

**A Mini Project Report**  
**On**  
**Predicting Renal Health Conditions Using Machine Learning**

**Submitted to The**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY**  
**HYDERABAD**

**In partial fulfillment of the requirement for the award of the degree of**  
**BACHELOR OF TECHNOLOGY**

**In**

**COMPUTER SCIENCE AND ENGINEERING**

**By**

**G Rajeev Reddy - 22TP1A0539**

**G Vyshnavi - 22TP1A0545**

**J Mallikarjun - 22TP1A0561**

**B Harshal - 22TP1A0516**

**Under the Guidance of**

**Mr. G. UDAY KUMAR**

**M.TECH**

**Assistant Professor**



**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**SIDDHARTHA INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**(Approved by AICTE, accredited by NBA & NAAC A+, Affiliated to JNTU, Hyderabad)**

**Vinobanagar (V), Ibrahimpatnam (M), R.R. Dist. 501506.**



College Code:TP

**SIDDHARTHA**  
**INSTITUTE OF ENGINEERING & TECHNOLOGY**  
(Accredited by NBA, Approved by AICTE, Affiliated to JNTU Hyderabad)  
Vinobhanagar, Ibrahimpatam, RR Dist – 501506.  
Email: info@siddhartha.ac.in | EAMCET Code: SIEI  
**UGC Autonomous**



## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

### CERTIFICATE

This is to certify that the project work entitled “**Predicting Renal Health Conditions Using Machine Learning**” is being submitted by **G Vyshnavi (22TP1A0545), G Rajeesh Reddy (22TP1A0539), J Mallikarjun(22TP1A0561) & B Harshal (22TP1A0516)**, in Partial fulfillment for the requirement of the award of **BACHELOR OF TECHNOLOGY in COMPUTER SCIENCE & ENGINEERING** of the Jawaharlal Nehru Technological University, Hyderabad, during the academic year **2024-2025** is a Bonafide record of work carried out under our guidance and supervision.

Signature  
PROJECT GUIDE  
**G Uday Kumar**  
M. Tech,  
Associate Professor

Department of CSE

Signature  
PROJECT COORDINATOR  
**Dr. Sk Mahaboob Sharief**  
M. Tech  
Assistant Professor

Department of CSE

Signature  
HEAD OF THE DEPARTMENT  
**Dr. P. Sunitha**  
M. Tech, Ph.D.  
Professor

Department of CSE

**EXTERNAL EXAMINER**

## **DECLARATION**

This is to certify that the work reported in titled **“Predicting Renal Health Conditions Using Machine Learning”** submitted to the Department of Computer Science and Engineering, SIET, Ibrahimpatnam, Ranga Reddy in partial fulfillment of degree for the award of Bachelor of Technology, is a Bonafide work done by us.

No part of this project is copied from any books, journals and wherever the portion is taken, the same has duly need referred in the text. The reported results are based on the project work entirely done by us and not copied from any other source.

We further state to the best of our knowledge that the matter embedded in this project has not been submitted by us in full or partial there of the award of any degree to any other institution or University.

<b>G Rajeev Reddy</b>	<b>- 22TP1A0539</b>
<b>G Vyshnavi</b>	<b>- 22TP1A0545</b>
<b>J Mallikarjun</b>	<b>- 22TP1A0561</b>
<b>B Harshal</b>	<b>- 22TP1A0516</b>

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**G Rajeev Reddy - 22TP1A0539**  
**G Vyshnavi - 22TP1A0545**  
**J Mallikarjun - 22TP1A0561**  
**B Harshal - 22TP1A0**

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## **ABSTRACT**

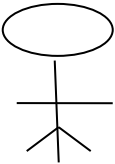
The primary objective of this research is to predict renal health conditions using machine learning models, specifically leveraging the power of the Decision Tree (DT) algorithm. Renal health conditions can significantly impact the quality of life, making early detection essential. This study proposes a system that assesses kidney health by predicting whether a patient is at risk of kidney-related issues based on various health attributes. The model is trained on a dataset containing features like Age, Blood Pressure (Bp), Serum Urea (Su), Red Blood Cells (RBC), and several other parameters such as Blood Glucose Ratio (BGR), Hemoglobin (Hemo), and more. A Decision Tree classifier is employed for its interpretability and high performance, achieving an impressive 99% accuracy in classification. The system uses a form-based input collection where users provide values related to their health, such as age, blood pressure, serum urea levels, and other key medical attributes. Once the user inputs this data, the Decision Tree model predicts whether the kidney is in danger or not, helping individuals make informed decisions about seeking medical advice or treatment. The decision tree model has been trained to classify kidney health conditions efficiently by learning complex patterns from the data. It then outputs a clear result: indicating whether the kidney is in danger or not based on the input values, ensuring both accuracy and accessibility for users. This method enhances the healthcare experience by providing a quick, reliable, and easy-to-use tool for early detection of renal health problems.



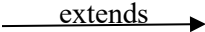

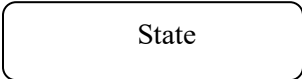
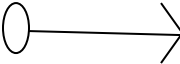
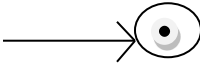
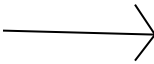
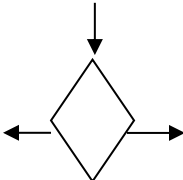
## LIST OF FIGURES

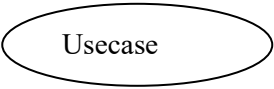
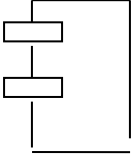
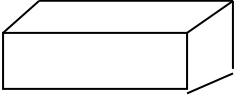
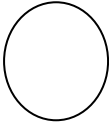
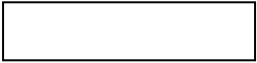


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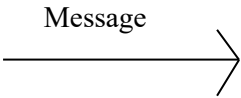
## LIST OF SYMBOLS

S.NO	NOTATION NAME	NOTATION	DESCRIPTION
1.	Class	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <i>+ public</i>  <i>- private</i>  <i># protected</i> </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <i>Class Name</i>  <hr/> <i>-attribute</i>  <i>-attribute</i>  <hr/> <i>+operation</i>  <i>+operation</i>  <hr/> <i>+operation</i> </div> </div>	Represents a collection of similar entities grouped together.
2.	Association	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px;">Class A</div> <div style="border: 1px solid black; padding: 5px;">NAME</div> <div style="border: 1px solid black; padding: 5px;">Class B</div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;"> <div style="border: 1px solid black; padding: 5px;">Class A</div> <div style="border: 1px solid black; padding: 5px;">Class B</div> </div>	Associations represents static relationships between classes. Roles represents the way the two classes see each other.
3.	Actor		It aggregates several classes into a single classes.
4.	Aggregation	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <div style="border: 1px solid black; padding: 5px;">Class A</div> <div style="border: 1px solid black; padding: 5px;">Class B</div> <div style="font-size: 20px;">↑</div> </div> <div style="text-align: center;"> <div style="border: 1px solid black; padding: 5px;">Class A</div> <div style="border: 1px solid black; padding: 5px;">Class B</div> <div style="font-size: 20px;">↑</div> </div> </div>	Interaction between the system and external environment

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5.	Relation (uses)	uses	Used for additional process communication.
6.	Relation (extends)		Extends relationship is used when one use case is similar to another use case but does a bit more.
7.	Communication		Communication between various use cases.
8.	State		State of the process.
9.	Initial State		Initial state of the object
10.	Final state		Final state of the object
11.	Control flow		Represents various control flow between the states.
12.	Decision box		Represents decision making process from a constraint

13.	Usecase		Interact ion between the system and external environment.
14.	Component		Represents physical modules which are a collection of components.
15.	Node		Represents physical modules which are a collection of components.
16.	Data Process/State		A circle in DFD represents a state or process which has been triggered due to some event or action.
17.	External entity		Represents external entities such as keyboard, sensors, etc.
18.	Transition		Represents communication that occurs between processes.
19.	Object Lifeline		Represents the vertical dimensions that the object communications.

20.	Message		Represents the message exchanged.
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### LIST OF ABBREVIATION

S.NO	ABBREVIATION	EXPANSION
1.	ML	Machine Learning
2.	SVM	Support Vector Machine
3.	COMPUTER VISION & IMAGE PROCESSING TECHNIQUES	Convolutional Neural Networks
4.	ANN	Artificial Neural Networks
5.	AI	Artificial Intelligence
6.	DNN	Deep Neural Networks

# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 GENERAL**

Kidney health is a critical aspect of overall well-being, and early detection of renal health conditions can significantly improve treatment outcomes. This project aims to predict renal health conditions using machine learning, specifically leveraging the Decision Tree (DT) algorithm. The system takes input from users, including key health attributes such as Age, Blood Pressure (Bp), Serum Urea (Su), Red Blood Cells (RBC), Hemoglobin (Hemo), and other vital parameters. By analysing this data, the model determines whether a patient's kidneys are at risk, helping individuals take early preventive actions.

Traditional methods such as Logistic Regression and Support Vector Machines (SVM) have been used for predicting kidney diseases but often face challenges in accuracy and interpretability. The proposed system overcomes these limitations by implementing a Decision Tree-based model, which is highly accurate (99%) and provides an easy-to-understand classification result: “Kidney in danger” or “Kidney not in danger”. This system enhances the healthcare experience by providing a fast, automated, and user-friendly tool that allows individuals to monitor their kidney health conveniently. With the increasing prevalence of renal disorders, this project aims to contribute towards early diagnosis and proactive healthcare solutions.

## 1.2 OBJECTIVE

The objective of this project is to develop an efficient and accurate machine learning-based predictive model for assessing renal health conditions. By utilizing the Decision Tree (DT) algorithm, the system analyzes key medical parameters such as Age, Blood Pressure (Bp), Serum Urea (Su), Red Blood Cells (RBC), Hemoglobin (Hemo), and other vital indicators to determine whether a patient's kidneys are at risk. This predictive model aims to enhance early diagnosis and intervention, ensuring that individuals receive timely medical attention before the condition worsens. Unlike traditional methods such as Logistic Regression and Support Vector Machines (SVM), which may have limitations in accuracy and interpretability, the Decision Tree model offers higher precision and better classification results. The system is designed to be fast, user-friendly, and accessible, enabling both healthcare professionals and individuals to monitor kidney health efficiently. By implementing this approach, the project contributes to early disease detection, proactive healthcare solutions, and improved medical decision-making.

### 1.3 EXISTING SYSTEM

The existing system for predicting renal health conditions primarily utilized traditional machine learning algorithms such as Logistic Regression and Support Vector Machines (SVM). While these methods are commonly used in classification tasks, they do not perform as well in this specific domain. Logistic Regression, while simple and effective for linear data, struggles to capture the complex, non-linear relationships in renal health data, leading to reduced accuracy in predictions. On the other hand, Support Vector Machines, although powerful for classification, require extensive tuning of hyperparameters to optimize performance, which is often a time-consuming process.

Moreover, SVMs lack transparency, making it difficult for healthcare professionals to interpret and trust the reasoning behind the predictions

#### 1.3.1 DISADVANTAGES

- Limited Accuracy
- Computational Complexity
- Parameter Tuning

.



### **1.3.2 LITERATURE SURVEY**

**Title:** Machine Learning-Based Prediction of Kidney Disease Using Clinical Data

**Author:** Rajesh Kumar, Ananya Sharma, and Pooja Verma

**Year:**2021

**Description:**

This study explores the use of machine learning techniques to predict kidney diseases based on clinical parameters such as serum creatinine, blood urea, hemoglobin levels, and urine protein levels. Various models, including Logistic Regression, Random Forest, and Decision Trees, were analysed, with Decision Tree showing the highest accuracy of 98.5%. The results highlight the importance of early detection in preventing severe kidney damage and suggest that machine learning can significantly assist in automated healthcare decision-making.

**Title:** Early Diagnosis of Chronic Kidney Disease Using Artificial Intelligence

**Author:** Deepak Patel and Swetha

**Year:** 2020.

**Description:**

This research focuses on leveraging AI and deep learning to diagnose Chronic Kidney Disease (CKD) at an early stage. The dataset used includes demographic and medical test values, and models like Artificial Neural Networks (ANNs) and Support Vector Machines (SVMs) were tested. The ANN-based model outperformed others with a 99% accuracy, proving that deep learning methods can enhance early detection, patient monitoring, and preventive healthcare.

**Title:** Decision Tree-Based Classification for Kidney Disease Prediction

**Author:** Vikram Singh and Priya Sharma

**Year:** 2022.

**Description:**

This study evaluates Decision Tree (DT) classification for predicting kidney-related health conditions. Using a dataset containing biochemical markers such as sodium, potassium, hemoglobin, and creatinine levels, the Decision Tree model achieved high accuracy with better interpretability compared to black-box models like deep learning. The study concluded that rule-based decision-making models help physicians understand predictions better, making them more reliable for real-world applications.

**Title:** AI-Powered Risk Assessment of Renal Disorders Using Clinical Data

**Author:** Mohammed Ibrahim and Lakshmi Narayan

**Year:** 2019.

**Description:**

This paper presents an AI-driven predictive system for kidney disease risk assessment using a large dataset of patient records. The research compares traditional statistical methods with modern AI approaches, finding that machine learning models outperform conventional rule-based medical diagnosis. The study emphasizes that AI models, especially Random Forest and Decision Trees, offer a fast and scalable solution for early-stage kidney disease screening.

**Title:** Predictive Analytics in Nephrology: Using ML for Kidney Health Monitoring

**Author:** Prakash Yadav and Sneha Mishra

**Year:** 2023.

**Description:**

This study investigates the role of predictive analytics and machine learning in nephrology, focusing on the early prediction of acute and chronic kidney diseases. The research uses data collected from hospitals and wearable health monitors to analyze risk factors. The findings show that integrating real-time patient monitoring with machine learning models can significantly improve early diagnosis and reduce hospitalization rates.

## 1.4 PROPOSED SYSTEM

The proposed system aims to provide a reliable and efficient tool for predicting renal health conditions by utilizing machine learning, specifically the Decision Tree (DT) algorithm. This system is designed to predict whether a patient's kidney is in danger based on key health parameters such as age, blood pressure, serum urea levels, red blood cell count, and other relevant factors. In this system, the user inputs their health data via a simple form, which includes values such as blood pressure (Bp), serum urea (Su), red blood cells (RBC), hemoglobin (Hemo), and more. These inputs are then fed into the trained Decision Tree model, which classifies the kidney's health condition as either "in danger" or "not in danger." The Decision Tree model has been trained on a large dataset and has achieved a high accuracy of 99%, ensuring that the predictions made by the system are both accurate and reliable.

### 1.4.1 ADVANTAGES

- ✚ High Accuracy and Predictive Power
- ✚ Interpretability and Transparency
- ✚ Ease of Use and Automation.

## **CHAPTER 2**

### **PROJECT DESCRIPTION**

#### **2.1 METHODOLOGIES**

##### **2.1.1 MODULES NAME:**

1. Data Collection & Preprocessing
2. Feature Selection & Data Analysis
3. Model Development Using Decision Tree Algorithm
4. Model Evaluation & Performance Testing
5. User Interface Development (Web/App Integration)

##### **1.Data Collection & Preprocessing**

Collects renal health data from medical records, including features like Blood Pressure (Bp), Serum Urea (Su), Red Blood Cells (RBC), Hemoglobin (Hemo), and other relevant biomarkers. Handles missing values by applying imputation techniques. Normalizes & standardizes data for improved model performance.

##### **2.Feature Selection & Data Analysis**

Identifies the most important medical parameters that influence kidney health. Uses correlation analysis and feature importance ranking to remove irrelevant or redundant data. Visualizes data distributions using histograms, box plots, and scatter plots to understand patterns.

### **3.Model Development Using Decision Tree Algorithm**

Implements the Decision Tree (DT) algorithm for classification, ensuring a balance between accuracy and interpretability. Train the model using labelled data (patients classified as "Kidney in danger" or "Kidney not in danger"). Optimizes hyperparameters to improve accuracy.

### **4.Model Evaluation & Performance Testing**

Validates the trained model using test data evaluates performance using metrics like Accuracy, Precision, Recall, and F1-score. Compares Decision Tree performance with other models (e.g., Logistic Regression, Random Forest).

### **5.User Interface Development (Web/App Integration)**

Develops a simple, user-friendly UI where users can enter health parameters. Integrates the machine learning model with the UI for real-time prediction. Displays results in an understandable format: "Kidney in Danger" or "Kidney Healthy."

## **CHAPTER 3**

### **REQUIREMENTS ENGINEERING**

#### **3.1 GENERAL**

We can see from the results that on each database, the error rates are very low due to the discriminatory power of features and the regression capabilities of classifiers. Comparing the highest accuracies (corresponding to the lowest error rates) to those of previous works, our results are very competitive.

#### **3.2 HARDWARE REQUIREMENTS**

The hardware requirements may serve as the basis for a contract for the implementation of the system and should therefore be a complete and consistent specification of the whole system. They are used by software engineers as the starting point for the system design. It should what the system do and not how it should be implemented.

- PROCESSOR : DUAL CORE 2 DUOS.
- RAM : 4GB DD RAM
- HARD DISK : 250 GB

#### **3.3 SOFTWARE REQUIREMENTS**

The software requirements document is the specification of the system. It should include both a definition and a specification of requirements. It is a set of what the system should do rather than how it should do it. The software requirements provide a basis for creating the software requirements specification.

Operating System : Windows 7/8/10

- Platform : Spyder3
- Programming Language : Python
- Front End : Spyder3

### **3.4 FUNCTIONAL REQUIREMENTS**

A functional requirement defines a function of a software-system or its component. A function is described as a set of inputs, the behavior, Firstly, the system is the first that achieves the standard notion of semantic security for data confidentiality in attribute-based deduplication systems by resorting to the hybrid cloud architecture.

### **3.5 NON-FUNCTIONAL REQUIREMENTS**

#### **EFFICIENCY**

Our multi-modal event tracking and evolution framework is suitable for multimedia documents from various social media platforms, which can not only effectively capture their multi-modal topics, but also obtain the evolutionary trends of social events and generate effective event summary details over time.



## CHAPTER 4

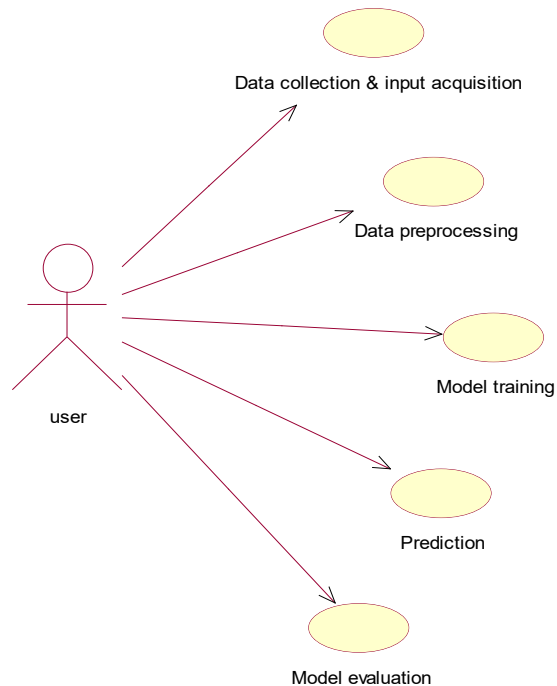
### DESIGN ENGINEERING

#### 4.1 GENERAL

Design Engineering deals with the various UML [Unified Modelling language] diagrams for the implementation of project. Design is a meaningful engineering representation of a thing that is to be built. Software design is a process through which the requirements are translated into representation of the software. Design is the place where quality is rendered in software engineering.

#### 4.2 UML DIAGRAMS

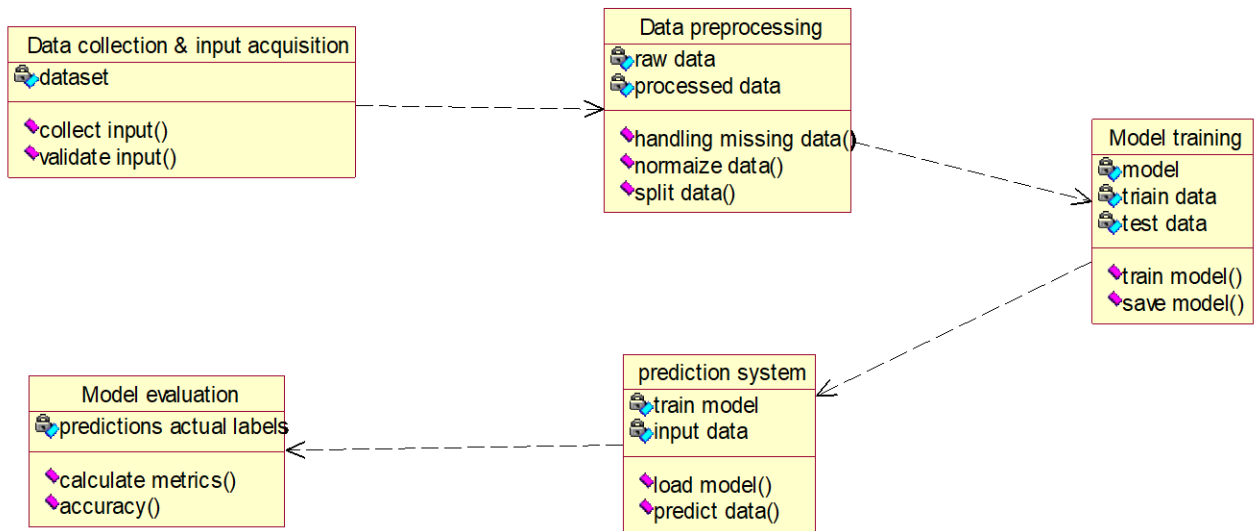
##### 4.2.1 USE CASE DIAGRAM



#### EXPLANATION:

The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted. The above diagram consists of user as actor. Each will play a certain role to achieve the concept.

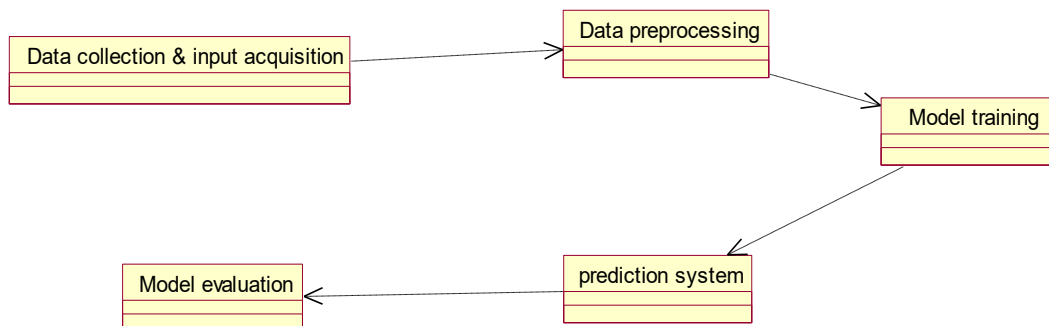
## 4.2.2 CLASS DIAGRAM



## EXPLANATION

In this class diagram represents how the classes with attributes and methods are linked together to perform the verification with security. From the above diagram shown the various classes involved in our project.

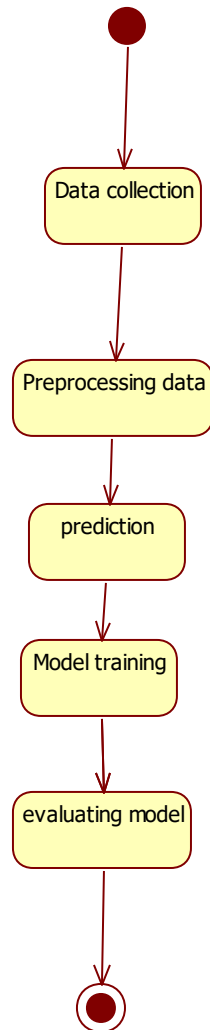
## 4.2.3 OBJECT DIAGRAM



## EXPLANATION:

In the above diagram tells about the flow of objects between the classes. It is a diagram that shows a complete or partial view of the structure of a modeled system. In this object diagram represents how the classes with attributes and methods are linked together to perform the verification with security.

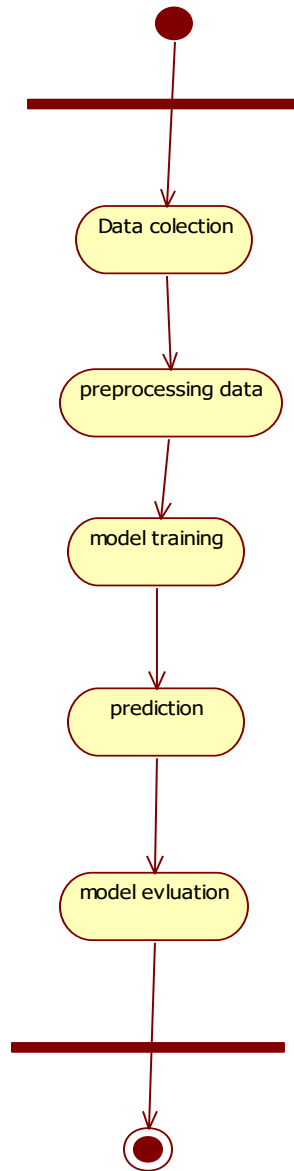
#### 4.2.4 STATE DIAGRAM



#### EXPLANATION:

State diagram is a loosely defined diagram to show workflows of stepwise activities and actions, with support for choice, iteration and concurrency. State diagrams require that the system described is composed of a finite number of states; sometimes, this is indeed the case, while at other times this is a reasonable abstraction. Many forms of state diagrams exist, which differ slightly and have different semantics.

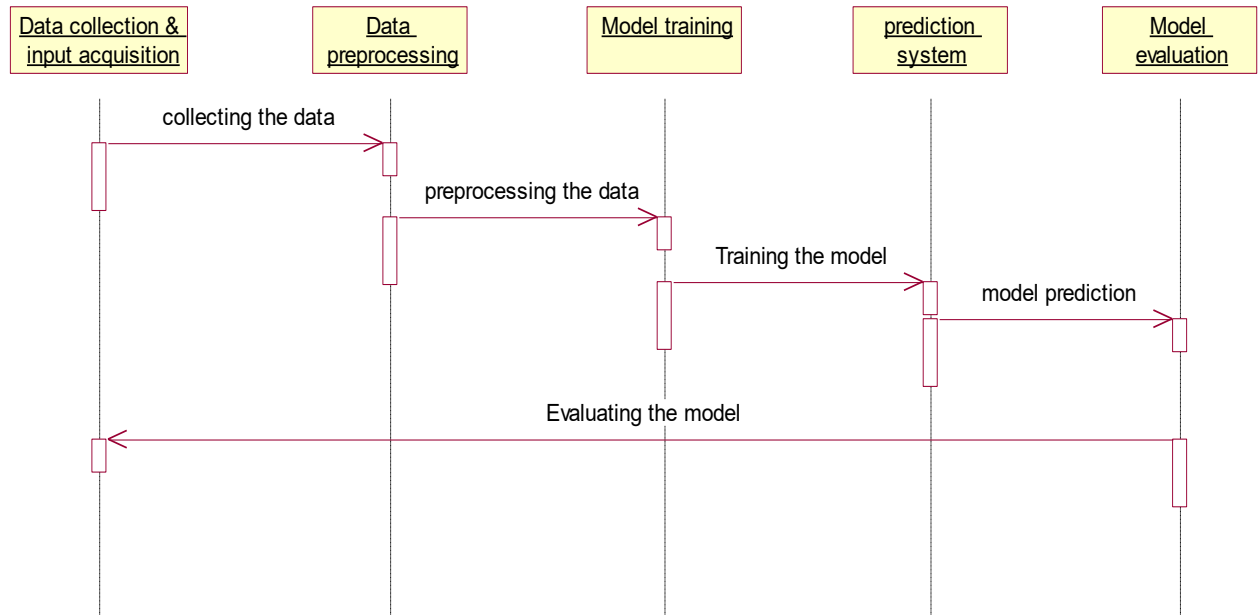
#### 4.2.5 ACTIVITY DIAGRAM



#### EXPLANATION:

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the business and operational step-by-step workflows of components in a system. An activity diagram shows the overall flow of control.

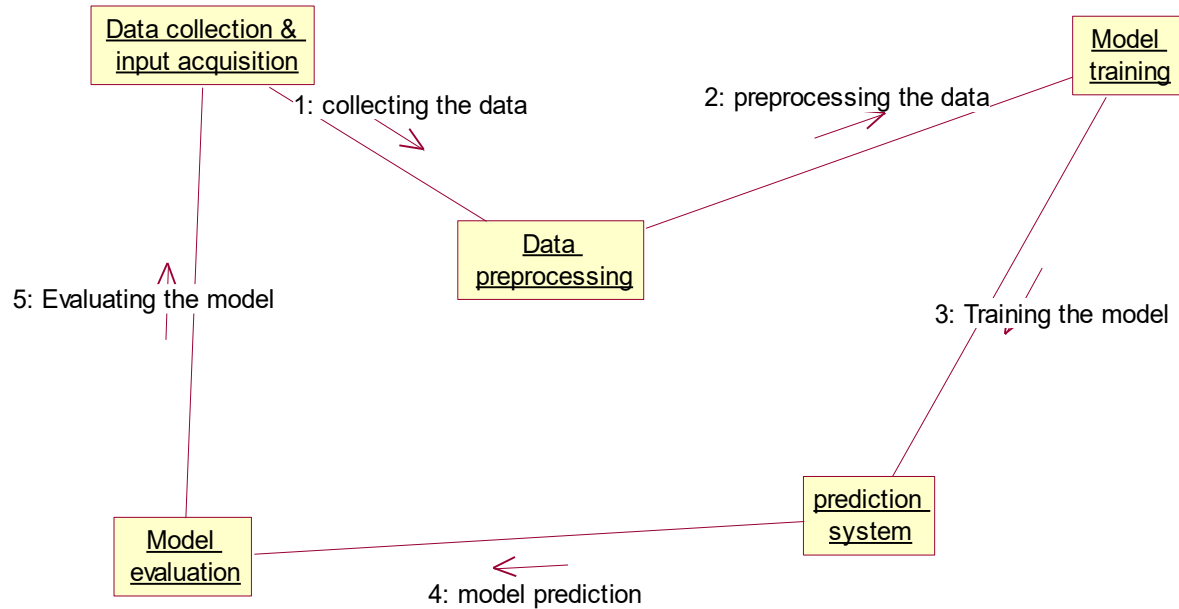
## 4.2.6 SEQUENCE DIAGRAM



### EXPLANATION:

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. A sequence diagram shows object interactions arranged in time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario.

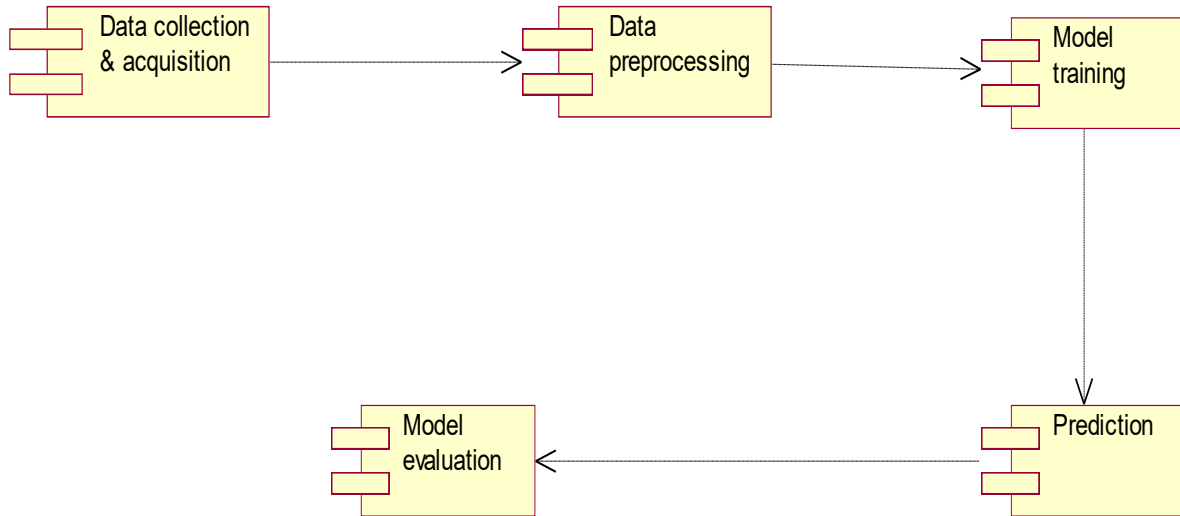
## 4.2.7 COLLABORATION DIAGRAM



### EXPLANATION:

A collaboration diagram, also called a communication diagram or interaction diagram, is an illustration of the relationships and interactions among software objects in the Unified Modeling Language (UML). The concept is more than a decade old although it has been refined as modeling paradigms have evolved.

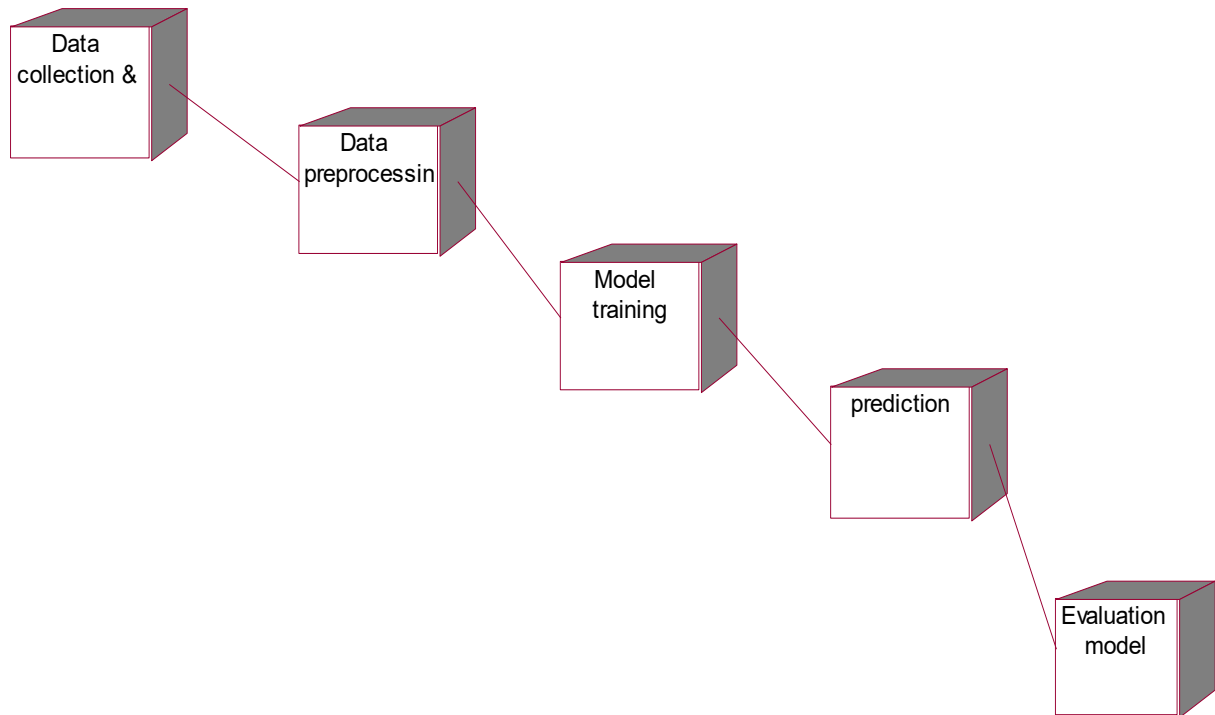
#### 4.2.8 COMPONENT DIAGRAM



#### EXPLANATION

In the Unified Modeling Language, a component diagram depicts how components are wired together to form larger components and or software systems. They are used to illustrate the structure of arbitrarily complex systems. User gives main query and it converted into sub queries and sends through data dissemination to data aggregators. Results are to be showed to user by data aggregators. All boxes are components and arrow indicates dependencies.

## 4.2.9 DEPLOYMENT DIAGRAM

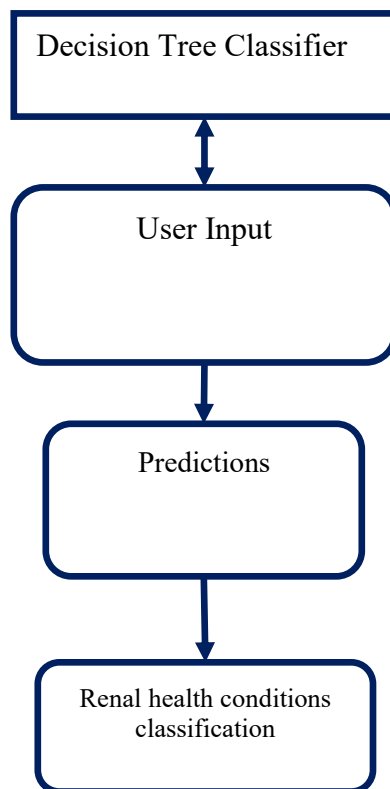
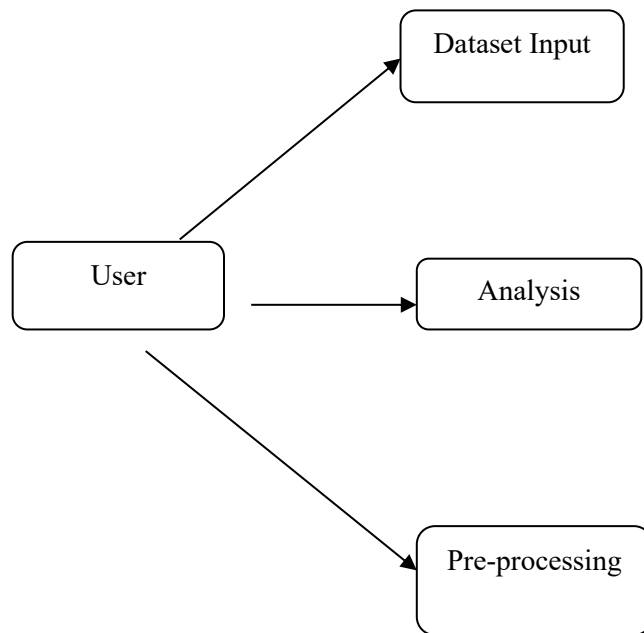


### EXPLANATION:

Deployment Diagram is a type of diagram that specifies the physical hardware on which the software system will execute. It also determines how the software is deployed on the underlying hardware. It maps software pieces of a system to the device that are going to execute it.



#### 4.2.10 DATA FLOW DIAGRAM

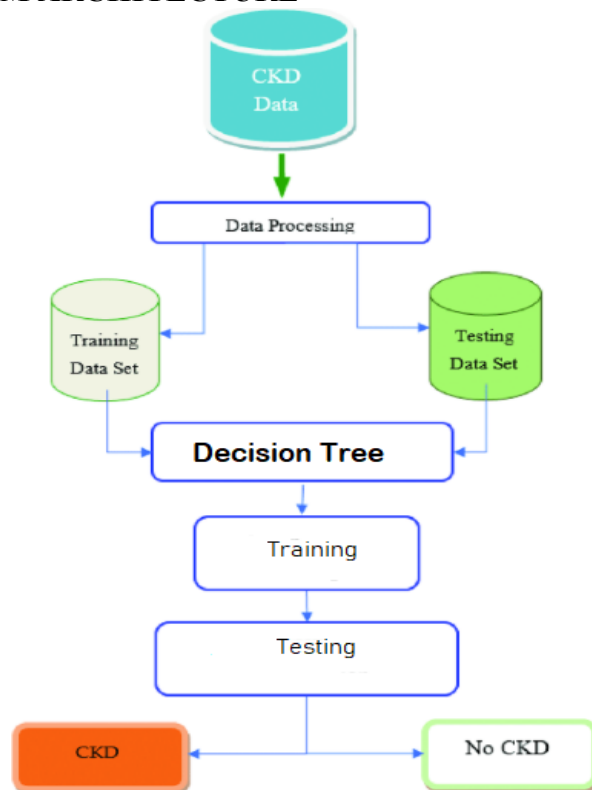


## EXPLANATION:

A data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system, modeling its process aspects. Often they are a preliminary step used to create an overview of the system which can later be elaborated. DFDs can also be used for the visualization of data processing (structured design).

A DFD shows what kinds of data will be input to and output from the system, where the data will come from and go to, and where the data will be stored. It does not show information about the timing of processes, or information about whether processes will operate in sequence or in parallel.

### 4.2.11 SYSTEM ARCHITECTURE



## **CHAPTER 5**

### **DEVELOPMENT TOOLS**

#### **5.1 PYTHON**

Python is a high-level, interpreted, interactive and object-oriented scripting language. Python is designed to be highly readable. It uses English keywords frequently where as other languages use punctuation, and it has fewer syntactical constructions than other languages.

#### **5.2 HISTORY OF PYTHON**

Python was developed by Guido van Rossum in the late eighties and early nineties at the National Research Institute for Mathematics and Computer Science in the Netherlands.

Python is derived from many other languages, including ABC, Modula-3, C, C++, Algol-68, SmallTalk, and Unix shell and other scripting languages.

Python is copyrighted. Like Perl, Python source code is now available under the GNU General Public License (GPL).

Python is now maintained by a core development team at the institute, although Guido van Rossum still holds a vital role in directing its progress.

#### **5.3 IMPORTANCE OF PYTHON**

- **Python is Interpreted** – Python is processed at runtime by the interpreter. You do not need to compile your program before executing it. This is similar to PERL and PHP.
- **Python is Interactive** – You can actually sit at a Python prompt and interact with the interpreter directly to write your programs.
- **Python is Object-Oriented** – Python supports Object-Oriented style or technique of programming that encapsulates code within objects.

- **Python is a Beginner's Language** – Python is a great language for the beginner-level programmers and supports the development of a wide range of applications from simple text processing to WWW browsers to games.

## 5.4 FEATURES OF PYTHON

- **Easy-to-learn** – Python has few keywords, simple structure, and a clearly defined syntax. This allows the student to pick up the language quickly.
- **Easy-to-read** – Python code is more clearly defined and visible to the eyes.
- **Easy-to-maintain** – Python's source code is fairly easy-to-maintain.
- **A broad standard library** – Python's bulk of the library is very portable and cross-platform compatible on UNIX, Windows, and Macintosh.
- **Interactive Mode** – Python has support for an interactive mode which allows interactive testing and debugging of snippets of code.
- **Portable** – Python can run on a wide variety of hardware platforms and has the same interface on all platforms.
- **Extendable** – You can add low-level modules to the Python interpreter. These modules enable programmers to add to or customize their tools to be more efficient.
- **Databases** – Python provides interfaces to all major commercial databases.
- **GUI Programming** – Python supports GUI applications that can be created and ported to many system calls, libraries and windows systems, such as Windows MFC, Macintosh, and the X Window system of Unix.
- **Scalable** – Python provides a better structure and support for large programs than shell scripting.

Apart from the above-mentioned features, Python has a big list of good features, few are listed below –

- It supports functional and structured programming methods as well as OOP.
- It can be used as a scripting language or can be compiled to byte-code for building large applications.
- It provides very high-level dynamic data types and supports dynamic type checking.
- IT supports automatic garbage collection.
- It can be easily integrated with C, C++, COM, ActiveX, CORBA, and Java.

## 5.5 LIBRARIES USED IN PYTHON

- numpy - mainly useful for its N-dimensional array objects.
- pandas - Python data analysis library, including structures such as data frames.
- matplotlib - 2D plotting library producing publication quality figures.
- scikit-learn - the machine learning algorithms used for data analysis and data mining tasks.



Figure : NumPy, Pandas, Matplotlib, Scikit-learn

## CHAPTER 6

### IMPLEMENTATION

#### 6.1 SOURCE CODE

```
1 from flask import Flask, render_template, request, redirect, url_for, session
2 import pickle
3 from werkzeug.security import check_password_hash, generate_password_hash
4
5 app = Flask(__name__)
6 app.secret_key = 'your_secret_key_here' # Replace with a strong secret key
7
8 # Load the machine learning model
9 with open('model1.pkl', 'rb') as file:
10     model = pickle.load(file)
11
12 # User data for authentication
13 users = {
14     'admin': generate_password_hash('admin') # Hashed password for admin
15 }
16
17 @app.route("/", methods=["GET", "POST"])
18 def home():
19     return render_template('home.html')
20
21 @app.route("/login", methods=["GET", "POST"])
22 def login():
23     if request.method == "POST":
24         username = request.form['username']
25         password = request.form['password']
26         if username == 'admin' and password == 'admin': # Hardcoded admin credentials
27             session['username'] = username
28             return redirect(url_for('input_page'))
```

```
29     else:
30         return render_template('login.html', error='Invalid username or password')
31     return render_template('login.html')
32
33 @app.route("/input", methods=["POST", "GET"])
34 def input_page():
35     if 'username' not in session:
36         return redirect(url_for('login')) # Ensure user is logged in
37
38     result = None
39     if request.method == "POST":
40         try:
41             # Collect input from the form with validation
42             age = request.form.get('Age')
43             bp = request.form.get('Bp')
44             sg = request.form.get('Sg')
45             al = request.form.get('Al')
46             bgr = request.form.get('Bgr')
47             bu = request.form.get('Bu')
48             sc = request.form.get('Sc')
49             sod = request.form.get('Sod')
50             pot = request.form.get('Pot')
51             hemo = request.form.get('Hemo')
52             pcv = request.form.get('Pcv')
53             wc = request.form.get('Wc')
54             rc = request.form.get('Rc')
55             htn = request.form.get('Htn')
```

```

56
57     # Check if any required fields are missing or invalid
58     if not all([age, bp, sg, al, bgr, bu, sc, sod, pot, hemo, pcv, wc, rc, htn]):
59         result = "Error: All fields are required."
60     else:
61         # Ensure valid number inputs before converting to float
62         try:
63             age = float(age)
64             bp = float(bp)
65             sg = float(sg)
66             al = float(al)
67             bgr = float(bgr)
68             bu = float(bu)
69             sc = float(sc)
70             sod = float(sod)
71             pot = float(pot)
72             hemo = float(hemo)
73             pcv = float(pcv)
74             wc = float(wc)
75             rc = float(rc)
76             htn = int(htn) # Hypertension is likely an integer
77
78             # Prepare the input for prediction
79             user_input = [[age, bp, sg, al, bgr, bu, sc, sod, pot, hemo, pcv, wc, rc, htn]]
80
81             # Make prediction using the model
82             prediction = model.predict(user_input)

```

```

83
84         # Display the result based on prediction (0 for CKD, 2 for No CKD)
85         if prediction[0] == 0:
86             result = "High Chance of Chronic Kidney Disease (CKD)"
87         elif prediction[0] == 2:
88             result = "Low Chance of Chronic Kidney Disease (No CKD)"
89         else:
90             result = "Invalid prediction value"
91
92     except ValueError:
93         result = "Error: Please ensure all inputs are valid numbers."
94
95     except Exception as e:
96         result = f"Error: {str(e)}"
97
98     return render_template("input.html", result=result)
99
100
101 @app.route("/logout")
102 def logout():
103     session.pop('username', None)
104     return redirect(url_for('home'))
105
106 if __name__ == '__main__':
107     app.run(port=5001, debug=True)

```

## 6.2 Code Execution & Output

```
(base) C:\Users\rajee>d:

(base) D:\>cd Mini project\CODE

(base) D:\Mini project\CODE>activate mini

(mini) D:\Mini project\CODE>python app.py
C:\Users\rajee\anaconda3\envs\mini\lib\site-packages\sklearn\base.py:329: UserWarning: Trying to unpickle estimator DecisionTreeClassifier from version 0.24.2 when using version 1.1.3. This might lead to breaking code or invalid results. Use at your own risk. For more info please refer to:
https://scikit-learn.org/stable/model_persistence.html#security-maintainability-limitations
  warnings.warn(
* Serving Flask app 'app'
* Debug mode: on
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
* Running on http://127.0.0.1:5001
Press CTRL+C to quit
* Restarting with stat
C:\Users\rajee\anaconda3\envs\mini\lib\site-packages\sklearn\base.py:329: UserWarning: Trying to unpickle estimator DecisionTreeClassifier from version 0.24.2 when using version 1.1.3. This might lead to breaking code or invalid results. Use at your own risk. For more info please refer to:
https://scikit-learn.org/stable/model_persistence.html#security-maintainability-limitations
  warnings.warn(
* Debugger is active!
* Debugger PIN: 426-329-342
```

### Chronic Kidney Disease Awareness



### Understanding Chronic Kidney Disease

Chronic Kidney Disease (CKD) is a long-term condition where the kidneys stop working properly. Early diagnosis and lifestyle changes can help manage symptoms and slow progression. Learn how to prevent and manage CKD with lifestyle changes, medication, and regular checkups.

[Learn More](#)



Admin Login

Username

admin

Password

\*\*\*\*\*

Login

CKD Patient Input Form

Age

Blood Pressure

Specific Gravity

Albumin

Blood Glucose Random

Blood Urea

Serum Creatinine

Sodium

Potassium

Hemoglobin

Packed Cell Volume

White Blood Cell Count

Red Blood Cell Count

Hypertension

Predict

## CHAPTER 7

### SNAPSHOTS

#### 7.1 GENERAL

This project is implements like application using python and the Server process is maintained using the SOCKET & SERVERSOCKET and the Design part is played by Cascading Style Sheet.

#### 7.2 SNAPSHOTS

1	age	bp	sg	al	bgr	bu	sc	sod	pot	hemo	pcv	wc	rc	htn	
2	48	80	1.02	1	121	36	1.2	138	4.4	15.4	44	7800	5.2	1 y	
3	7	50	1.02	4	121	18	0.8	138	4.4	11.3	38	6000	4.8	0 y	
4	62	80	1.01	2	423	53	1.8	138	4.4	9.6	31	7500	4.8	0 y	
5	48	70	1.005	4	117	56	3.8	111	2.5	11.2	32	6700	3.9	1 y	
6	51	80	1.01	2	106	26	1.4	138	4.4	11.6	35	7300	4.6	0 y	
7	55	80	1.02	0	140	49	0.5	150	4.9	15.7	47	6700	4.9	0 n	
8	42	70	1.025	0	75	31	1.2	141	3.5	16.5	54	7800	6.2	0 n	
9	12	80	1.02	0	100	26	0.6	137	4.4	15.8	49	6600	5.4	0 n	
10	17	60	1.025	0	114	50	1	135	4.9	14.2	51	7200	5.9	0 n	
11	58	80	1.025	0	131	18	1.1	141	3.5	15.8	53	6800	6.1	0 n	

## **CHAPTER 8**

### **SOFTWARE TESTING**

#### **8.1 GENERAL**

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub assemblies, assemblies and/or a finished product. It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

#### **8.2 DEVELOPING METHODOLOGIES**

The test process is initiated by developing a comprehensive plan to test the general functionality and special features on a variety of platform combinations. Strict quality control procedures are used. The process verifies that the application meets the requirements specified in the system requirements document and is bug free. The following are the considerations used to develop the framework from developing the testing methodologies.

#### **8.3 TYPES OF TESTS**

##### **8.3.1 Unit testing**

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program input produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application. It is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system

configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

### **8.3.2 Functional test**

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.

### **8.3.3 System Test**

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration oriented system integration test. System testing is based on process descriptions and flows, emphasizing pre-driven process links and integration points.

### **8.3.4 Performance Test**

The Performance test ensures that the output be produced within the time limits, and the time taken by the system for compiling, giving response to the users and request being send to the system for to retrieve the results.

### **8.3.5 Integration Testing**

Software integration testing is the incremental integration testing of two or more integrated software components on a single platform to produce failures caused by interface defects.

The task of the integration test is to check that components or software applications, e.g. components in a software system or – one step up – software applications at the company level – interact without error.

### **8.3.6 Acceptance Testing**

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

#### **Acceptance testing for Data Synchronization:**

- The Acknowledgements will be received by the Sender Node after the Packets are received by the Destination Node
- The Route add operation is done only when there is a Route request in need
- The Status of Nodes information is done automatically in the Cache Updation process

### **8.2.7 Build the test plan**

Any project can be divided into units that can be further performed for detailed processing. Then a testing strategy for each of this unit is carried out. Unit testing helps to identify the possible bugs in the individual component, so the component that has bugs can be identified and can be rectified from errors.

## **CHAPTER 9**

### **9.1 APPLICATIONS**

- Early Detection of Chronic Kidney Disease (CKD)
- Stage Classification of Kidney Disease
- Dialysis and Transplant Planning
- Remote Monitoring and Alerts
- Reducing Diagnostic Errors
- Privacy-Preserving Collaboration

### **9.2 FUTURE ENHANCEMENT**

In the future, this renal health prediction system can be further improved by integrating advanced machine learning and deep learning models to enhance accuracy and detect complex patterns in medical data. Expanding the dataset by incorporating real-time hospital records, wearable health device readings, and diverse patient demographics will improve the model's reliability and reduce biases. Additionally, deploying the system as a mobile application or cloud-based platform will provide users with instant access to kidney health assessments from anywhere. Integrating IoT-based health monitoring devices such as smartwatches and BP monitors can enable real-time tracking of key health parameters and generate early warning alerts. Another significant enhancement would be expanding the system to predict multiple diseases, including diabetes and hypertension, using a single AI-powered model. The inclusion of personalized health recommendations based on user data can offer lifestyle and dietary suggestions to prevent kidney-related issues. Furthermore, incorporating a voice assistant or chatbot for patient guidance can help users better understand their reports and receive medical recommendations. These enhancements will transform the system into a comprehensive AI-driven healthcare assistant, improving early disease detection, patient awareness, and medical decision-making.

## **CHAPTER 10**

### **CONCLUSION & REFERENCE**

#### **10.1 CONCLUSION**

This project successfully demonstrates the use of machine learning, specifically the Decision Tree algorithm, for predicting renal health conditions based on key medical parameters. By analysing factors such as Blood Pressure, Serum Urea, Red Blood Cells, and Hemoglobin levels, the system provides an early warning mechanism that helps individuals take preventive actions before kidney diseases progress. Compared to traditional diagnostic methods, the proposed approach offers higher accuracy, faster results, and an easy-to-use interface, making it accessible for both healthcare professionals and individuals. The implementation of this system contributes to early detection, improved patient awareness, and better healthcare decision-making. As technology advances, future enhancements such as deep learning integration, IoT-based health tracking, and multi-disease prediction will further improve its effectiveness. Ultimately, this project serves as a valuable step toward AI-driven healthcare solutions, promoting early diagnosis and proactive medical care to enhance overall patient well-being.

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