Integrated Healthcare Prognosis

B.E. Phase I report submitted in partial

fulfilment of the requirements of the degree of

Bachelor of Engineering (B.E.)

in

INFORMATION TECHNOLOGY

by

Durwangsingh Bundele EU2204003 (44)

Komal Nehete EU2204002 (57)

Roshan Bhagat EU2204020 (65)

Under the guidance of

Ms. Shraddha More

Assistant Professor

Department of Information Technology

St. John College of Engineering and Management, Palghar

University of Mumbai

2023–2024

CERTIFICATE

This is to certify that the B.E. major-project entitled **“Integrated Healthcare Prognosis”** is a bonafide work of **“Durwangsingh Bundele” (EU2204003) (44), “Komal Nehete” (EU2204002) (57)** and **“Roshan Bhagat” (EU2204020) (65)** submitted to University of Mumbai in partial fulfilment of the requirement for the award of the degree of **“Bachelor of Engineering”** in **“Information Technology”** during the academic year 2023–2024.

Ms. Shraddha More | Assistant Professor

Project Guide

Dr. Arun Saxena

Head of Department

Dr. G.V. Mulgund

Principal

B.E. Project Report Approval

This major-project synopsis entitled ***Integrated Healthcare Prognosis*** by ***Durwangsingh Bundele, Komal Nehete and Roshan Bhagat*** is approved for the degree of ***Information Technology Engineering*** from the ***University of Mumbai***.

Examiners

1.---

2.---

Date:

Place:

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Signature

Durwangsingh Bundele (EU2204003)

Signature

Komal Nehete (EU2204002)

Signature

Roshan Bhagat (EU2204020)

Date:

Abstract

The evolution of healthcare, Integrated Healthcare Prognosis System, leveraging Machine Learning (ML) to precisely assess an individual's disease risk based on their medical history and health attributes. This system integrates various Machine Learning (ML) and Deep Learning (DL) techniques, including Logistic Regression (LR), Random Forest (RF), and Convolutional Neural Networks (CNN), to accurately predict serious Disease such as Heart Disease, Lung Cancer, Diabetes, and Brain Tumor. Unlike traditional methods, this system offers the unique capability to predict all four diseases within a single platform, enhancing user convenience and healthcare efficiency. Moreover, the system goes beyond prognosis; it actively engages patients by delivering preventative guidance through SMS notifications. This holistic approach not only aids in disease prevention but also elevates the overall quality of patient life. this Integrated Healthcare Prognosis System setting new standards in medical field and promising a brighter, healthier future for individuals.

.

Keywords— *Convolutional Neural Networks, Deep Learning, Logistic Regression, Machine Learning, Random Forest.*

Table of Contents

List of Figures

List of Tables

List of Abbreviations

IHP	Integrated Healthcare Prognosis
ML	Machine Learning
DL	Deep Learning
LR	Logistic Regression
KNN	K-Nearest Neighbor
RF	Random Forest
CNN	Convolutional Neural Networks
SMS	Short Messaging Service

Chapter 1

Introduction

The healthcare industry is undergoing a transformative era, driven by advancements in technology and a growing emphasis on preventive care. In this context, the Integrated Healthcare Prognosis System (IHPS) emerges as a groundbreaking solution that leverages the power of machine learning (ML) to provide precise disease risk assessment and personalized preventative guidance.

Unlike traditional methods that focus on a single disease, the IHPS integrates various ML and deep learning (DL) techniques to predict multiple serious diseases within a unified platform. This includes Logistic Regression (LR), Random Forest (RF), and Convolutional Neural Networks (CNN), which are employed to analyse a comprehensive set of medical history and health attributes.

By combining the strengths of these diverse ML algorithms, the IHPS achieves a high level of accuracy in predicting the risk of developing heart disease, lung cancer, diabetes, and brain Tumour. This holistic approach provides valuable insights into an individual's overall health status, enabling clinicians to make informed decisions about preventive care.

Furthermore, the IHPS goes beyond prognosis it actively engages patients by delivering preventative guidance through SMS notifications. This holistic approach not only aids in disease prevention but also elevates the overall quality of patient life. It provides preventative guidance on lifestyle modifications that can help reduce disease risk.

In essence, the IHPS represents a significant advancement in the field of healthcare. As the healthcare industry continues to evolve, the IHPS is composed to play a pivotal role in shaping the future of preventive care.

1.1 Motivation

The rising prevalence of chronic diseases poses a significant challenge to healthcare systems worldwide. Traditional healthcare systems are often fragmented, this can lead to misdiagnosis, duplication of services, and missed opportunities for prevention. Integrated healthcare prognosis systems have the potential to address these challenges by providing a more comprehensive and coordinated approach to patient care. These systems use machine learning (ML) and deep learning (DL) techniques to analyze large datasets of patient data, including medical history, lifestyle factors, and genetic information. This data can be used to predict an individual's risk of developing a particular disease, as well as to identify potential interventions that could help to prevent or delay the onset of disease.

1.2 Problem Statement

In the evolution of healthcare, there is need for the development of a robust Integrated Healthcare Prognosis System using Machine Learning To precisely estimate the probability of an individual suffering from a particular disease using their medical history and relevant health attributes. The system should be able to handle few diseases and provide predictions with high accuracy and reliability.

1.3 Objectives

- To integrate the prognosis system with existing healthcare infrastructure to facilitate seamless data flow and enhance clinical decision-making.
- To design and develop a user-friendly interface that allows patients to easily access and understand their individual disease risk assessments.

- To contribute to the advancement of machine learning and deep learning in the healthcare field.
- To promote a brighter and healthier future for individuals by empowering them to take control of their health.

1.4 Scope

- Develop ML-based system for disease prognosis.
- Use LR, RF, and CNN for disease prediction.
- Predict risk of heart disease, lung cancer, diabetes, and brain Tumour.
- Develop single platform for predicting all four diseases.
- Develop system for delivering preventative guidance through SMS.

Chapter 2

Review of Literature

Sr. No.	Paper Title	Author names	Conclusion	Research Gaps
[1]	**A Heuristic Machine Learning Based Optimization Technique to Predict Lung Cancer Patient Survival**	Sonia Kukreja, Munish Sabharwal, Mohd Asif Shah, D. S. Gill	Naive Bayes Algorithm, predict survival time of lung cancer patients, Achieved high accuracy with 98.78%.	Evaluate New algorithms and feature selection strategies.
[2]	**Early-Stage Lung Cancer Prediction Using Various Machine Learning Techniques**	Chinmayi Thallam, Aarsha Peruboyina, Sagi Sai Tejasvi Raju, Nalini Sampath	Applied Random Forest with 97.5% and K-Nearest Neighbor 97% accuracy.	exploring additional models, handling imbalanced data, improving scalability and interpretability, enhancing preprocessing techniques, and using larger and more diverse datasets.
[3]	**Lung Cancer Prediction Using Stochastic Diffusion Search (SDS) Based Feature Selection and Machine Learning Methods**	S. Shanthi, N. Rajkumar	Applies SDS in conjunction with two classification algorithms: Naive Bayes and Neural Networks. where SDS NN gives accuracy 89.63%.	Further research should be conducted on preprocessing techniques and the selection of optimal classifiers to potentially improve the accuracy.
[4]	**A method for Improving Prediction of Human Heart Disease Using Machine**	Abdul Saboor, Muhammad Usman, Sikandar Ali	To classify the prediction of heart disease, including an accuracy of 96.72% achieved by SVM.	Use XGBoost for heart disease prediction.

[5]	**Computational Learning Model for Prediction of Heart Disease Using Machine Learning Based on a New Regularize**	Abdulaziz Albahr, Marwan Albahar, Mohammed Thanoon, Muhammad Binsawad	Introduced a new regularization technique based on weight decay and standard deviation. Applied this technique to the RSD-ANN model which gives accuracy of 96.30%.	Inadequacy of existing models in achieving such high accuracy or addressing the heterogeneity of heart diseases effectively
[6]	**Estimation of Prediction for Getting Heart Disease Using Logistic Regression Model of Machine Learning**	Montu Saw, Tarun Saxena, Sanjana Kaithwas, Rahul Yadav, Nidhi Lal	Applied Logistic Regression Model achieved an accuracy of 87%.	address ethical and privacy concerns and propose solutions to ensure the responsible and ethical use of patient data.
[7]	**Diabetes Disease Prediction Using Machine Learning Algorithms**	Arwatki Chen Lyngdoh, Nurul Amin Choudhury, Soumen Moulik	Comparing ML Algorithms and identifies K-Nearest Neighbors (KNN) as the most optimal classifier with the highest accuracy of 76% for diabetes prediction.	Try to create a diabetes dataset in collaboration with a hospital or a medical institute and will try to achieve better Results.
[8]	**Diabetes Prediction using Machine Learning Algorithms with Feature Selection and Dimensionality Reduction**	Sivaranjani S, Ananya S, Aravinth J, Karthika R	Applied Random Forest model and SVM model achieved a significant accuracy of 83% and 81.4% respectively.	Lead to more robust and accurate predictive models for Diabetes Related Diseases.
[9]	**Machine Learning based Diabetes Prediction using Decision Tree J48**	Mary Posonia, S. Vigneshwari, D. Jamuna Rani	using Decision Tree J48 for diabetes prediction Achieved an efficiency of 91.2% in diabetes prediction.	Potential exploration of deep neural networks for diabetes prediction, implementation of feature selection methods.

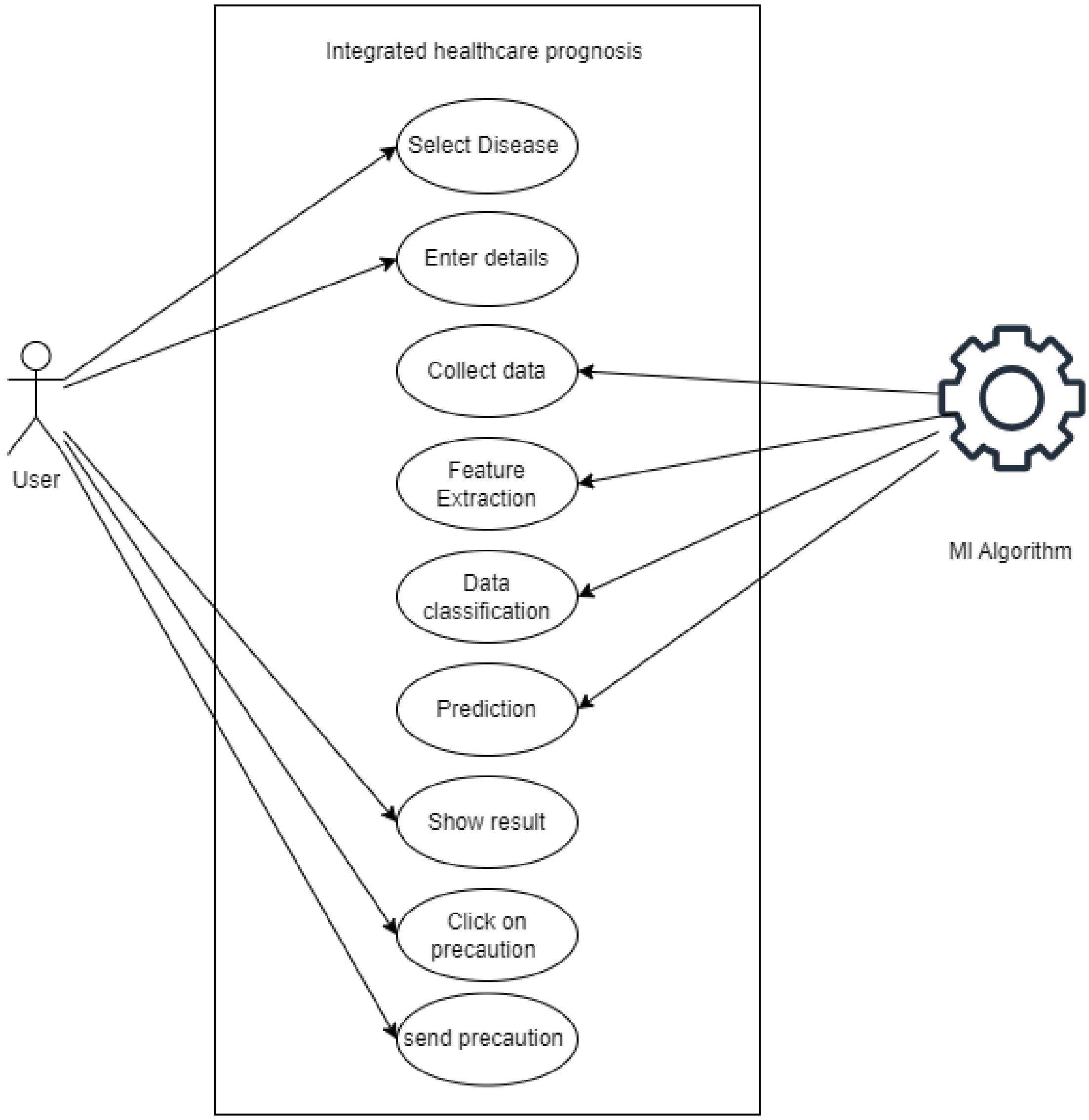
[10]	**Human Expert-level Brain Tumour Detection using Deep learning with Data Distillation and Augmentation**	Diyuan Lu, Nenad Polomac, Iskra Gacheva, Elke Hattingen, Jochen Triesch.	Using Deep Neural Network (DNN) achieves an Accuracy of 0.78.	Consider patient wise training using multiple spectra from a single individual.
[11]	**Brain Tumour Detection Analysis Using CNN**	Sunil Kumar, Renu Dhir, Nisha Chaurasia	Using Convolution Neural Network (CNN) achieves an Accuracy of 92%.	Improving the accuracy with a low rate of error using different classifier techniques.
[12]	**Detection and Classification of Brain Tumour in MRI Images using Deep Convolutional Network**	Yakub Bhanothu, Anandhana rayanan Kamalakannan, Govindaraj Rajamanickam	Region based Convolution Neural Network (R-CNN) Provide Average Accuracy of 77.60%.	This method can also be generalized to other medical applications, such as skin lesion segmentation and Classification.

Chapter 3

Requirement Gathering and Planning

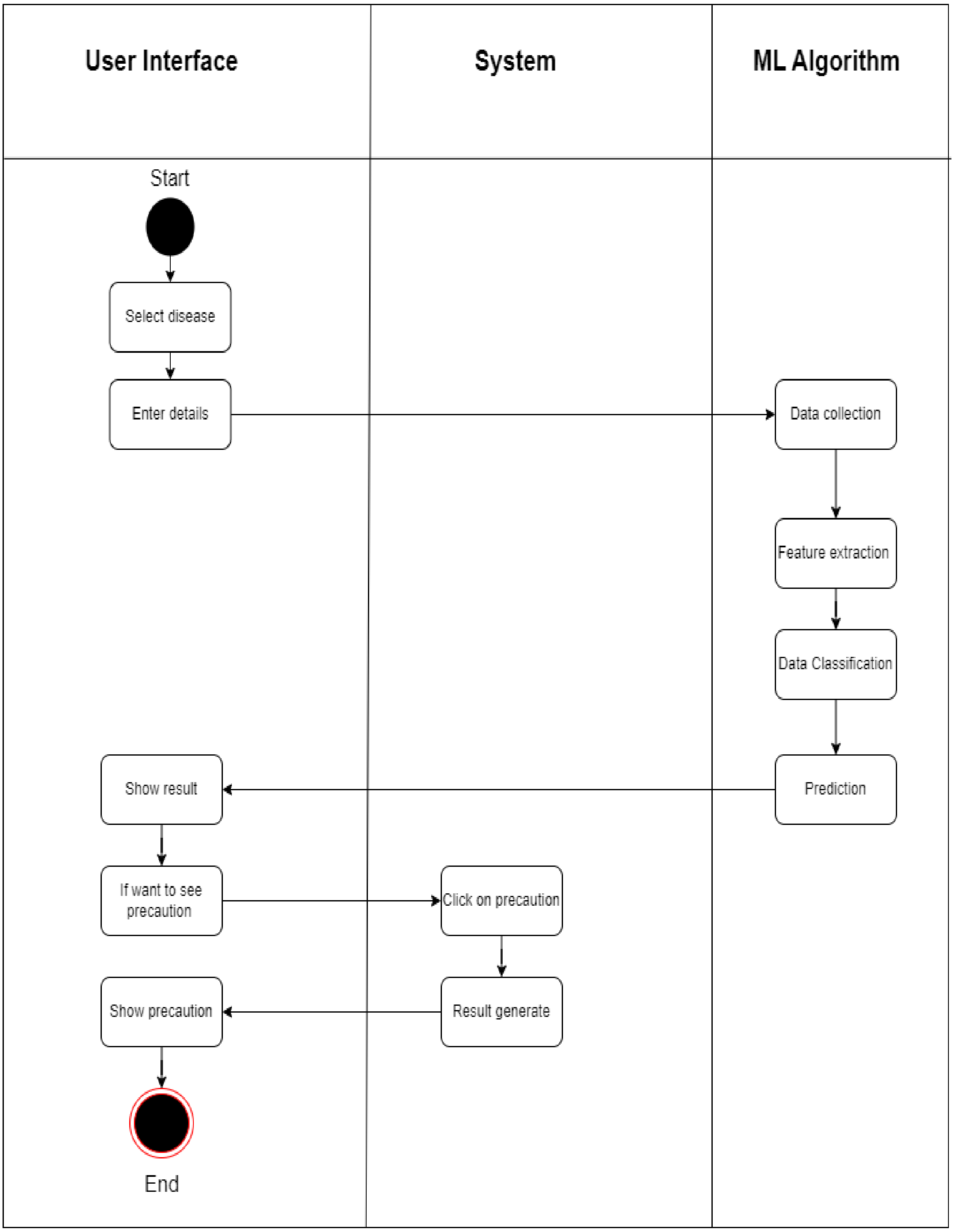
3.1 Requirement Elicitation

3.1.1 Use Case Diagram



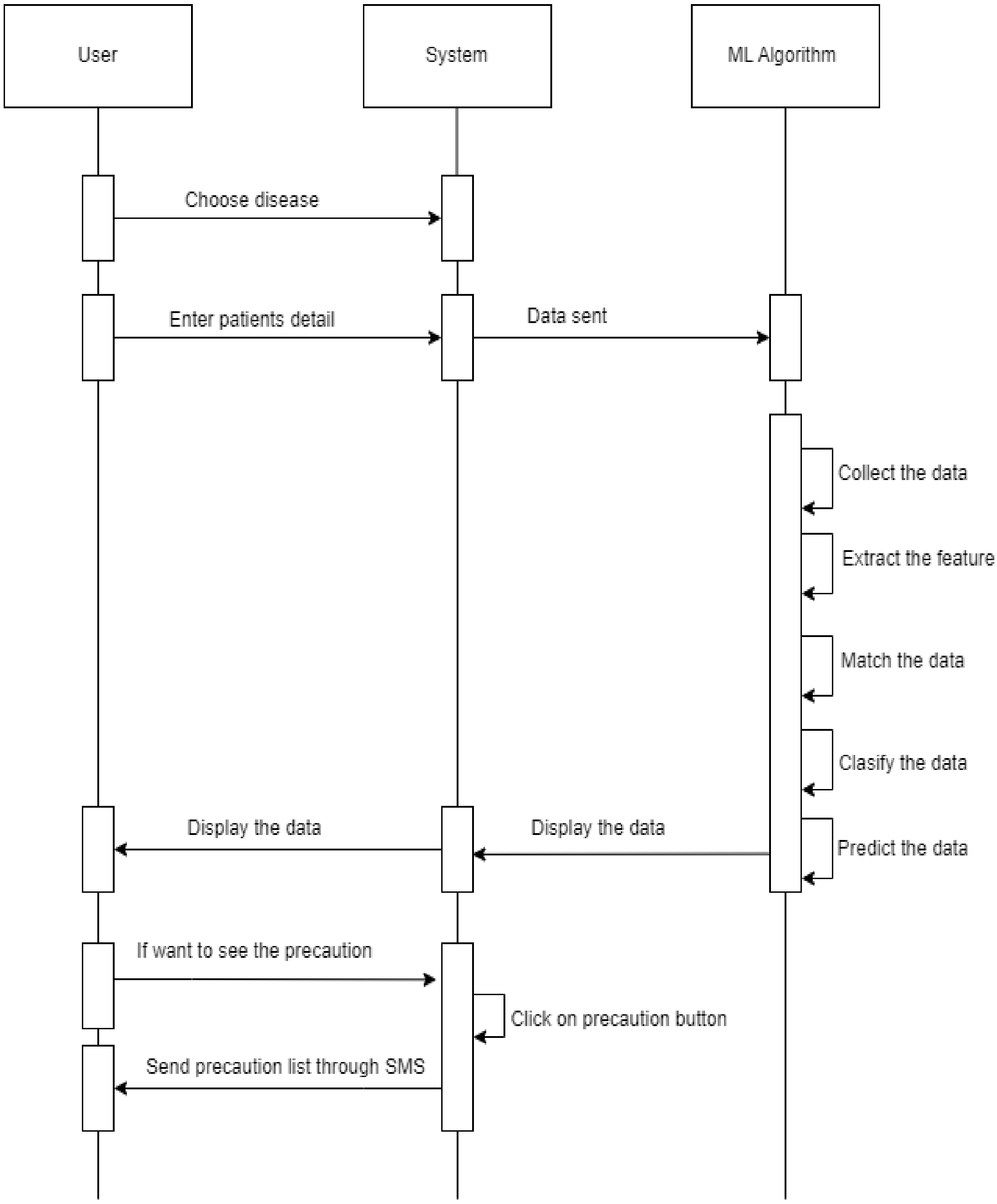
3.1.1 Use Case Diagram

3.1.2 Activity Diagram



3.1.2 Activity Diagram

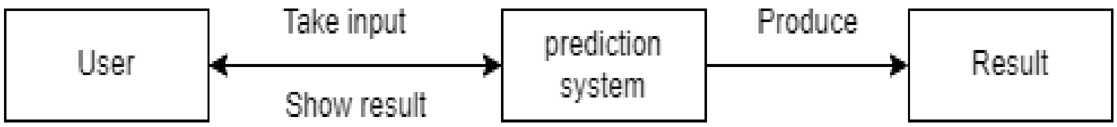
3.1.3 Sequence Diagram



3.1.3 Sequence Diagram

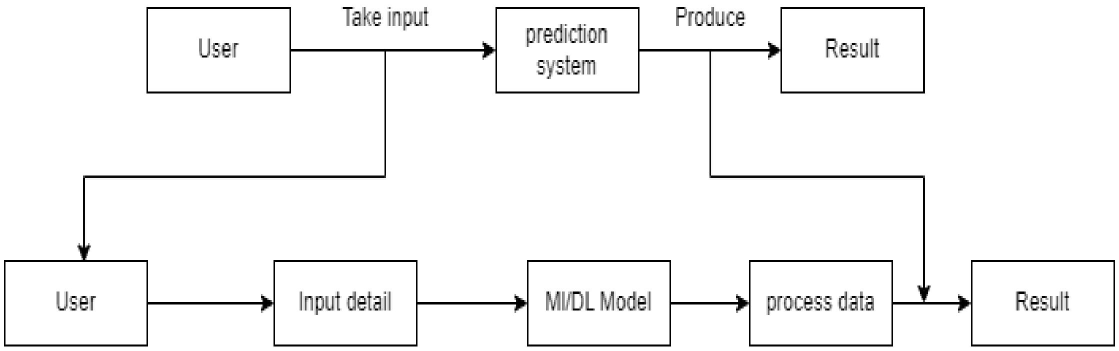
3.2 Dataflow Diagrams (DFDs)

3.2.1 Level 0 Diagram



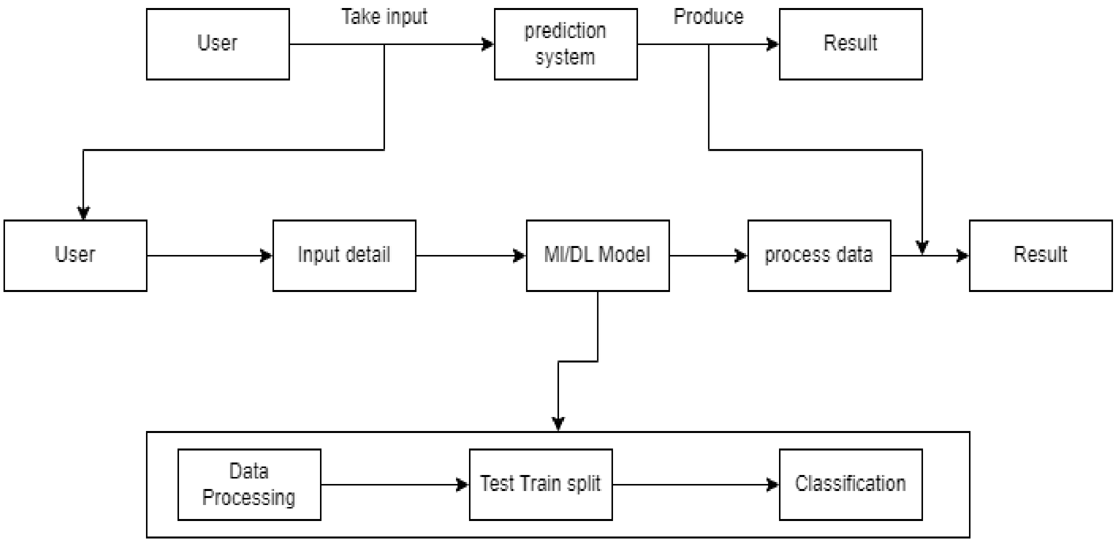
3.2.1 Level 0 Diagram

3.2.2 Level 1 Diagram



3.2.2 Level 1 Diagram

3.2.3 Level 2 Diagram



3.2.3 Level 2 Diagram

3.3 Feasibility Study

3.3.1 Technical Feasibility

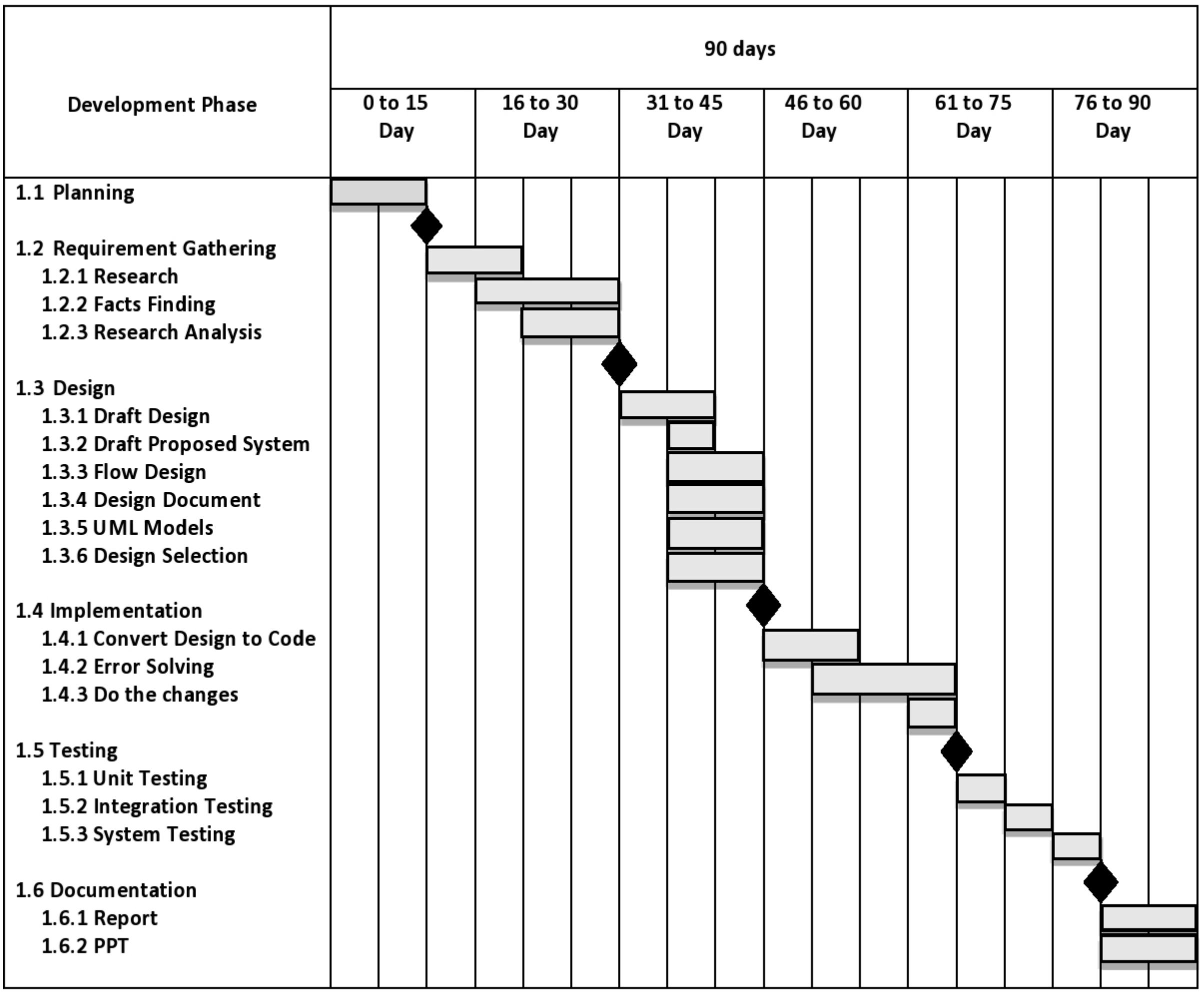
3.3.1.1 Hardware Requirements

- DELL Intel(R) Core (TM) i3-7020U
- CPU @ 2.30GHz
- 4.00 GB RAM

3.3.1.2 Software Requirements

- Windows 10 64-bit Operating System
- IDE- vs code
- Frontend- HTML, CSS
- Backend- Python

3.4 Timeline/Gantt Chart



3.4 Timeline Chart

3.5 Work Breakdown Structure (W.B.S) Chart

3.5 Work Breakdown Structure (W.B.S) Chart

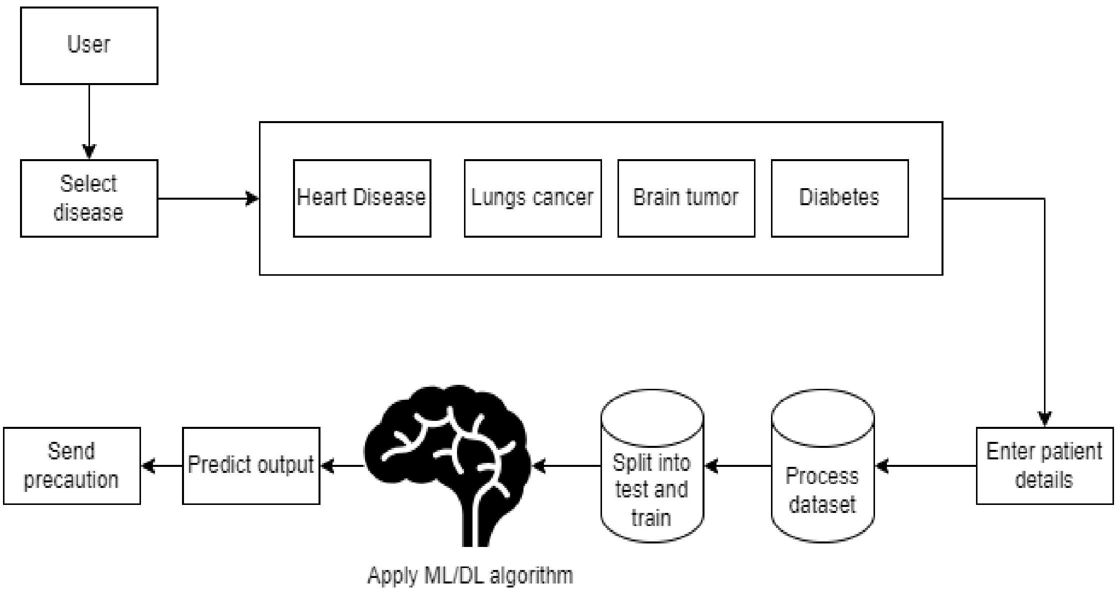
Chapter 4

Report on Present Investigation

4.1 Proposed System

The proposed integrated healthcare prognosis system employs machine learning and deep learning algorithms to detect heart disease, lung cancer, diabetes, and brain tumour. It uses Flask to connect the frontend (HTML, CSS, JS) and backend (Python) for user input. By utilizing algorithms like logistic regression, random forest, and convolutional neural networks, it predicts disease probabilities. When risks are high, it advises users to consult a doctor and provides preventive measures via SMS. This system not only facilitates early disease detection, potentially improving treatment outcomes and reducing healthcare system burdens, but also educates users about diseases and preventive actions, thereby promoting individual well-being and health.

4.1.1 Block diagram of Proposed System

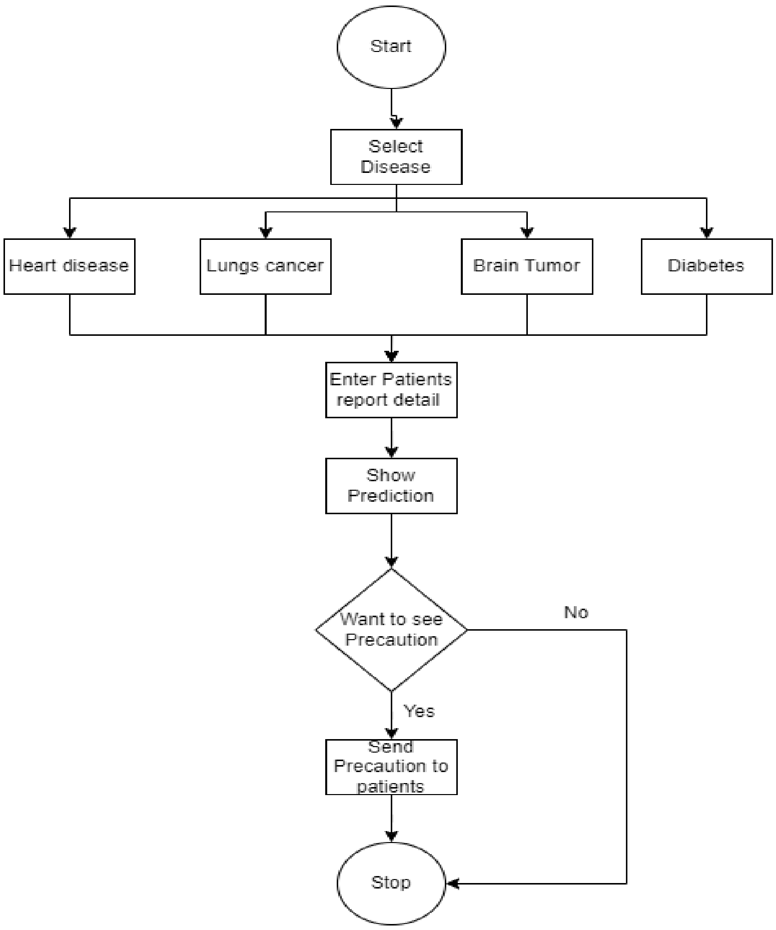


4.1.1 Block diagram of Proposed System

4.2 Implementation

The project's workflow initiates with the user's selection of a specific disease for early prediction from a list comprising heart disease, lung cancer, diabetes, and brain Tumour. Once the disease is chosen, the user proceeds to input the patient's details into the system. These details serve as input for the machine learning or deep learning algorithms embedded within the system, which analyse the provided information to generate a predictive output. Subsequently, the results are displayed to the user. At this stage, the user is offered the option to send a list of precautions to the patient through a text message. This feature enables the dissemination of tailored preventive measures or precautions directly to the individual, based on the predicted health condition, providing an immediate and proactive approach to healthcare management.

4.2.1 Algorithm/Flowchart



4.2.1 Flowchart

4.2.2 Pseudo code

```
from flask import Flask, render_template, request
import pickle
import pandas as pd
import numpy as np
import os
import tensorflow as tf
from PIL import Image
import cv2
from keras.models import load_model
from werkzeug.utils import secure_filename
app = Flask(__name__)
model_hdp = pickle.load(open('model.pkl', 'rb'))
model_lcp = pickle.load(open('lungs_model.pkl', 'rb'))
model_dp = pickle.load(open('diabetes_model.pkl', 'rb'))
model =load_model('brainTumour10Epochs.h5')
@app.route('/')
def home():
    return render_template('index.html')
@app.route('/heart.html')
def heart():
    return render_template('heart.html')
@app.route('/hdp_predict', methods=['POST'])
def predict():
    age = int(request.form.get('age'))
    sex = int(request.form.get('sex'))
    cp = int(request.form.get("cp"))
    trestbps = int(request.form.get("trestbps"))
    chol = int(request.form.get("chol"))
    fbs = int(request.form.get("fbs"))
    restecg = int(request.form.get("restecg"))
    thalach = int(request.form.get("thalach"))
    exang = int(request.form.get("exang"))
    oldpeak = int(request.form.get("oldpeak"))
```

```
    slope = int(request.form.get("slope"))
    ca = int(request.form.get("ca"))
    thal = int(request.form.get("thal"))
    input_data = (age, sex, cp, trestbps, chol, fbs, restecg,
                  thalach, exang, oldpeak, slope, ca, thal)
    input_data_as_numpy_array = np.asarray(input_data)
    input_data_reshaped = input_data_as_numpy_array.reshape(1, -1)
    prediction = model_hdp.predict(input_data_reshaped)
    print(prediction)
    if prediction == 1:
        return render_template('heart.html', label=1)
    else:
        return render_template('heart.html', label=-1)
@app.route('/lungs.html')
def lcp():
    return render_template('lungs.html')
@app.route('/lcp_predict', methods=['POST'])
def lcp_predict():
    gen = int(request.form.get('gen'))
    age = int(request.form.get('age'))
    smoke = int(request.form.get("smoke"))
    ylw_fin = int(request.form.get("ylw_fin"))
    anx = int(request.form.get("anx"))
    cd = int(request.form.get("cd"))
    fati = int(request.form.get("fati"))
    alg = int(request.form.get("alg"))
    whz = int(request.form.get("whz"))
    alc = int(request.form.get("alc"))
    cough = int(request.form.get("cough"))
    sb = int(request.form.get("sb"))
    sd = int(request.form.get("sd"))
    cp = int(request.form.get("cp"))
    input_data = (gen,age,smoke,ylw_fin,anx,cd,fati,alg,whz,alc,cough,sb,sd,cp)
    input_data_as_numpy_array = np.asarray(input_data)
    input_data_reshaped = input_data_as_numpy_array.reshape(1, -1)
```

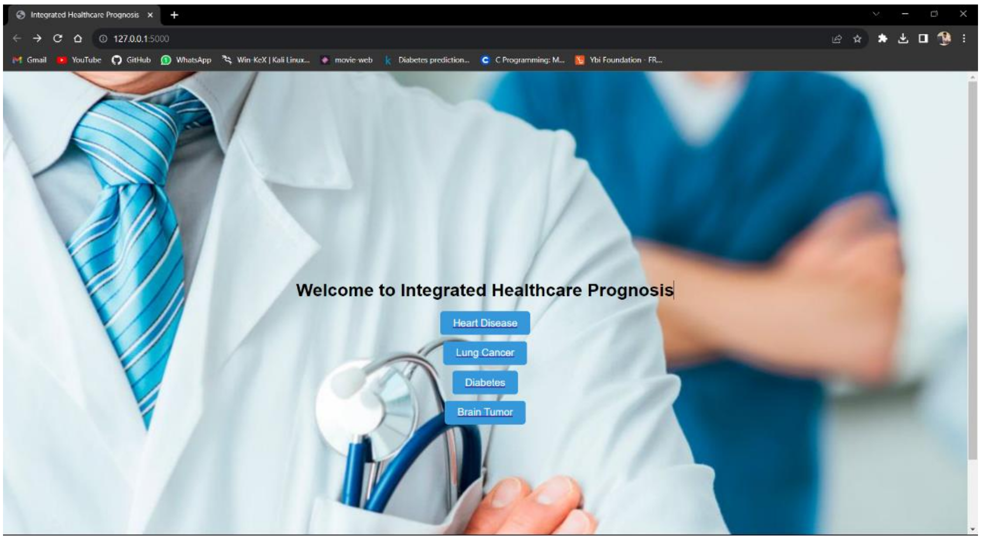
```
    prediction = model_lcp.predict(input_data_reshaped)
    print(prediction)
    if prediction == 1:
        return render_template('lungs.html', label=1)
    else:
        return render_template('lungs.html', label=-1)
@app.route('/diabetes.html')
def dp():
    return render_template('diabetes.html')
@app.route('/dp_predict', methods=['POST'])
def dp_predict():
    gen = int(request.form.get('gen'))
    age = int(request.form.get('age'))
    hyper = int(request.form.get("hyper"))
    hd = int(request.form.get("hd"))
    sh = int(request.form.get("sh"))
    bmi = float(request.form.get("bmi"))
    hl = float(request.form.get("hl"))
    bgl = int(request.form.get("bgl"))
    input_data = (gen,age,hyper,hd,sh,bmi,hl,bgl)
    input_data_as_numpy_array = np.asarray(input_data)
    input_data_reshaped = input_data_as_numpy_array.reshape(1, -1)
    prediction = model_dp.predict(input_data_reshaped)
    print(prediction)
    if prediction == 1:
        return render_template('diabetes.html', label=1)
    else:
        return render_template('diabetes.html', label=-1)
print('Model loaded. Check http://127.0.0.1:5000/')
def get_className(classNo):
   if classNo==0:
            return "No Brain Tumour"
   elif classNo==1:
            return "Yes Brain Tumour"
```

```
def getResult(img):
    image = cv2.imread(img)
    image = Image.fromarray(image, 'RGB')
    image = image.resize((64, 64))
    image = np.array(image)
    input_img = np.expand_dims(image, axis=0)
    result = model.predict(input_img)
 # Get the index of the class with the highest probability
    return result

@app.route('/brainTumour.html',methods=['GET'])
def index():
    return render_template('brainTumour.html')

@app.route('/predict', methods=['GET', 'POST'])
def upload():
    if request.method == 'POST':
        f = request.files['file']

        basepath = os.path.dirname(__file__)
        file_path = os.path.join(
            basepath, 'uploads', secure_filename(f.filename))
        f.save(file_path)
        value=getResult(file_path)
        result=get_className(value)
        return result
    return None

if __name__ == '__main__':
    app.run(debug=True)
```

4.2.3 Screenshots of the output with description

4.2.3.1 Home Page

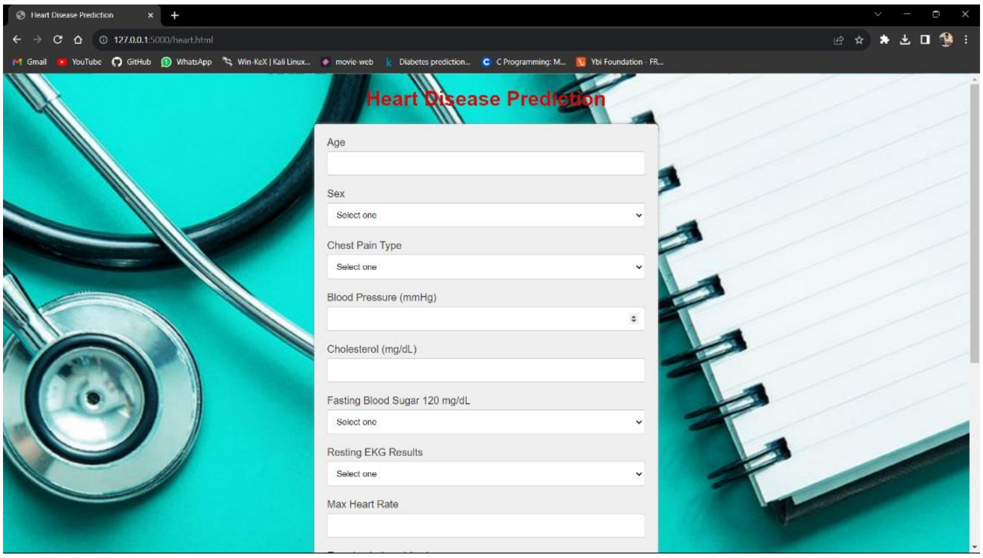
Home page for IHP where user will be able to select any one disease from various disease like heart disease, lungs cancer, diabetes, and brain Tumour.



4.2.3.1 Home Page

4.2.3.2 Heart Disease Prediction Form

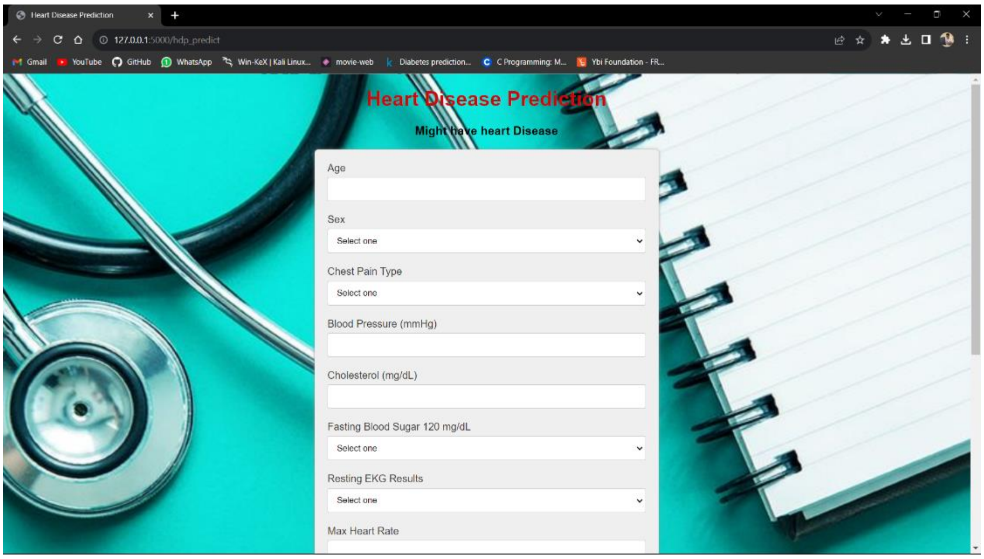
here, user will able to enter patients report detail.



4.2.3.2 Heart Disease Prediction Form

4.2.3.3 Heart Disease True Prediction

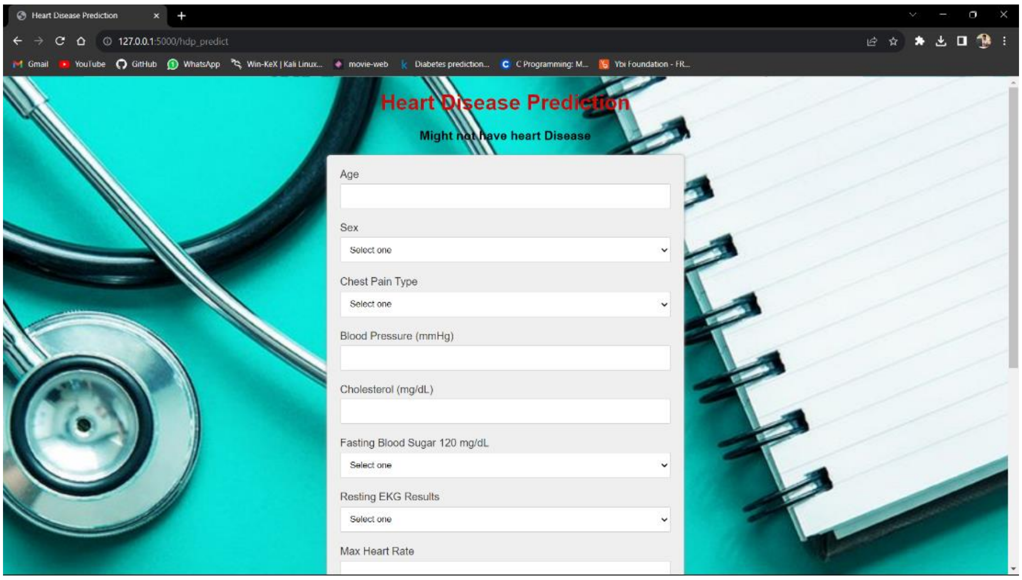
Here, it is been predicted that, the patient might have heart disease.



4.2.3.3 Heart Disease Prediction True Prediction

4.2.3.4 Heart Disease False Prediction

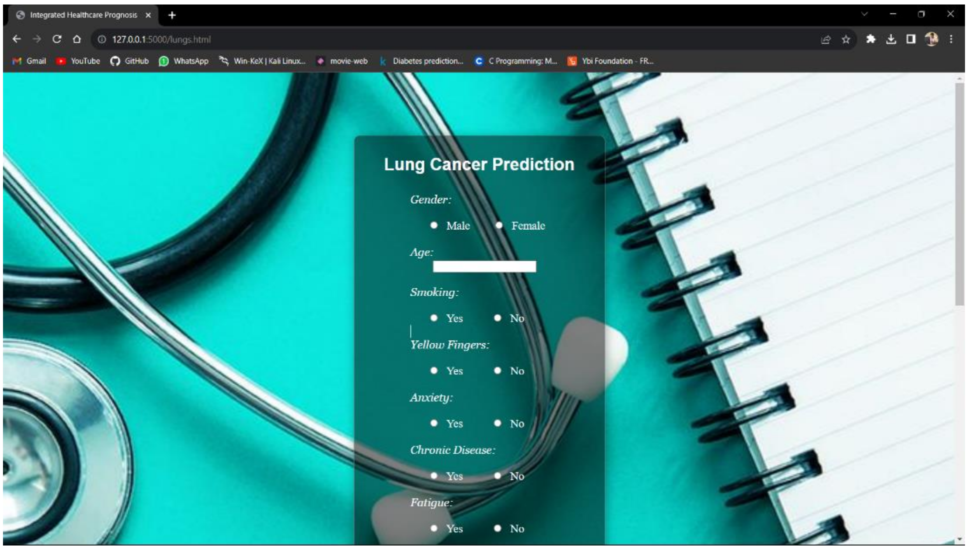
Here, it is been predicted that, the patient might not have heart disease.



4.2.3.4 Heart Disease Prediction False Prediction

4.2.3.5 Lung Cancer Prediction Form

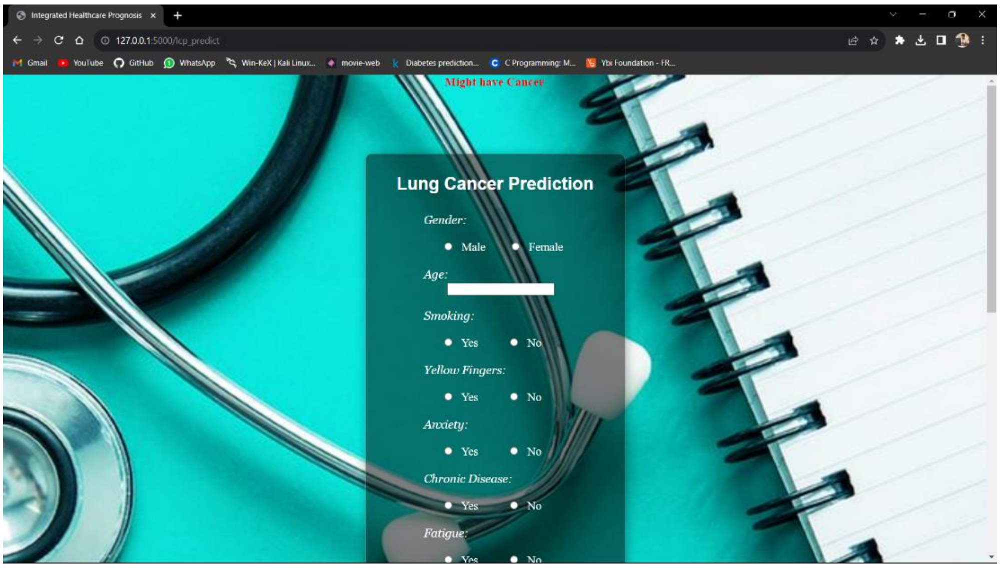
here, user will able to enter patients report detail.



4.2.3.5 Lung Cancer Prediction Form

4.2.3.6 Lung Cancer True Prediction

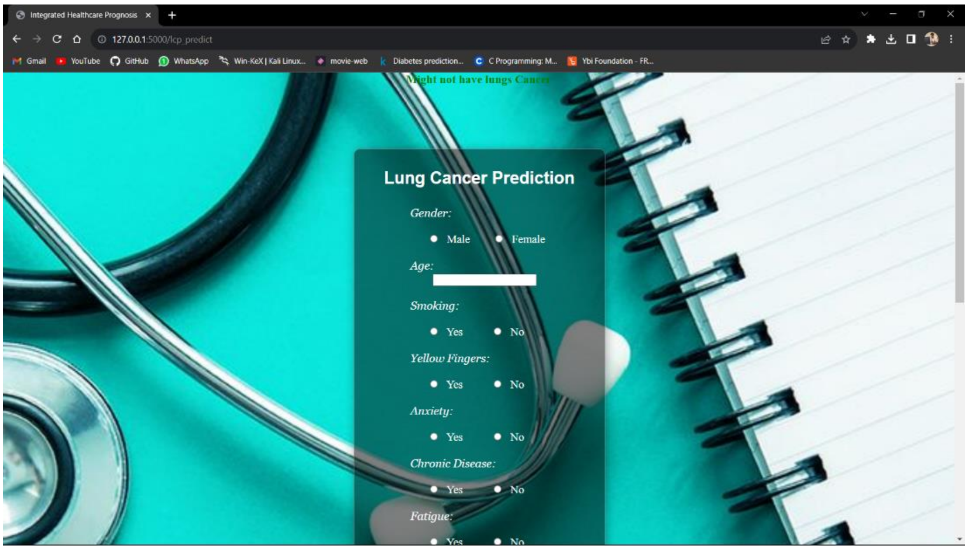
Here, it is been predicted that, the patient might have lung cancer.



4.2.3.6 Lung Cancer True Prediction

4.2.3.7 Lung Cancer False Prediction

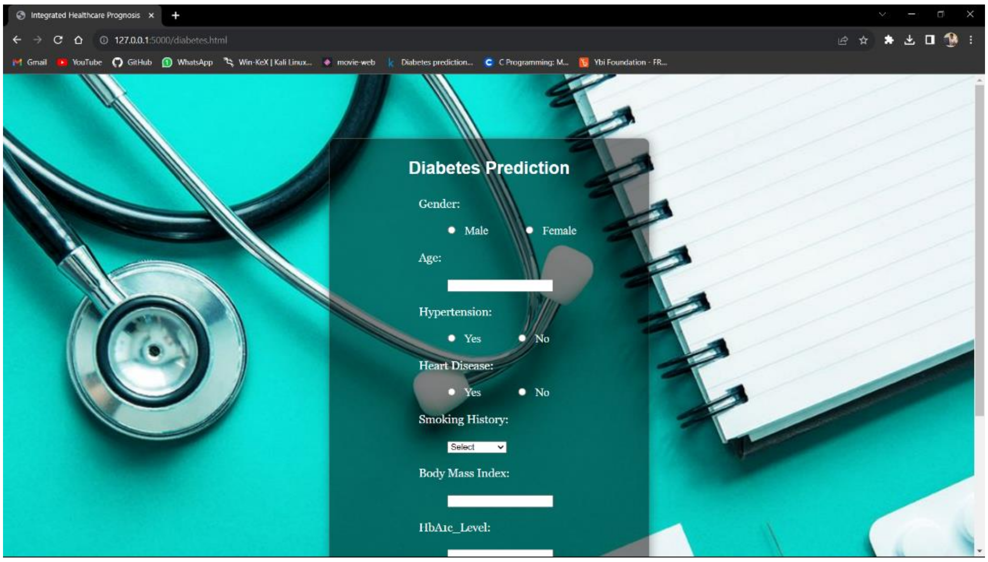
Here, it is been predicted that, the patient might not have lung cancer.



4.2.3.7 Lung Cancer False Prediction

4.2.3.8 Diabetes Prediction Form

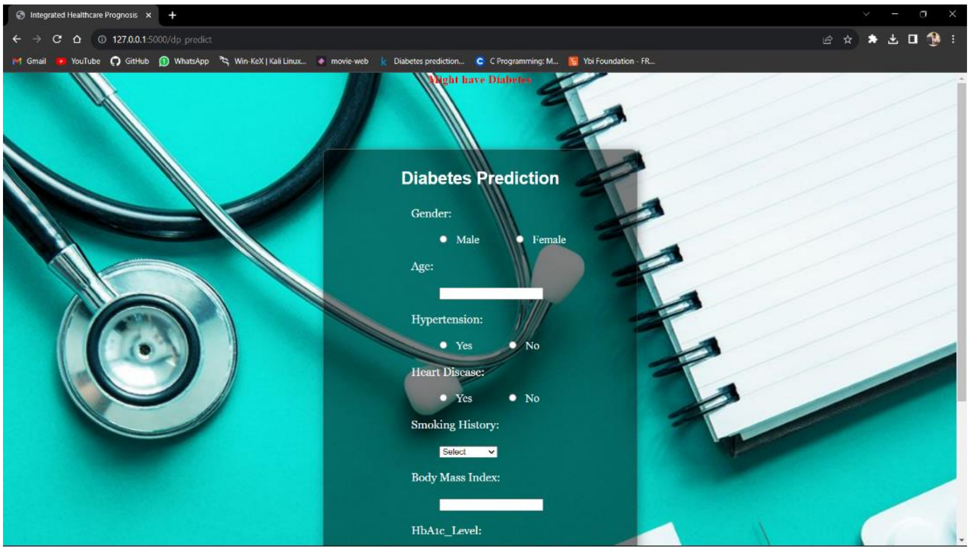
here, user will able to enter patients report detail.



4.2.3.8 Diabetes Prediction Form

4.2.3.9 Diabetes True Prediction

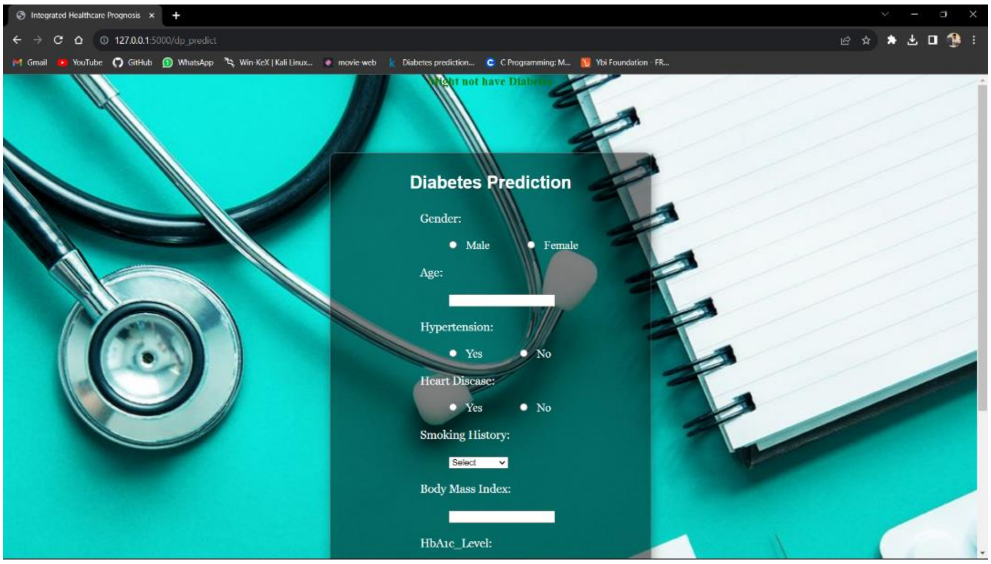
Here, it is been predicted that, the patient might have diabetes.



4.2.3.9 Diabetes True Prediction

4.2.3.10 Diabetes False Prediction

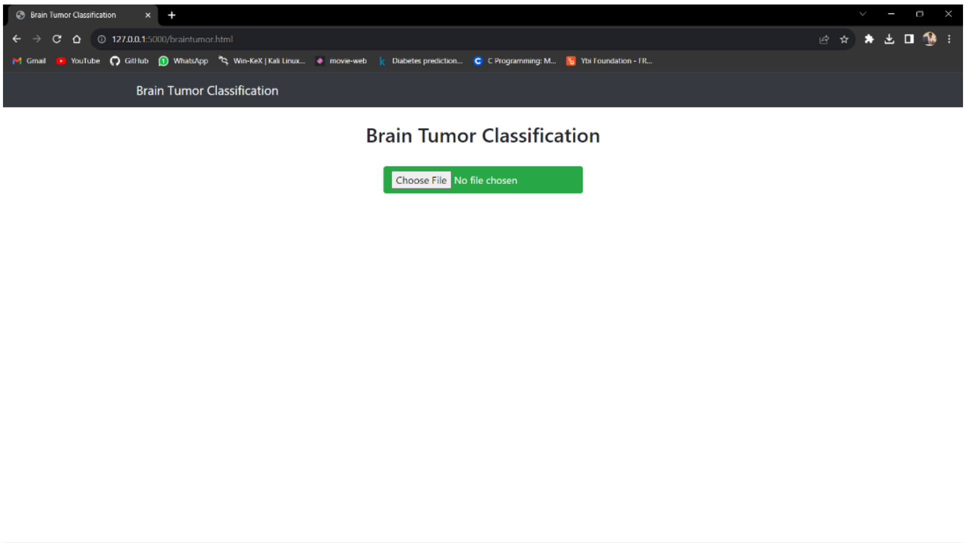
Here, it is been predicted that, the patient might not have diabetes.



4.2.3.10 Diabetes False Prediction

4.2.3.11 Brain Tumour Classification Page

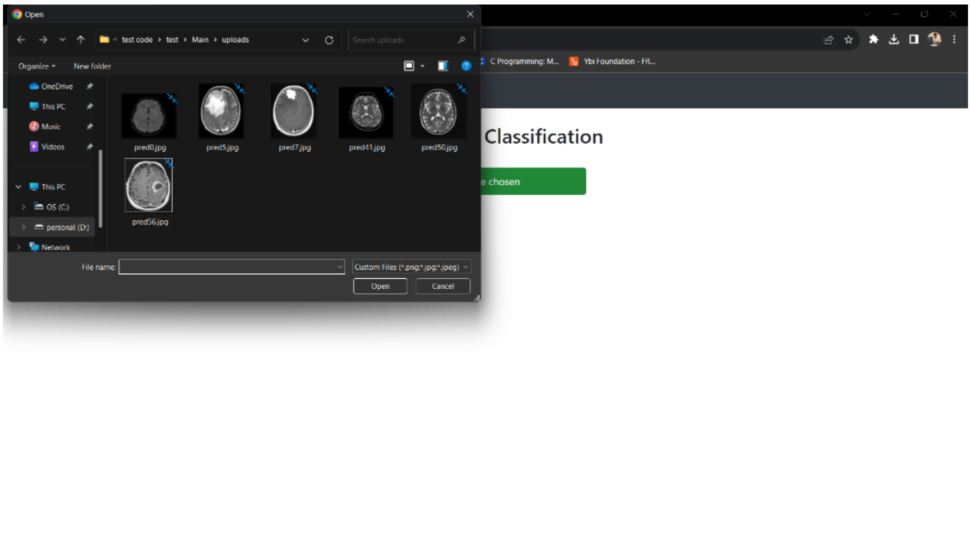
This is a brain Tumour classification page.



4.2.3.11 Brain Tumour Classification Page

4.2.3.12 Brain Tumour Classification Input Page

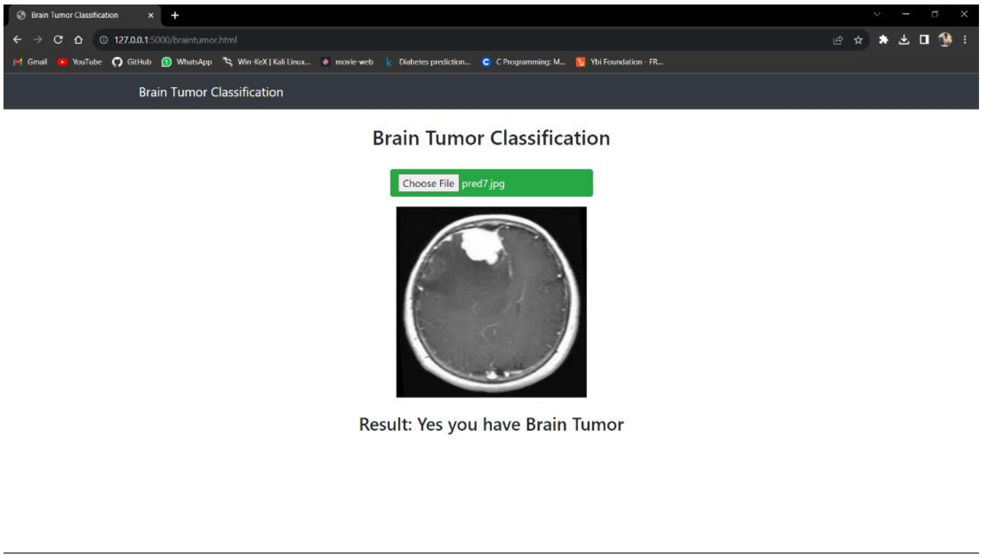
here, user will able to enter patients brain MRI.



4.2.3.12 Brain Tumour Classification Input Page

4.2.3.13 Brain Tumour True Classification

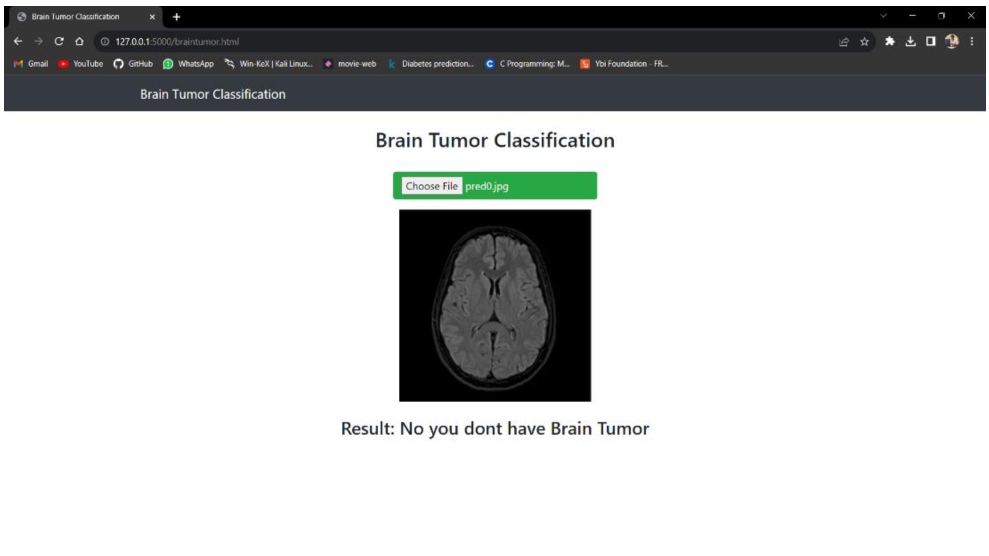
Here, it is been detected that, the patient is having brain Tumour.



4.2.3.13 Brain Tumour True Classification

4.2.3.14 Brain Tumour False Classification

Here, it is been detected that, the patient is not having brain Tumour.



4.2.3.14 Brain Tumour False Classification

Chapter 5

Technologies Used

- **Flask:**

  Flask is used to provide connection between frontend with backend. Where it takes input from html form and forward it to backend for further processing.

- **Python:**

  Python is commonly used to build backends for machine learning (ML) projects due to its extensive ecosystem of ML libraries and frameworks, such as TensorFlow, and scikit-learn. These libraries offer powerful tools for data manipulation, model training, and deployment.

- **ML:**

  It can analyse large and complex datasets, identifying patterns and relationships that might be difficult for humans to discern. By leveraging machine learning algorithms, healthcare professionals can develop predictive models that consider a wide range of factors and variables, helping to improve early detection, prognosis, and treatment planning for various diseases.

- **Logistic Regression:**

  Logistic regression is used to predict heart disease because it is well-suited for binary classification tasks, such as determining whether an individual has heart disease (yes/no).

- **Random Forest:**

  Random Forest is used for predicting lung cancer and diabetes because it is a powerful machine learning algorithm that can handle complex, high-dimensional data effectively.

- **DL:**

  Deep learning is used to detect brain Tumours because it excels at automatically identifying patterns and features in medical images, such as MRI scans, which are commonly used for brain Tumour diagnosis. By training deep neural networks on large datasets of labelled images, the technology can learn to distinguish between normal brain tissue and Tumour regions with high accuracy, aiding healthcare professionals in early and precise diagnosis.

- **CNN:**

  Convolutional Neural Networks (CNNs) are commonly used for brain Tumour detection in medical imaging because they are highly effective at capturing complex patterns and features within images.

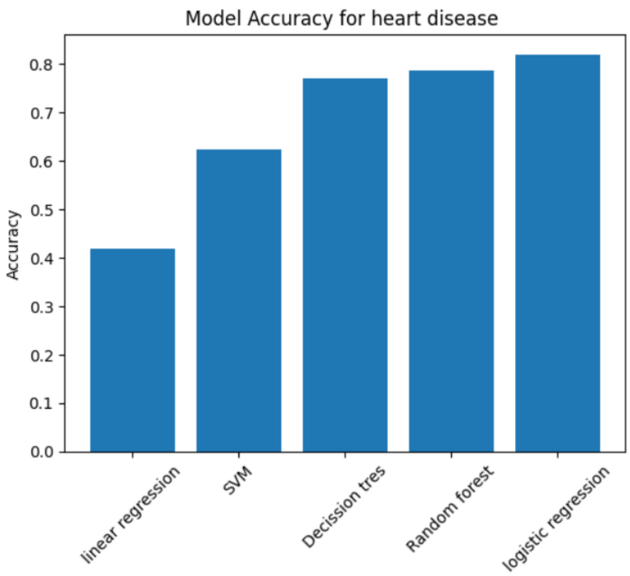
- **HTML/CSS/JS:**

  HTML (Hypertext Markup Language) provides the structure and content of a web page, CSS (Cascading Style Sheets) is used to control the presentation and layout of web pages, enabling designers to style and format HTML elements, JavaScript adds interactivity and dynamic functionality to web pages.

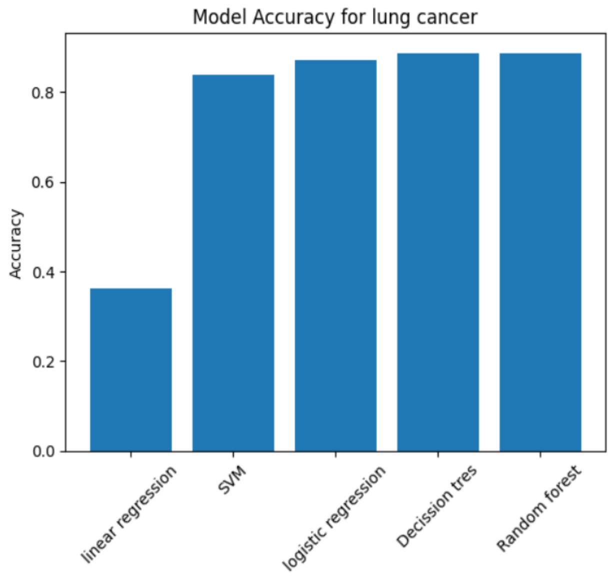
Chapter 6

Results and Discussion

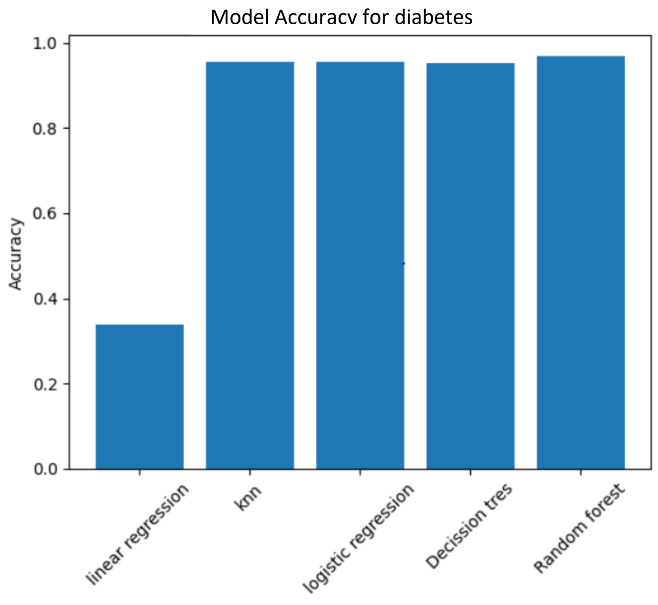
After comparing all five-machine learning algorithm including linear regression, SVM, Decision Tree, Random Forest, and Logistic Regression, it has been observed that Logistic Regression gives higher accuracy for heart disease prediction than other algorithm. And for lung cancer and diabetes Prediction random forest gives higher accuracy for prediction than other algorithms. For brain Tumour detection CNN provides better classification than other deep learning algorithm.

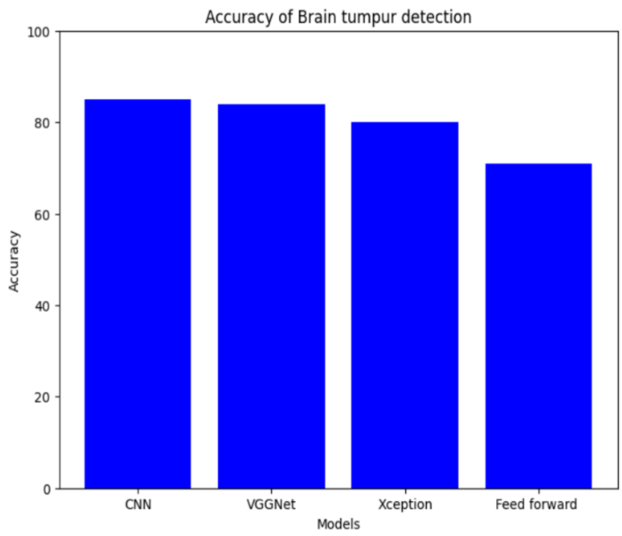


6.1 Model Accuracy for Heart Disease



6.2 Model Accuracy for Lung Cancer





6.3 Model Accuracy for Diabetes **6.4 Model Accuracy for Brain Tumour**

6.4 ML Model Accuracy Table

Disease	Linear Regression	Logistic Regression	SVM	Random Forest	Decision Tree	KNN
Heart Disease	41%	**81%**	62%	78%	77%	-
Lung Cancer	36%	87%	83%	**88.79%**	88.70%	-
Diabetes	33%	94%	-	**96.9%**	95.14%	95%

6.4 ML Model Accuracy Table

6.5 DL Model Accuracy Table

Disease	CNN	VGGNet	Xception	Feed-Forward
Brain Tumour	**85%**	84%	80%	71%

6.5 DL Model Accuracy Table

Chapter 7

Conclusion and Future Work

In conclusion, the Integrated Healthcare Prognosis project has successfully developed a single platform to detect heart disease, lung cancer, diabetes, and brain Tumour using machine learning and deep learning algorithms. The system is able to generate personalized precaution lists for patients, which can be sent to them via SMS. The system was developed using Flask to connect the frontend (HTML, CSS, JS) with the backend (Python).

In the future, the Integrated Healthcare Prognosis system could be expanded to detect more diseases, improve its accuracy, develop a mobile app, integrate with electronic health records, use deep learning to develop new algorithms, and provide personalized treatment recommendations. These improvements would make the system more comprehensive, accessible, and effective, helping to improve healthcare for a wider range of patients.

References

[1] Sonia Kukreja, Munish Sabharwal, Mohd Asif Shah, D. S. Gill, "A Heuristic Machine Learning-Based Optimization Technique to Predict Lung Cancer Patient Survival", *Computational Intelligence and Neuroscience*, vol. 2023, Article ID 4506488, 9 pages, 2023. https://doi.org/10.1155/2023/4506488

[2] C. Thallam, A. Peruboyina, S. S. T. Raju and N. Sampath, "Early Stage Lung Cancer Prediction Using Various Machine Learning Techniques," 2020 4th International Conference on Electronics, Communication and Aerospace Technology (ICECA), Coimbatore, India, 2020, pp. 1285-1292, doi: 10.1109/ICECA49313.2020.9297576.

[3] S. Shanthi and N. Rajkumar, "Lung Cancer Prediction Using Stochastic Diffusion Search (SDS) Based Feature Selection and Machine Learning Methods," *Neural Process Lett*, vol. 53, no. 4, pp. 2617–2630, Aug. 2021, doi: 10.1007/s11063-020-10192-0.

[4] A. Saboor, M. Usman, S. Ali, A. Samad, M. F. Abrar, and N. Ullah, "A Method for Improving Prediction of Human Heart Disease Using Machine Learning Algorithms," *Mobile Information Systems*, vol. 2022, 2022, doi: 10.1155/2022/1410169.

[5] Abdulaziz Albahr, Marwan Albahar, Mohammed Thanoon, Muhammad Binsawad, "Computational Learning Model for Prediction of Heart Disease Using Machine Learning Based on a New Regularizer", *Computational Intelligence and Neuroscience*, vol. 2021, Article ID 8628335, 10 pages, 2021. https://doi.org/10.1155/2021/8628335

[6] M. Saw, T. Saxena, S. Kaithwas, R. Yadav and N. Lal, "Estimation of Prediction for Getting Heart Disease Using Logistic Regression Model of Machine Learning," 2020 International Conference on Computer Communication and Informatics (ICCCI), Coimbatore, India, 2020, pp. 1-6, doi: 10.1109/ICCCI48352.2020.9104210.

[7] A. C. Lyngdoh, N. A. Choudhury and S. Moulik, "Diabetes Disease Prediction Using Machine Learning Algorithms," 2020 IEEE-EMBS Conference on Biomedical Engineering and Sciences (IECBES), Langkawi Island, Malaysia, 2021, pp. 517-521, doi: 10.1109/IECBES48179.2021.9398759.

[8] S. Sivaranjani, S. Ananya, J. Aravinth and R. Karthika, "Diabetes Prediction using Machine Learning Algorithms with Feature Selection and Dimensionality Reduction," 2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, India, 2021, pp. 141-146, doi: 10.1109/ICACCS51430.2021.9441935.

[9] A. M. Posonia, S. Vigneshwari and D. J. Rani, "Machine Learning based Diabetes Prediction using Decision Tree J48," 2020 3rd International Conference on Intelligent Sustainable Systems (ICISS), Thoothukudi, India, 2020, pp. 498-502, doi: 10.1109/ICISS49785.2020.9316001.

[10] Lu, D., Polomac, N., Gacheva, I., Hattingen, E., & Triesch, J. (2021). Human-Expert-Level Brain Tumour Detection Using Deep Learning with Data Distillation And

Augmentation. ICASSP 2021 - 2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP). doi:10.1109/icassp39728.2021.9415

[11] S. Kumar, R. Dhir and N. Chaurasia, "Brain Tumour Detection Analysis Using CNN: A Review," 2021 International Conference on Artificial Intelligence and Smart Systems (ICAIS), Coimbatore, India, 2021, pp. 1061-1067, doi: 10.1109/ICAIS50930.2021.9395920.

[12] Y. Bhanothu, A. Kamalakannan and G. Rajamanickam, "Detection and Classification of Brain Tumour in MRI Images using Deep Convolutional Network," 2020 6th International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, India, 2020, pp. 248-252, doi: 10.1109/ICACCS48705.2020.9074375.

Acknowledgement

Today, we cannot find appropriate words that will express a deep sense of gratitude and satisfaction. We are indebted to our inspiring guide **Ms. Shraddha More** who has extended all valuable guidance, helping and giving constant encouragement through various difficult stages of the development of the project. We express our sincere gratitude to our respected principal **Dr.G.V. Mulgund** for the encouragement and facilities provided to us. We would also like to acknowledge the patience that our ever-beloved parents have shown during our efforts and the encouragement we have received from them. Thus, we have fully obliged and convey our thanks to the **teaching and as well as non-teaching staff of the department**. Special thanks to all the **lab assistants** for helping us with problems developed in the lab and assisting, helping us to solve any problems generated on the spot. Last but not least we would like to thank all the direct and indirect identities of the college with whom we took strides for this successful project.