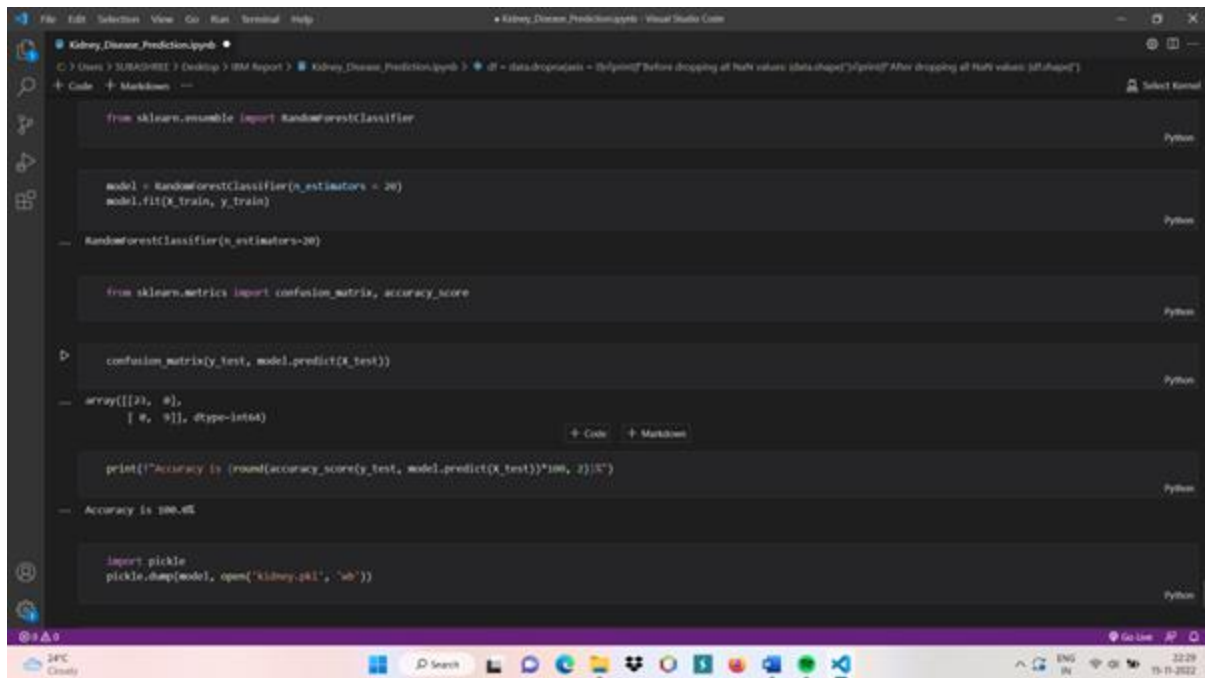
C:\Users\SUBASHREE\Desktop> IBM Report > Kidney_Disease_Prediction.ipynb > df = data.dropna(inplace=True)
print("Before dropping all NaN values: {data.shape}")
print("After dropping all NaN values: {df.shape}")

+ Code + Markdown

Output exceeds the size limit. Open the full output data in a text editor.

6700
82100
4500
11000
9200
6900
9600
18900
7200
14600
6400
6200
3000
9000
12500
5600
7000
15200
5000
16300
6400
10500
15200
14600
7900
...
6700
7000
6600
```





7.2 FEATURE 2:

models.py:

```

import numpy as np
import pandas as pd
from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.naive_bayes import GaussianNB
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import confusion_matrix

```

class Model:

```

def __init__(self):
    self.name = "
    path = 'dataset/kidney_disease.csv'
    df = pd.read_csv(path)
    df = df[['age', 'bp', 'su', 'pc', 'pcc', 'sod', 'hemo', 'htn', 'dm', 'classification']]

    df['age'] = df['age'].fillna(df['age'].mean())
    df['bp'] = df['bp'].fillna(df['bp'].mean())
    df['su'] = df['su'].fillna(df['su'].mode()[0])
    df['pc'] = df['pc'].fillna(df['pc'].mode()[0])

```

```

df['pcc'] = df['pcc'].fillna(df['pcc'].mode()[0])
df['sod'] = df['sod'].fillna(df['sod'].mode()[0])
df['hemo'] = df['hemo'].fillna(df['hemo'].mode()[0])
df['htn'] = df['htn'].fillna(df['htn'].mode()[0])
df['dm'] = df['dm'].str.replace(" ", "")
df['dm'] = df['dm'].str.replace("\t", "")
df['dm'] = df['dm'].fillna(df['dm'].mode()[0])
df['classification'] = df['classification'].str.replace("\t", "")
df['classification'] = df['classification'].fillna(df['classification'].mode()[0])

labelencoder = LabelEncoder()
df['pc'] = labelencoder.fit_transform(df['pc'])
df['pcc'] = labelencoder.fit_transform(df['pcc'])
df['htn'] = labelencoder.fit_transform(df['htn'])
df['dm'] = labelencoder.fit_transform(df['dm'])
df['classification'] = labelencoder.fit_transform(df['classification'])
self.split_data(df)

def split_data(self,df):
    x = df.iloc[:, [0, 1, 2, 3, 4, 5, 6, 7, 8]].values
    y = df.iloc[:, 9].values
    x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.3, random_state=24)
    self.x_train = x_train
    self.x_test = x_test
    self.y_train = y_train
    self.y_test = y_test

def svm_classifier(self):
    self.name = 'Svm Classifier'
    classifier = SVC()
    return classifier.fit(self.x_train, self.y_train)

def decisionTree_classifier(self):
    self.name = 'Decision tree Classifier'
    classifier = DecisionTreeClassifier()
    return classifier.fit(self.x_train, self.y_train)

def randomforest_classifier(self):
    self.name = 'Random Forest Classifier'
    classifier = RandomForestClassifier()
    return classifier.fit(self.x_train, self.y_train)

def naiveBayes_classifier(self):

```

```

self.name = 'Naive Bayes Classifier'
classifier = GaussianNB()
return classifier.fit(self.x_train,self.y_train)

```

```

def knn_classifier(self):
    self.name = 'Knn Classifier'
    classifier = KNeighborsClassifier()
    return classifier.fit(self.x_train,self.y_train)

```

```

def accuracy(self,model):
    predictions = model.predict(self.x_test)
    cm = confusion_matrix(self.y_test, predictions)
    accuracy = (cm[0][0] + cm[1][1]) / (cm[0][0] + cm[0][1] + cm[1][0] + cm[1][1])
    print(f"{self.name} has accuracy of {accuracy*100} % ")

```

```

if __name__ == '__main__':
    model = Model()
    model.accuracy(model.svm_classifier())
    model.accuracy(model.decisionTree_classifier())
    model.accuracy(model.randomforest_classifier())
    model.accuracy(model.naiveBayes_classifier())
    model.accuracy(model.knn_classifier())

```

login.html:

```

<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <meta http-equiv="X-UA-Compatible" content="ie=edge">
    <title>KCP Demo</title>
    <link href="//maxcdn.bootstrapcdn.com/bootstrap/4.1.1/css/bootstrap.min.css"
rel="stylesheet" id="bootstrap-css">
    <script
src="//maxcdn.bootstrapcdn.com/bootstrap/4.1.1/js/bootstrap.min.js"></script>
    <script src="//cdnjs.cloudflare.com/ajax/libs/jquery/3.2.1/jquery.min.js"></script>
</head>
<style>

```

```

.login-container{
    margin-top: 5%;
    margin-bottom: 5%;
}

```

```
.login-logo{
  position: relative;
  margin-left: -41.5%;
}
.login-logo img{
  position: absolute;
  width: 20%;
  margin-top: 19%;
  background: #282726;
  border-radius: 4.5rem;
  padding: 5%;
}
.login-form-1{
  padding: 9%;
  background:#282726;
  box-shadow: 0 5px 8px 0 rgba(0, 0, 0, 0.2), 0 9px 26px 0 rgba(0, 0, 0, 0.19);
}
.login-form-1 h3{
  text-align: center;
  margin-bottom:12%;
  color:#fff;
}
.login-form-2{
  padding: 9%;
  background: #f05837;
  box-shadow: 0 5px 8px 0 rgba(0, 0, 0, 0.2), 0 9px 26px 0 rgba(0, 0, 0, 0.19);
}
.login-form-2 h3{
  text-align: center;
  margin-bottom:12%;
  color: #fff;
}
.btnSubmit{
  font-weight: 600;
  width: 50%;
  color: #282726;
  background-color: #fff;
  border: none;
  border-radius: 1.5rem;
  padding:2%;
}
.btnForgetPwd{
  color: #fff;
  font-weight: 600;
```

```

    text-decoration: none;
}
.btnForgetPwd:hover{
    text-decoration:none;
    color:#fff;
}
.fon{
    color: white;
    text-align: center;
}
</style>
<body>

<div class="container login-container">
    <div class="row">
        <div class="col-md-6 login-form-1">
            <h3>Application Login</h3>
            <h6 class="fon">Login here to access CK-Detector</h6>

        </div>
        <div class="col-md-6 login-form-2">
            <div class="login-logo">
                
            </div>
            <h3>Login</h3>
            <form action="/login" method="POST">
                <div class="form-group">
                    <input type="text" name="username" class="form-control"
placeholder="Your Username *" value="" />
                </div>
                <div class="form-group">
                    <input type="password" name="password" class="form-control"
placeholder="Your Password *" value="" />
                </div>
                <div class="form-group">
                    <input type="submit" class="btnSubmit" value="Login" />
                </div>
                <div class="form-group">
                    <a href="#" class="btnForgetPwd" value="Login">Forget Password?</a>
                </div>
            </form>
        </div>
    </div>
</div>

```



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

8. TESTING:

The program comprises of several algorithms which are tested individually for the accuracy. we check for the correctness of the program as a whole and how it performs.

8.1 TESTCASE:

Black System Testing is a level of software testing where a complete and integrated software is tested. The purpose of this test is to evaluate the systems compliance with the specified requirements. System Testing is the testing of a complete and fully integrated software product. and White Box Testing. System test falls under the black box testing category of software testing. Different Types of System Testing:

- Usability Testing - Usability Testing mainly focuses on the users ease to use the application, flexibility in handling controls and ability of the system to meet its objectives.
- Load Testing - Load Testing is necessary to know that a software solution will perform under real-life loads.
- Regression Testing- Regression Testing involves testing done to make sure none of the changes made over the course of the development process have caused new bugs.
- Recovery Testing - Recovery testing is done to demonstrate a software solution is reliable, trustworthy and can successfully recoup from possible crashes.
- Migration Testing - Migration testing is done to ensure that the software can be moved from older system infrastructures to current system infrastructures without any issues.

8.2 USER ACCEPTANCE TESTING:

Functional Testing is also known as functional completeness testing, Functional Testing involves trying to think of any possible missing functions. Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:

Valid Input : identified classes of valid input must be accepted. Invalid Input : identified classes of invalid input must be rejected. Functions : identified functions must be exercised.

Output : identified classes of application outputs must be exercised.

Systems/Procedures: Interfacing systems or procedures must be invoked.

9. RESULTS:

For the purposes of this project we have used five popular algorithms: Logistic regression and Neural network, Decision Tree, Gaussian NB, KNN. All the algorithms are

based on supervised learning. We are determining the best method considering 4 factors namely Specificity, Sensitivity, Log Loss, Accuracy. When plotted on a graph for all the algorithms it was found that Logistic Regression was the best method to use to find Chronic Kidney Disease.

9.1 PERFORMANCE METRICS:

Accuracy Accuracy is the number of correctly predicted data points out of all the data points. More formally, it is defined as the number of true positives and true negatives divided by the number of true positives, true negatives, false positives, and false negatives. $\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$

Specificity Specificity is defined as the proportion of actual negative, which got predicted as the negative (or true negative). $\text{Specificity} = \frac{TN}{TN + FP}$

Sensitivity Sensitivity is a measure of the proportion of actual positive cases that got predicted as positive (or true positive). $\text{Sensitivity} = \frac{TP}{TP + FN}$

Log Loss Logarithmic loss measures the performance of a classification model where the prediction input is a probability value between 0 and 1. The goal of our machine learning models is to minimize this value. $\text{Log Loss} = -\{y \log(p) + (1 - y) \log(1 - p)\}$

· y - a binary indicator (0 or 1) of whether class label c is the correct classification for observation o

· p - the model's predicted probability that observation o is of class c

Log Loss Logarithmic loss measures the performance of a classification model where the prediction input is a probability value between 0 and 1. The goal of our machine learning models is to minimize this value. $\text{Log Loss} = -\{y \log(p) + (1 - y) \log(1 - p)\}$

· y - a binary indicator (0 or 1) of whether class label c is the correct classification for observation o

· p - the model's predicted probability that observation o is of class c

10. ADVANTAGES & DISADVANTAGES:

ADVANTAGES:

- This application helps the user to predict their kidney disease at their convenience.
- It saves the user's time and money.

DISADVANTAGES:

- The results could be predicted only if they know all their body levels.
- Sometimes the results can vary .
- Appropriate results cannot be predicted.

11. CONCLUSION

This system presented the best prediction algorithm to predict CKD at an early stage. The dataset shows input parameters collected from the CKD patients and the models are trained and validated for the given input parameters. K-Nearest-Neighbors Classifier, Decision Tree Classifier, GaussianNB, Logical Regression and Artificial Neural Network learning models are constructed to carry out the diagnosis of CKD. The performance of

the models is evaluated based on a variety of comparison metrics are being used, namely Accuracy, Specificity, Sensitivity and Log Loss. The results of the research showed that Logical Regression model better predicts CKD in comparison to the other models taking all the metrics under consideration. This system would help detect the chances of a person having CKD further on in his life which would be really helpful and cost-effective people. This model could be integrated with normal blood report generation, which could automatically flag out if there is a person at risk. Patients would not have to go to a doctor unless they are flagged by the algorithms. This would make it cheaper and easier for the modern busy person.

12.FUTURE SCOPE:

- This would help detect the chances of a person having CKD further on in his life which would be really helpful and cost-effective people.
- This model could be integrated with normal blood report generation, which could automatically flag out if there is a person at risk.
- Patients would not have to go to a doctor unless they are flagged by the algorithms. This would make it cheaper and easier for the modern busy person.

13. APPENDIX:

SOURCE CODE:

Display records:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Chronic Kidney Disease Detection</title>
  <!-- Latest compiled and minified CSS -->
  <link rel="stylesheet"
href="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/css/bootstrap.min.css"
integrity="sha384-
BVYiISIFeK1dGmJRAkycuHAHRg32OmUcww7on3RYdg4Va+PmSTsz/K68vbdEjh4u"
crossorigin="anonymous">
</head>
<body>
```

```
    {% for table in tables %}
      {{ table|safe }}
    {% endfor %}
<div class="container">
  <div class="row" align="center">
    <form action="/">
```

```
        <input class="btn btn-success" type="submit" value="Go Back">
    </form>
</div>
</div>
</body>
</html>
```

Index page:

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

<head>
    <meta charset="utf-8">
    <meta content="width=device-width, initial-scale=1.0" name="viewport">

    <title>Kidney Cancer Predictor System</title>
    <meta content="" name="description">
    <meta content="" name="keywords">

    <!-- Google Fonts -->
    <link
href="https://fonts.googleapis.com/css?family=Open+Sans:300,300i,400,400i,600,600i,700,700i|Montserrat:300,300i,400,400i,500,500i,600,600i,700,700i|Poppins:300,300i,400,400i,500,500i,600,600i,700,700i" rel="stylesheet">

    <!-- Vendor CSS Files -->
    <link href="{{url_for('static',filename='vendor/bootstrap/css/bootstrap.min.css')}}"
rel="stylesheet">
    <link href="{{url_for('static',filename='vendor/icomfont/icomfont.min.css')}}"
rel="stylesheet">
    <link href="{{url_for('static',filename='vendor/boxicons/css/boxicons.min.css')}}"
rel="stylesheet">
    <link href="{{url_for('static',filename='vendor/venobox/venobox.css')}}"
rel="stylesheet">
    <link
href="{{url_for('static',filename='vendor/owl.carousel/assets/owl.carousel.min.css')}}"
rel="stylesheet">
    <link href="{{url_for('static',filename='vendor/aos/aos.css')}}" rel="stylesheet">

    <!-- Template Main CSS File -->
```

```
<link href="{{url_for('static',filename='css/style.css')}}" rel="stylesheet">
```

```
</head>
```

```
<body>
```

```
<!-- ===== Hero Section ===== -->
```

```
<section id="hero">
```

```
<div class="hero-container">
```

```
<a href="index.html" class="hero-logo" data-aos="zoom-in"></a>
```

```
<h1 data-aos="zoom-in">Chronic Kidney Disease Detection System</h1>
```

```
<h2 data-aos="fade-up">It's possible not just to survive, but to thrive and to live a healthy, wonderful life again.</h2>
```

```
<a data-aos="fade-up" href="#about" class="btn-get-started scrollto">Get Started</a>
```

```
</div>
```

```
</section><!-- End Hero -->
```

```
<!-- ===== Header ===== -->
```

```
<header id="header" class="d-flex align-items-center">
```

```
<div class="container">
```

```
<!-- The main logo is shown in mobile version only. The centered nav-logo in nav menu is displayed in desktop view -->
```

```
<div class="logo d-block d-lg-none">
```

```
<a href="index.html"></a>
```

```
</div>
```

```
<nav class="nav-menu d-none d-lg-block">
```

```
<ul class="nav-inner">
```

```
<li class="active"><a href="/">Home</a></li>
```

```
<li><a href="#about">Demo</a></li>
```

```
<li><a href="#services">Take a Test</a></li>
```

```
<li><a href="#contact">Contact</a></li>
```

```
<li><a href="/login">Access Records</a></li>
```

```
</ul>
```

```
</nav><!-- .nav-menu -->
```

```
</div>
```

```
</header><!-- End Header -->
```

```

<main id="main">

<!-- ===== About Us Section ===== -->
<section id="about" class="about">
  <div class="container">

    <div class="section-title" data-aos="fade-up">
      <h2>Demo</h2>
      <p>An application to test chronic kidney disease.</p>
    </div>

    <div class="row">
      <div class="col-lg-6" data-aos="fade-right">
        <div class="image">
          
        </div>
      </div>
      <div class="col-lg-6" data-aos="fade-left">
        <div class="content pt-4 pt-lg-0 pl-0 pl-lg-3 ">
          <h3>How to respond to Test</h3>
          <ul>
            <li><i class="bx bx-check-double"></i> Fill out all required fields.</li>
            <li><i class="bx bx-check-double"></i> Fill the filds as per the measurement
standards mentioned.</li>
          </ul>
          <p>
            As good and effective educators, we always want to improve. Improvement is
something we instill in our patients and
            it would be hypocritical to not expect the same from ourselves. Patients are
the center of our Hospital and they are
            where we can find the most relevant information about how to be better at our
jobs.
            If we are not delivering effectively to the patients how can we ever expect
better satisfaction hopefully.
          </p>

          <a href="#services"><input class="btn btn-success" type="button" value="Take a
Test"></a>

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

```

```

</div>
</section><!-- End About Us Section -->

<!-- ===== Services Section ===== -->
<section id="services" class="services">
  <div class="container">

    <div class="section-title" data-aos="fade-up">
      <h2>Take a Test</h2>
      <p>We care for you</p>
    </div>

    <div class="row">
      <div class="col-lg-6 order-2 order-lg-1">
        <form action="/predict" method="POST">
          <div class="icon-box mt-5 mt-lg-0" data-aos="fade-up">
            <i class="bx bx-receipt"></i>
            <h4>Age</h4>
            <div class="form-group">
              <input required type="number" name="age" class="form-control">
            </div>
          </div>
          <div class="icon-box mt-5" data-aos="fade-up" data-aos-delay="100">
            <i class="bx bx-receipt"></i>
            <h4>Blood Pressure</h4>
            <div class="form-group">
              <input required type="number" name="bp" class="form-control">
            </div>
          </div>
          <div class="icon-box mt-5" data-aos="fade-up" data-aos-delay="200">
            <i class="bx bx-receipt"></i>
            <h4>Sugar(nominal)</h4>
            <div class="form-group">
              <select required name="sugar" class="form-control">
                <option value="0">0</option>
                <option value="1">1</option>
                <option value="2">2</option>
                <option value="3">3</option>
                <option value="4">4</option>
              </select>
            </div>
          </div>
          <div class="icon-box mt-5" data-aos="fade-up" data-aos-delay="300">
            <i class="bx bx-receipt"></i>

```

```

<h4>Pus Cell</h4>
<div class="form-group">
  <select required name="pc" class="form-control">
    <option value="1">Normal</option>
    <option value="0">Abnormal</option>
  </select>
</div>
</div>
<div class="icon-box mt-5" data-aos="fade-up" data-aos-delay="300">
  <i class="bx bx-receipt"></i>
  <h4>Pus Cell Clumps</h4>
  <div class="form-group">
    <select required name="pcc" class="form-control">
      <option value="0">NotPresent</option>
      <option value="1">Present</option>
    </select>
  </div>
</div>

</div>
<div class="col-lg-6 order-2 order-lg-1">

  <div class="icon-box mt-5" data-aos="fade-up" data-aos-delay="300">
    <i class="bx bx-receipt"></i>
    <h4>Sodium(mEq/L)</h4>
    <div class="form-group">
      <input required type="number" name="sodium" class="form-
control">
    </div>
  </div>

  <div class="icon-box mt-5 mt-lg-0" data-aos="fade-up">
    <i class="bx bx-receipt"></i>
    <h4>Hemoglobin(gms)</h4>
    <div class="form-group">
      <input required type="any" name="hemo" class="form-control">
    </div>
  </div>
  <div class="icon-box mt-5" data-aos="fade-up" data-aos-delay="100">
    <i class="bx bx-receipt"></i>
    <h4>Hypertension</h4>
    <div class="form-group">

```



```

        <select required name="htn" class="form-control">
            <option value="0">No</option>
            <option value="1">Yes</option>
        </select>
    </div>
</div>
<div class="icon-box mt-5" data-aos="fade-up" data-aos-delay="200">
    <i class="bx bx-receipt"></i>
    <h4>Diabetes Mellitus</h4>
    <div class="form-group">
        <select required name="db" class="form-control">
            <option value="0">No</option>
            <option value="1">Yes</option>
        </select>
    </div>
</div>
<br>
<input class="btn btn-success" type="submit" value="Get Results">
</form>

</div><!--End of 2nd col-->
</div>
</div>
</section><!-- End Services Section -->

```

```

<!-- ===== Testimonials Section ===== -->
<section id="testimonials" class="testimonials">
    <div class="container" data-aos="zoom-in">
        <div class="quote-icon">
            <i class="bx bxs-quote-right"></i>
        </div>
        <div class="owl-carousel testimonials-carousel">

            <div class="testimonial-item">
                <p>
                    There's always hope beyond what you see.
                </p>
            </div>

            <div class="testimonial-item">
                <p>
                    Difficult roads can lead to beautiful destinations.
                </p>
            </div>

```

```

</div>

<div class="testimonial-item">
  <p>
    Cancer is like a teeter-totter. Sometimes you gotta go down to go back up.
  </p>
</div>

<div class="testimonial-item">
  <p>
    Don't pass up the cherry pie.
  </p>
</div>

<div class="testimonial-item">
  <p>
    Being positive is the best medicine you can take.
  </p>
</div>
</div>

</div>
</section><!-- End Testimonials Section -->


<!-- ===== Contact Section ===== -->
<section id="contact" class="contact section-bg">
  <div class="container">

    <div class="section-title">
      <h2>Contact</h2>
    </div>

    <div class="row">

      <div class="col-lg-4">
        <div class="info d-flex flex-column justify-content-center" data-aos="fade-right">
          <div class="address">

```

```
<i class="icofont-google-map"></i>
<h4>Location:</h4>
<p>MCET,<br>Pollachi, 642003</p>
</div>
```

```
<div class="email">
  <i class="icofont-envelope"></i>
  <h4>Email:</h4>
  <p>preethitom464@gmail.com</p>
</div>
```

```
<div class="phone">
  <i class="icofont-phone"></i>
  <h4>Call:</h4>
  <p>+91 123456789</p>
</div>
```

```
</div>
```

```
</div>
```

```
<div class="col-lg-8 mt-5 mt-lg-0">
```

```
  <form action="forms/contact.php" method="post" role="form" class="php-email-
form" data-aos="fade-left">
    <div class="form-row">
      <div class="col-md-6 form-group">
        <input type="text" name="name" class="form-control" id="name"
placeholder="Your Name" data-rule="minlen:4" data-msg="Please enter at least 4 chars"
/>
        <div class="validate"></div>
      </div>
      <div class="col-md-6 form-group">
        <input type="email" class="form-control" name="email" id="email"
placeholder="Your Email" data-rule="email" data-msg="Please enter a valid email" />
        <div class="validate"></div>
      </div>
    </div>
    <div class="form-group">
      <input type="text" class="form-control" name="subject" id="subject"
placeholder="Subject" data-rule="minlen:4" data-msg="Please enter at least 8 chars of
subject" />
      <div class="validate"></div>
    </div>
```

```
<div class="form-group">
  <textarea class="form-control" name="message" rows="5" data-rule="required"
data-msg="Please write something for us" placeholder="Message"></textarea>
  <div class="validate"></div>
</div>
<div class="mb-3">
  <div class="loading">Loading</div>
  <div class="error-message"></div>
  <div class="sent-message">Your message has been sent. Thank you!</div>
</div>
<div class="text-center"><button type="submit">Send Message</button></div>
</form>
```

```
</div>
```

```
</div>
```

```
</div>
```

```
</section><!-- End Contact Section -->
```

```
</main><!-- End #main -->
```

```
<!-- ===== Footer ===== -->
```

```
<footer id="footer">
```

```
<div class="footer-top">
```

```
<div class="container">
```

```
<div class="row justify-content-center">
```

```
<div class="col-lg-6">
```

```
<a href="#header" class="scrollto footer-logo"></a>
```

```
<h3>Chronic Kidney Disease Detection System</h3>
```

```
</div>
```

```
</div>
```

```
<div class="row footer-newsletter justify-content-center">
```

```
<div class="col-lg-6">
```

```
<form action="" method="post">
```

```
<input type="email" name="email" placeholder="Enter your Email"><input
type="submit" value="Get in touch">
```

```
</form>
```

```
</div>
```

</div>

<div class="social-links">

<i class="bx bxl-twitter"></i>

<i class="bx bxl-facebook"></i>

<i class="bx bxl-instagram"></i>

<i class="bx bxl-skype"></i>

<i class="bx bxl-linkedin"></i>

</div>

</div>

</div>

<div class="container footer-bottom clearfix">

<div class="copyright">

© Copyright CKD. All Rights Reserved

</div>

</div>

</footer><!-- End Footer -->

<i class="icofont-simple-up"></i>

<!-- Vendor JS Files -->

<script src="{{url_for('static',filename='vendor/jquery/jquery.min.js')}}"></script>

<script

src="{{url_for('static',filename='vendor/bootstrap/js/bootstrap.bundle.min.js')}}"></script>

<script

src="{{url_for('static',filename='vendor/jquery.easing/jquery.easing.min.js')}}"></script>

<script src="{{url_for('static',filename='vendor/php-email-form/validate.js')}}"></script>

<script src="{{url_for('static',filename='vendor/jquery-sticky/jquery.sticky.js')}}"></script>

<script src="{{url_for('static',filename='vendor/venobox/venobox.min.js')}}"></script>

<script src="{{url_for('static',filename='vendor/isotope-layout/isotope.pkgd.min.js')}}"></script>

<script

src="{{url_for('static',filename='vendor/owl.carousel/owl.carousel.min.js')}}"></script>

<script src="{{url_for('static',filename='vendor/aos/aos.js')}}"></script>

<!-- Template Main JS File -->

<script src="{{url_for('static',filename='js/main.js')}}"></script>

</body>

</html>

Result page:

<!DOCTYPE html>

<html lang="en">

<head>

<meta charset="utf-8">

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

<title>Chronic Kidney Disease Detection System</title>

<meta content="" name="description">

<meta content="" name="keywords">

<!-- Google Fonts -->

<link

href="https://fonts.googleapis.com/css?family=Open+Sans:300,300i,400,400i,600,600i,700,700i|Montserrat:300,300i,400,400i,500,500i,600,600i,700,700i|Poppins:300,300i,400,400i,500,500i,600,600i,700,700i" rel="stylesheet">

<!-- Vendor CSS Files -->

<link href="{{url_for('static',filename='vendor/bootstrap/css/bootstrap.min.css')}}" rel="stylesheet">

<link href="{{url_for('static',filename='vendor/icomfont/icomfont.min.css')}}" rel="stylesheet">

<link href="{{url_for('static',filename='vendor/boxicons/css/boxicons.min.css')}}" rel="stylesheet">

<link href="{{url_for('static',filename='vendor/venobox/venobox.css')}}" rel="stylesheet">

<link href="{{url_for('static',filename='vendor/owl.carousel/assets/owl.carousel.min.css')}}" rel="stylesheet">

<link href="{{url_for('static',filename='vendor/aos/aos.css')}}" rel="stylesheet">

<!-- Template Main CSS File -->

<link href="{{url_for('static',filename='css/style.css')}}" rel="stylesheet">

</head>

<body>

{% block code_block %}

```

<!-- ===== Hero Section ===== -->
<section id="hero">
  <div class="hero-container">
    <a href="index.html" class="hero-logo" data-aos="zoom-in"></a>
    {% if result == 0 %}
    <h1 data-aos="zoom-in">You have sever chronic kidney disease.</h1>
    {% else %}
    <h1 data-aos="zoom-in">You have no signs of kidney diseases.</h1>
    {% endif %}

    <h2 data-aos="fade-up">It's possible not just to survive, but to thrive and to live a
healthy, wonderful life again.</h2>
    <a data-aos="fade-up" href="#about" class="btn-get-started scrollto">Explore</a>
  </div>
</section><!-- End Hero -->
  {% endblock %}
<!-- ===== Header ===== -->
<header id="header" class="d-flex align-items-center">
  <div class="container">

    <!-- The main logo is shown in mobile version only. The centered nav-logo in nav
menu is displayed in desktop view -->
    <div class="logo d-block d-lg-none">
      <a href="index.html"></a>
    </div>

    <nav class="nav-menu d-none d-lg-block">
      <ul class="nav-inner">
        <li class="active"><a href="/">Home</a></li>
        <li><a href="#about">Demo</a></li>
        <li><a href="#contact">Contact</a></li>
        <li><a href="/login">Login</a></li>

        </ul>
      </nav><!-- .nav-menu -->

    </div>
  </header><!-- End Header -->

  <main id="main">

```

<!-- ===== About Us Section ===== -->

<section id="about" class="about">

<div class="container">

<div class="section-title" data-aos="fade-up">

<h2>Care to be taken</h2>

</div>

<div class="row">

<div class="col-lg-6" data-aos="fade-right">

<iframe width="560" height="315"

src="https://www.youtube.com/embed/42NH2kDdhts?controls=0" frameborder="0"

allow="accelerometer; autoplay; encrypted-media; gyroscope; picture-in-picture"

allowfullscreen></iframe>

</div>

<div class="col-lg-6" data-aos="fade-left">

<iframe width="560" height="315"

src="https://www.youtube.com/embed/3HX41vym40o?controls=0" frameborder="0"

allow="accelerometer; autoplay; encrypted-media; gyroscope; picture-in-picture"

allowfullscreen></iframe>

</div>

</div>

</div>

</section><!-- End About Us Section -->

<!-- ===== Testimonials Section ===== -->

<section id="testimonials" class="testimonials">

<div class="container" data-aos="zoom-in">

<div class="quote-icon">

<i class="bx bxs-quote-right"></i>

</div>

<div class="owl-carousel testimonials-carousel">

<div class="testimonial-item">

<p>

There's always hope beyond what you see.

</p>

</div>


```
<div class="testimonial-item">
  <p>
    Difficult roads can lead to beautiful destinations.
  </p>
</div>

<div class="testimonial-item">
  <p>
    Cancer is like a teeter-totter. Sometimes you gotta go down to go back up.
  </p>
</div>

<div class="testimonial-item">
  <p>
    Don't pass up the cherry pie.
  </p>
</div>

<div class="testimonial-item">
  <p>
    Being positive is the best medicine you can take.
  </p>
</div>
</div>

</div>

</div>
</section><!-- End Testimonials Section -->
```

```
<!-- ===== Contact Section ===== -->
<section id="contact" class="contact section-bg">
  <div class="container">

    <div class="section-title">
      <h2>Contact</h2>
    </div>
```

```
<div class="row">
```

```
<div class="col-lg-4">
```

```
<div class="info d-flex flex-column justify-content-center" data-aos="fade-right">
```

```
<div class="address">
```

```
<i class="icofont-google-map"></i>
```

```
<h4>Location:</h4>
```

```
<p>MCET,<br>Pollachi, 642003</p>
```

```
</div>
```

```
<div class="email">
```

```
<i class="icofont-envelope"></i>
```

```
<h4>Email:</h4>
```

```
<p>preethitom464@gmail.com</p>
```

```
</div>
```

```
<div class="phone">
```

```
<i class="icofont-phone"></i>
```

```
<h4>Call:</h4>
```

```
<p>+91 123456789</p>
```

```
</div>
```

```
</div>
```

```
</div>
```

```
<div class="col-lg-8 mt-5 mt-lg-0">
```

```
<form action="forms/contact.php" method="post" role="form" class="php-email-form" data-aos="fade-left">
```

```
<div class="form-row">
```

```
<div class="col-md-6 form-group">
```

```
<input type="text" name="name" class="form-control" id="name"
placeholder="Your Name" data-rule="minlen:4" data-msg="Please enter at least 4 chars"
/>
```

```
<div class="validate"></div>
```

```
</div>
```

```
<div class="col-md-6 form-group">
```

```
<input type="email" class="form-control" name="email" id="email"
placeholder="Your Email" data-rule="email" data-msg="Please enter a valid email" />
```

```
<div class="validate"></div>
```

```
</div>
```

```
</div>
```

```
<div class="form-group">
```

```

        <input type="text" class="form-control" name="subject" id="subject"
placeholder="Subject" data-rule="minlen:4" data-msg="Please enter at least 8 chars of
subject" />
        <div class="validate"></div>
    </div>
    <div class="form-group">
        <textarea class="form-control" name="message" rows="5" data-rule="required"
data-msg="Please write something for us" placeholder="Message"></textarea>
        <div class="validate"></div>
    </div>
    <div class="mb-3">
        <div class="loading">Loading</div>
        <div class="error-message"></div>
        <div class="sent-message">Your message has been sent. Thank you!</div>
    </div>
    <div class="text-center"><button type="submit">Send Message</button></div>
</form>

</div>

</div>

</div>
</section><!-- End Contact Section -->

</main><!-- End #main -->

<!-- ===== Footer ===== -->
<footer id="footer">

    <div class="footer-top">

        <div class="container">

            <div class="row justify-content-center">
                <div class="col-lg-6">
                    <a href="#header" class="scrollto footer-logo"></a>
                    <h3>Chronic Kidney Disease Detection System</h3>
                </div>
            </div>
        </div>

        <div class="row footer-newsletter justify-content-center">
            <div class="col-lg-6">

```

```
        <form action="" method="post">
            <input type="email" name="email" placeholder="Enter your Email"><input
type="submit" value="Get in touch">
        </form>
    </div>
</div>
```

```
<div class="social-links">
    <a href="#" class="twitter"><i class="bx bxl-twitter"></i></a>
    <a href="#" class="facebook"><i class="bx bxl-facebook"></i></a>
    <a href="#" class="instagram"><i class="bx bxl-instagram"></i></a>
    <a href="#" class="google-plus"><i class="bx bxl-skype"></i></a>
    <a href="#" class="linkedin"><i class="bx bxl-linkedin"></i></a>
</div>
```

```
</div>
</div>
```

```
<div class="container footer-bottom clearfix">
    <div class="copyright">
        &copy; Copyright <strong><span>CKD</span></strong>. All Rights Reserved
    </div>
</div>
</footer><!-- End Footer -->
```

```
<a href="#" class="back-to-top"><i class="icofont-simple-up"></i></a>
```

```
<!-- Vendor JS Files -->
<script src="{{url_for('static',filename='vendor/jquery/jquery.min.js')}}"></script>
<script
src="{{url_for('static',filename='vendor/bootstrap/js/bootstrap.bundle.min.js')}}"></scrip
t>
<script
src="{{url_for('static',filename='vendor/jquery.easing/jquery.easing.min.js')}}"></script>
<script src="{{url_for('static',filename='vendor/php-email-form/validate.js')}}"></script>
<script src="{{url_for('static',filename='vendor/jquery-
sticky/jquery.sticky.js')}}"></script>
<script src="{{url_for('static',filename='vendor/venobox/venobox.min.js')}}"></script>
<script src="{{url_for('static',filename='vendor/isotope-
layout/isotope.pkgd.min.js')}}"></script>
<script
src="{{url_for('static',filename='vendor/owl.carousel/owl.carousel.min.js')}}"></script>
```

```
<script src="{{url_for('static',filename='vendor/aos/aos.js')}}"></script>
```

```
<!-- Template Main JS File -->  
<script src="{{url_for('static',filename='js/main.js')}}"></script>  
</body>  
</html>
```

server.py:

```
from flask import Flask, request, render_template, flash, redirect, session, abort  
from models import Model  
from writeCsv import write_to_csv  
from datetime import datetime  
import os  
import pandas as pd
```

```
app = Flask(__name__)
```

```
@app.route('/')  
def root():  
    return render_template('index.html')
```

```
@app.route('/login', methods=['POST'])  
def do_admin_login():  
    if request.form['password'] == 'user1' and request.form['username'] == 'user1':  
        session['logged_in'] = True  
        return render_template('index.html')  
    elif request.form['password'] == 'admin' and request.form['username'] == 'admin':  
        session['logged_in'] = True  
        return displayrecords()  
    else :  
        return render_template('loginerror.html')
```

```
@app.route('/displayrecords', methods=['GET'])  
def displayrecords():  
    df = pd.read_csv('dataset/records.csv')  
    return render_template('displayrecords.html', tables=[df.to_html(classes='data',  
header="true")])
```

```
@app.route('/login', methods=['GET'])  
def login():
```

```

return render_template('login.html')

@app.route("/logout")
def logout():
    session['logged_in'] = False
    return root()

@app.route('/predict', methods=["POST"])
def predict():
    age = int(request.form['age'])
    bp = int(request.form['bp'])
    sugar = int(request.form['sugar'])
    pc = int(request.form['pc'])
    pcc = int(request.form['pcc'])
    sodium = int(request.form['sodium'])
    hemo = float(request.form['hemo'])
    htn = int(request.form['htn'])
    db = int(request.form['db'])

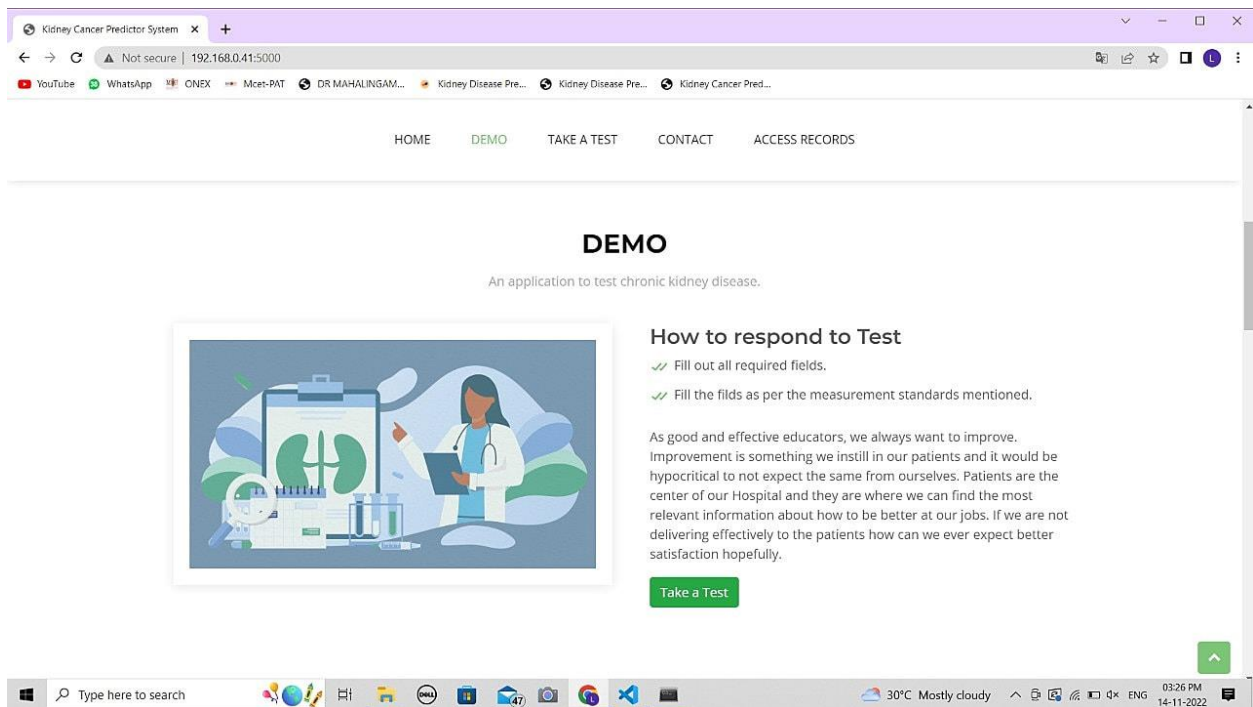
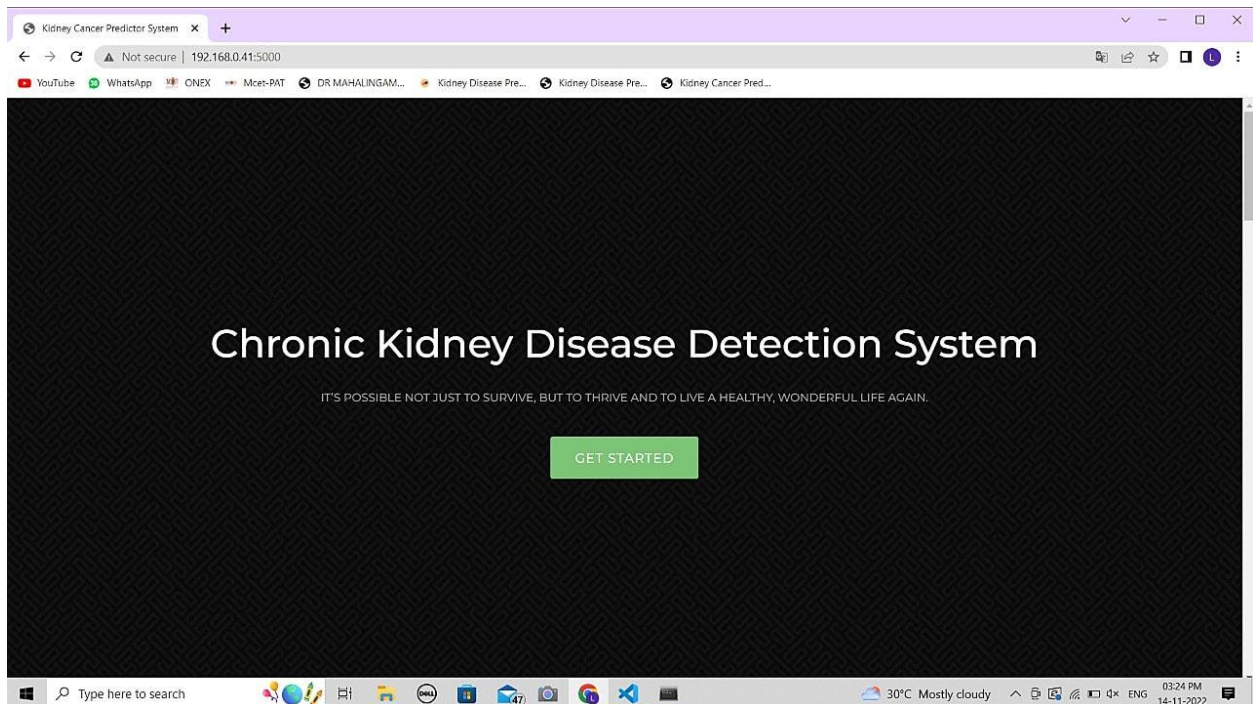
    values = [age, bp, sugar, pc, pcc, sodium, hemo, htn,db]
    print(values)
    model = Model()
    classifier = model.randomforest_classifier()
    prediction = classifier.predict([values])
    print(f"Kidney disease = {prediction[0]}")

    time = datetime.now().strftime("%m/%d/%Y (%H:%M:%S)")
    write_to_csv(time,age, bp, sugar, pc, pcc, sodium, hemo, htn,db,prediction[0])
    return render_template("result.html", result=prediction[0])

app.secret_key = os.urandom(12)
app.run(port=5000, host='0.0.0.0', debug=True)

```

SCREENSHOTS:



Kidney Cancer Predictor System

Not secure | 192.168.0.41:5000/#services

YouTubeWhatsAppONEXMcet-PATDR MAHALINGAM...Kidney Disease Pre...Kidney Disease Pre...Kidney Cancer Pred...

HOMEDEMO**TAKE A TEST**CONTACTACCESS RECORDS

TAKE A TEST

We care for you

Age

Sodium(mEq/L)

Blood Pressure

Hemoglobin(gms)

Sugar(nominal)

Hypertension

Chronic Kidney Disease Detection

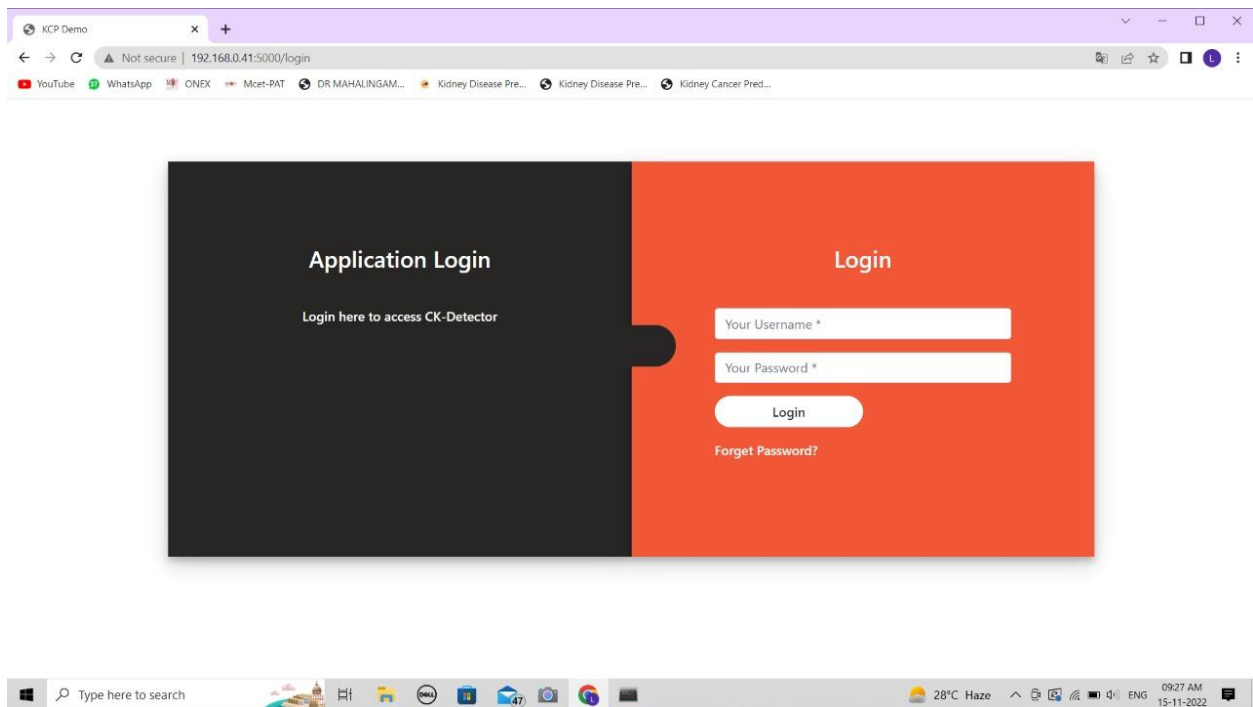
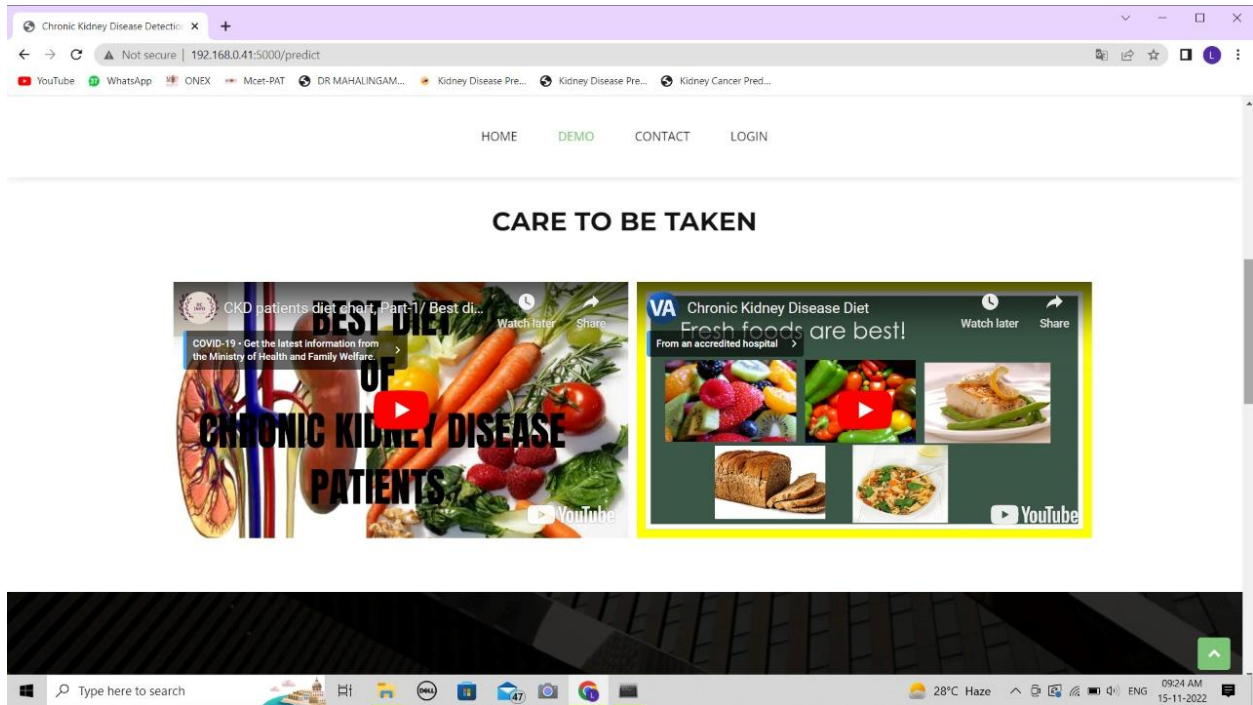
Not secure | 192.168.0.41:5000/predict

YouTubeWhatsAppONEXMcet-PATDR MAHALINGAM...Kidney Disease Pre...Kidney Disease Pre...Kidney Cancer Pred...

You have sever chronic kidney disease.

IT'S POSSIBLE NOT JUST TO SURVIVE, BUT TO THRIVE AND TO LIVE A HEALTHY, WONDERFUL LIFE AGAIN.

EXPLORE



time	age	bloodPressure	sugar	pusCell	pusCell	Clumps	sodium	hemoglobin	hypertension	diabetes	Mellitus	result
0	04/26/2020 (11:52:15)	20	85	0	1	0	15	22.0	0	0	0	1
1	04/26/2020 (11:57:47)	50	120	2	0	1	18	25.0	1	1	0	0
2	04/26/2020 (13:36:40)	20	124	3	0	0	15	21.0	1	0	0	0
3	04/26/2020 (13:40:58)	20	124	3	0	0	15	21.0	1	0	0	0
4	05/01/2020 (22:08:37)	22	120	0	1	0	20	22.0	0	0	0	0
5	05/01/2020 (22:13:43)	37	60	1	1	0	135	16.0	0	0	0	1
6	05/31/2020 (21:00:43)	22	90	1	0	0	32	14.0	0	0	0	0
7	05/31/2020 (21:02:16)	22	90	1	0	1	30	17.0	1	1	0	0
8	05/31/2020 (21:05:02)	50	80	1	1	0	135	12.0	0	0	0	0
9	06/01/2020 (20:02:02)	23	120	1	0	1	45	12.0	1	1	0	0
10	06/01/2020 (20:43:43)	52	80	0	1	0	135	15.0	0	0	0	1
11	06/01/2020 (20:44:42)	73	60	0	1	0	135	13.0	0	0	0	1
12	06/01/2020 (20:48:21)	69	80	0	1	0	132	12.0	1	0	0	0
13	06/01/2020 (20:50:40)	73	60	0	1	0	135	13.0	0	0	0	1
14	06/01/2020 (20:51:20)	52	80	0	1	0	135	15.0	0	0	0	1
15	06/01/2020 (20:52:02)	69	80	0	1	0	132	12.0	1	0	0	0
16	06/01/2020 (21:44:38)	73	60	0	1	0	135	13.0	0	0	0	1
17	06/01/2020 (21:46:41)	69	80	0	1	0	132	12.0	1	0	0	0
18	10/24/2020 (20:17:07)	23	23	1	1	0	34	34.0	0	0	0	0
19	11/10/2022 (11:44:04)	20	142	2	1	0	135	13.0	0	0	0	0
20	11/10/2022 (11:45:54)	20	142	2	1	0	135	13.0	0	0	0	0
21	11/10/2022 (11:48:02)	20	142	2	1	0	135	13.0	0	0	0	0
22	11/10/2022 (11:51:52)	25	45	2	1	0	132	13.0	0	0	0	0
23	11/14/2022 (09:39:06)	21	45	3	1	0	6	13.0	0	0	0	0
24	11/14/2022 (09:46:00)	21	45	3	1	0	6	13.0	0	0	0	0
25	11/14/2022 (09:46:35)	21	45	3	1	0	6	13.0	0	0	0	0
26	11/14/2022 (09:47:55)	21	45	3	1	0	6	13.0	0	0	0	0
27	11/14/2022 (09:50:14)	21	45	3	1	0	6	13.0	0	0	0	0
28	11/14/2022 (09:51:01)	21	45	3	1	0	6	13.0	0	0	0	0
29	11/14/2022 (09:51:24)	21	45	3	1	0	6	13.0	0	0	0	0
30	11/14/2022 (09:51:43)	21	45	3	1	0	6	13.0	0	0	0	0
31	11/14/2022 (09:52:29)	21	45	3	1	0	6	13.0	0	0	0	0
32	11/14/2022 (10:19:17)	25	45	1	1	1	3	13.0	1	1	0	0

Kidney Cancer Predictor System

(38) WhatsApp

IBM

[HOME](#)
[DEMO](#)
[TAKE A TEST](#)
[CONTACT](#)
[ACCESS RECORDS](#)

Age

25

Blood Pressure

45

Sugar(nominal)

2

Pus Cell

Normal

Sodium(mEq/L)

135

Hemoglobin(gms)

11

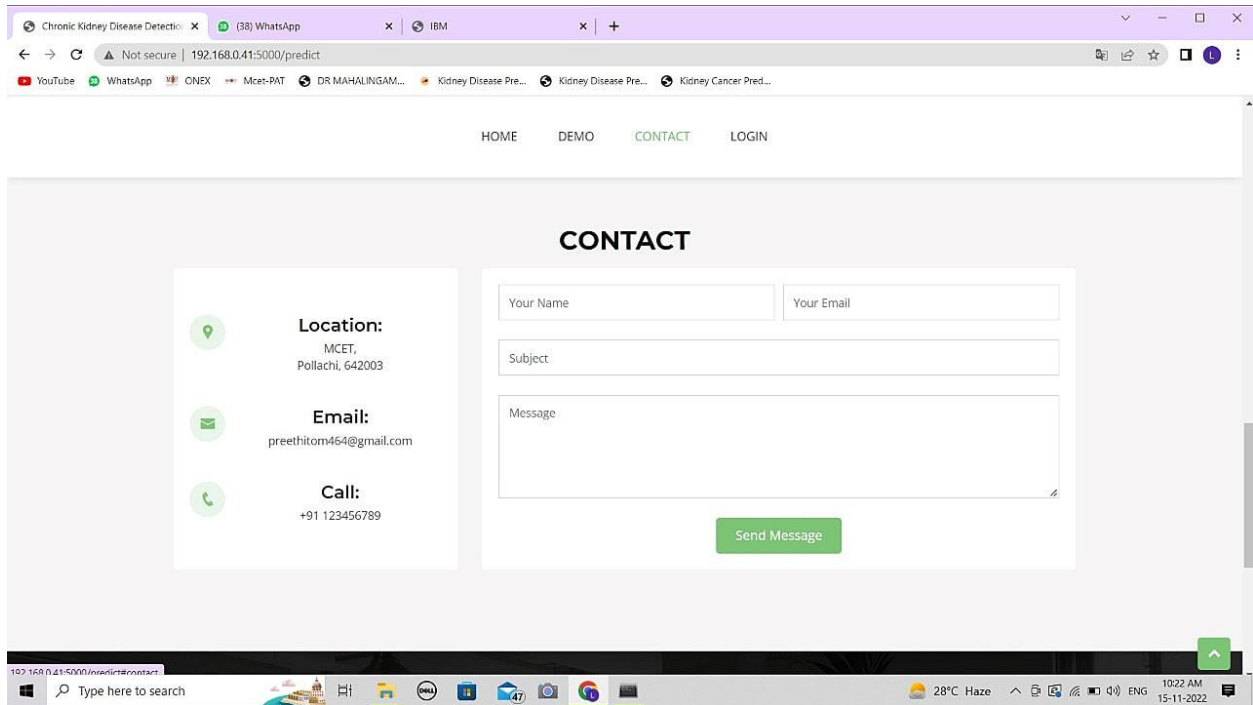
Hypertension

No

Diabetes Mellitus

No

Get Results



GITHUB AND DEMOLINK:

Github link: IBM-EPBL/IBM-Project-2581-1658475524

Demo link:

https://drive.google.com/file/d/1rI1L4CzJMNKymNG_8LCIGNJWpMoyOc-Z/view?usp=share_link