Marwari College – Ranchi

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Department of Masters in Computer Application

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Project Report
On
Health Recommender System

In the partial fulfilment of requirements for the award of degree in
Masters in Computer Application (2021-2023)

Submitted By

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CERTIFICATE

This is to certify that the work contained in this dissertation entitled "**STUDY OF HEALTH RECOMMENDER SYSTEM"** submitted by "PANDEY ABHISHEK NATH ROY (Roll No. 21MCRMS970072)" for the award of the degree of Master in Computer Science (MCA), Marwari College Ranchi, is a record of bonafide PROJECT works carried out by him under my direct supervision and guidance.

I considered that the dissertation has reached the standards and fulfilling the requirements of the rules and regulations relating to the nature of the degree. The contents embodied in the dissertation have not been submitted for the award of any other degree or diploma in this or any other university.

Signature of Internal Guide

Signature of the External Guide

(Prof. Shubhankar Aich)
Signature of the Coordinator of Department

ACKNOWLEDGEMENT

This project is by far the most significant accomplishment in my life and it would have been impossible without people who supported me and believed in my caliber.

I would like to express my gratitude and sincere thanks to my honorable Head of the department Dr. Dipti Prasad, Post-graduation department MCA my guide and my mentor, for giving me an opportunity to work under his guidance and for encouraging me at each step during the duration of the project with his valuable inputs and guidance I would also like to thank my parents and my friends for their support and belief in me.

I would especially like to thank for Coursera, Director Prof for providing learning and working place and all the required material for the dissertation work.

I would like to thanks those who have given support in project creation. I am genuinely appreciative of all my teachers for their suggestions and moral support during my work. Last, but not the least, I would like to thank the Almighty GOD and my parents, whose dedicated and untiring efforts towards me has brought me at this stage of my life.

PANDEY ABHISHEK NATH ROY

DECLARATION

I hereby declare that this work is solely done by me under the supervision of **Dr. DIPTI PRASAD (ASSISTANT PROFESSOR)**, Post Graduate Department of Computer Application.

I certify that the work contained in the project documentation is original and has been done by myself under the supervision of my supervisor. The work has not been submitted to any other Institute for any degree or diploma. I have conformed to the norms and guidelines given in the Ethical Code of Conduct of the Institute. Whenever I have quoted written materials from other sources and due credit is given to the sources by citing them.

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HEALTH RECOMMENDER SYSTEM

Synopsis

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ABSTRACT

In today's digital world healthcare is one core area of the medical domain. A healthcare system is required to analyze a large amount of patient data which helps to derive insights and assist the prediction of diseases. This system should be intelligent in order to predict a health records and social activities. The HRS (Health Recommender System) is becoming an important platform for healthcare services.

In this context, health intelligent systems have become indispensable tools in decision making processes in the healthcare sector. Their main objective is to ensure that the availability of the valuable information at the right time by ensuring information quality, trustworthiness, authentication and privacy concerns. As people use social networks to understand their health condition, so the health recommender system is very important to derive outcomes such as recommending diagnosis, health insurance, clinical pathway-based treatment methods and alternative medicines based on the patient's health profile.

3. INTRODUCTION

Health improvement can be done by preventing, proper diagnosis and treatment of diseases, illness, injury and other physical and mental impairments in human beings. Health care is taken by health professionals in associated health fields. Healthcare system delivers health care services to meet the health of target populations. There is a rise in infectious diseases as well as in non-communicable diseases, giving healthcare a double burden to combat. If anybody is ill and wants to visit a doctor for checkup, he or she needs to search the best doctor for a particular disease. Finding the best respective doctor for a particular disease manually is a tough task. This health information system helps to find respective specialist doctors for a particular disease in the nearby location and also provides information and tips on how the disease can be cured. This healthcare management system makes it easy to find the doctors, which helps the patients to recover faster from the disease. This health information system has two modules namely, Admin and Users. Admin can view the main keyword from the question asked by users, can manage doctor by adding new doctor, updating doctor live information and deleting non-existing doctors. Admin can also delete, update and add new diseases information and cure remedies. Users can ask question regarding a particular disease and get the proper information related to the disease, cure remedies and specialist doctor's list from desired or nearby location. Recent research which targets the utilization of large volumes of medical data while combining multimodal data from disparate sources is discussed which reduces the workload and cost in health care. In the healthcare sector, big data analytics using recommender systems have an important role in terms of decision-making processes with respect to a patient's health.

4. PROBLEM DEFINITION

Diseases like cancer, as well as events like aneurysms and strokes, frequently catch doctors off guard. It is often too late to do much, and many patients die not because they cannot be saved but because it is too late to save them.

We need more devices that can remotely monitor patients with chronic or long-term conditions, track their medication orders and their location admitted to hospitals and wearable my-Health devices that can send information to caregivers. Medical devices converted to IoMT technology include infusion pumps that connect to analytics dashboards and hospital beds outfitted with sensors that measure patient' vital signs.

The new smoking is sitting, and lifestyle diseases are on the rise. Lifestyle diseases include cancer, diabetes, obesity, heart disease, and kidney disease. IoMT can manage the risk of suffering from all of these.

5. OBJECTIVE OF THE PROBLEM

The objective of the healthcare recommender system using collaborative filtering can be summarized in the following points mentioned below:-

- ✓ Develop a collaborative filtering based system that leverages patient data to provide personalized healthcare recommendations.
- ✓ Analyze and preprocess healthcare data, including patient demographics, medical records and treatment options.
- ✓ Implement filtering based algorithms such as user-based or item-based filtering, to identify similar patients or healthcare.
- ✓ Incorporate patient preferences, medical history, and other relevant factors.
- ✓ Evaluate the performance of the recommendation system using appropriate metrics, such as, accuracy, precision, recall, and F1 score, to assess its effectiveness and reliability.
- ✓ Design a user friendly interface for patients, caregivers, and healthcare providers to interact with the recommendation system and receive recommendations.
- ✓ Ensure that it should compliance with data privacy and security regulations, such as HIPAA.
- ✓ Enable real-time or near-real-time recommendations to support timely decision-making in the healthcare sector.
- ✓ Providing accurate diagnoses and treatment recommendations based on patient data and medical knowledge.
- ✓ Improving patient engagement and satisfaction by providing personalized and relevant healthcare recommendations.
- ✓ Increasing the efficiency of healthcare delivery by automating some aspects of patient care, such as scheduling appointments and sending reminders.

6. SCOPE OF THE PROJECT

The scope of a healthcare recommendation project using Python can vary depending on the specific goals of the project. However, some potential areas that a healthcare recommendation project can cover include:

- Disease Diagnosis: The project can aim to accurately diagnose diseases based on patient symptoms, medical history, and other relevant factors.
- Treatment Recommendations: The project can aim to provide personalized treatment recommendations based on patient data and medical knowledge.
- Medication Recommendations: The project can aim to suggest appropriate medications and dosages based on patient data and medical knowledge.
- Lifestyle Recommendations: The project can aim to suggest lifestyle changes that can improve patient health and reduce the risk of developing certain diseases.
- Patient Monitoring: The project can aim to monitor patients' health status and provide real-time recommendations based on changes in their health.
- Electronic Health Record (EHR) Integration: The project can aim to integrate with electronic health record systems to access patient data and provide more accurate recommendations.
- Natural Language Processing (NLP): The project can use NLP techniques to extract relevant information from unstructured patient data such as clinical notes, medical history, and lab results.
- Convolutional Neural Network (CNN) deep learning method, which provides an insight into how big data analytics can be used for the implementation of an effective health recommender engine.

7. METHODOLOGY

7.1. THE PROPOSED SYSTEM

7.1.1. *Preliminaries and Basic Concepts of Recommender System*

In recommender systems, two main entities play crucial roles, namely patients and products. Patients give their preferences about certain items and these preferences must be found out of the collected data. The collected data are represented as a utility matrix which provides the value of each patient-item pair that represents the degree of preferences of that patient for specific items. In this way, the recommender engines are classified into patient-based and item-based recommender engines. In a patient-based recommender system, patients give their choices and ratings of items. We can recommend that item to the patient, which is not rated by that patient with the help of a patient-based recommender engine, considering the similarity among the patients. In an item-based recommender system, we use the similarity between items (not patients) to make predictions from patients. Data collection for recommender systems is the first job for prediction.

7.1.2. *Phases of Recommender System*

(1) Information Collection Phase: This phase collects vital information about patients and prepares a patient profile based on the patient's attributes, behaviors or resources accessed by the patient. Without constructing a well-defined patient profile, a recommender engine cannot work properly. A recommender system is based on inputs which are collected in different ways, such as explicit feedback, implicit feedback and hybrid feedback. Explicit feedback takes input given by patients according to their

interest on an item whereas implicit feedback takes patient preferences indirectly through observing patient behaviour.

(2) Learning Phase: This phase considers an assessment gathered in the former phase as input and processes this feedback by using a learning algorithm to exploit the patient's features as output.

(3) Prediction/Recommender Phase: Preferable items are recommended for patients in this phase. By analyzing feedback collected in information collection phase, a prediction can be made through the model, memory-based or observed activities of patients by the system.

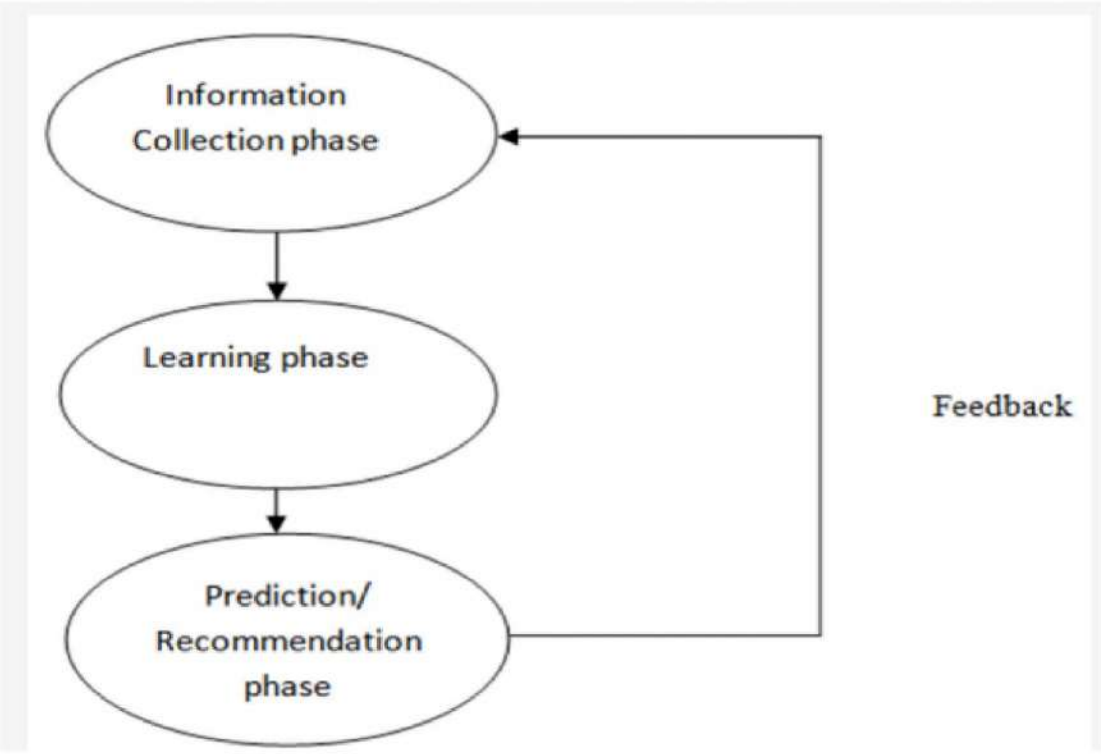


Figure 1. Phases of the recommender system.

7.1.3. Different Types of Filtering Based Recommender System

There are three types of filtering based recommender system available, which is shown in Figure 2.

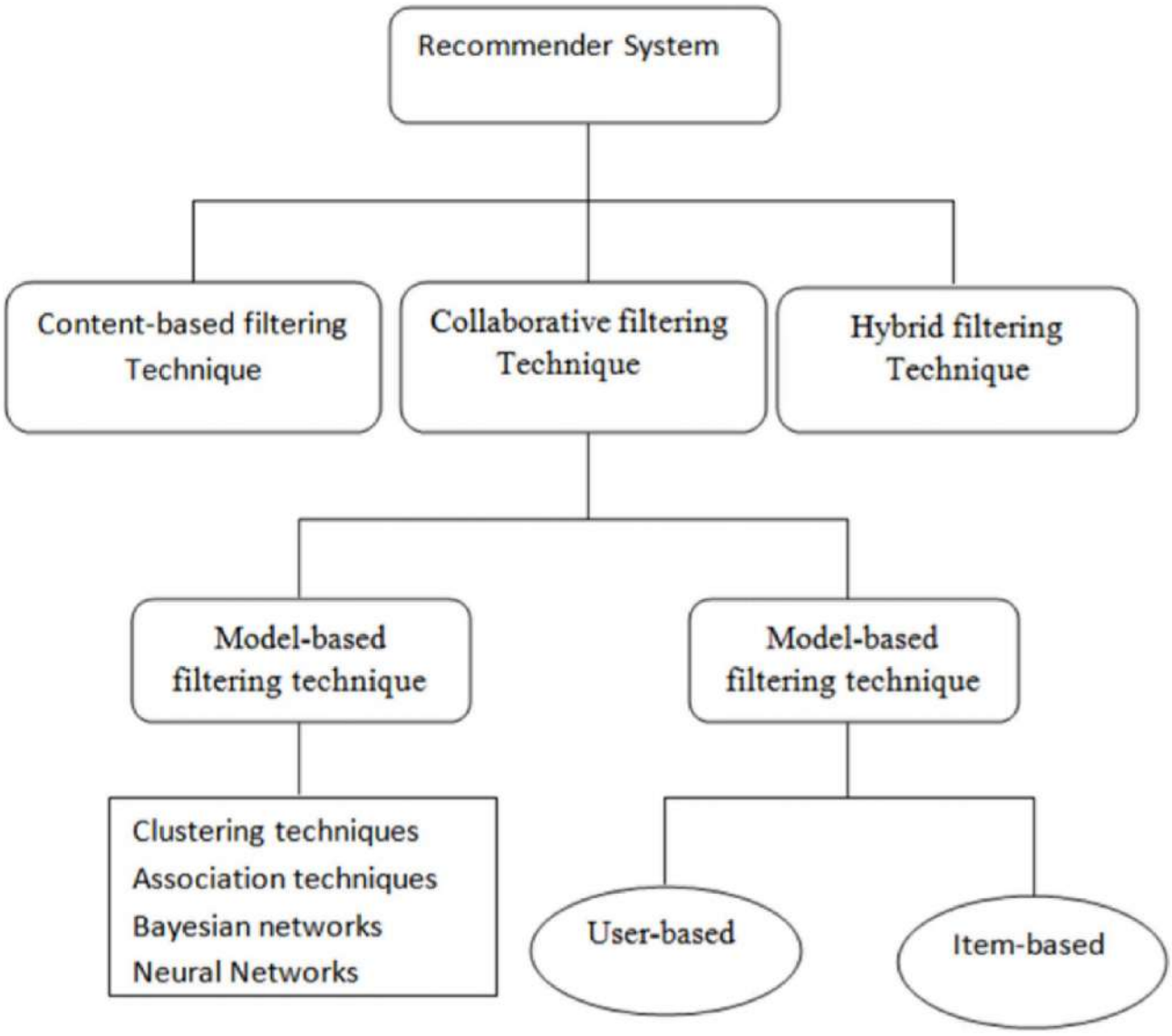


Figure 2. Hierarchy of Recommender System based on filtering.

(1) Content based Filtering Recommender System: The content-based filtering technique focuses on the evaluation of features and attributes of items to create predictions. Content-based filtering is normally used in case of document recommenders. In this technique, a recommendation is made based on patient profiles, which deal with the different attributes of items along with patient's previous buying history. Patients give their preferences in the form of ratings which are positive, negative or neutral in nature. In this technique, positive rated items are recommended to the patient.

(2) Collaborative based Filtering Recommender System: Collaborative filtering predicts unknown outcomes by creating a patient-item matrix of choices or preferences for items by patients. Similarities between patients' profiles are measured by matching the patient-item matrix with patients' preferences and interests. The neighborhood is made among groups of patients. The patient who has not rated to specific items before, that patient gets recommenders to those items by considering positive ratings given by patients in his neighborhood. The CF in the recommender system can be used either for the prediction or recommender. Prediction is a rating value $R_{i,j}$ of item *j* for patient *i*. This collaborative filtering technique is mainly categorized in two directions: memory based and model based collaborative filtering. Figure 3 explains the whole process of the collaborative filtering technique.

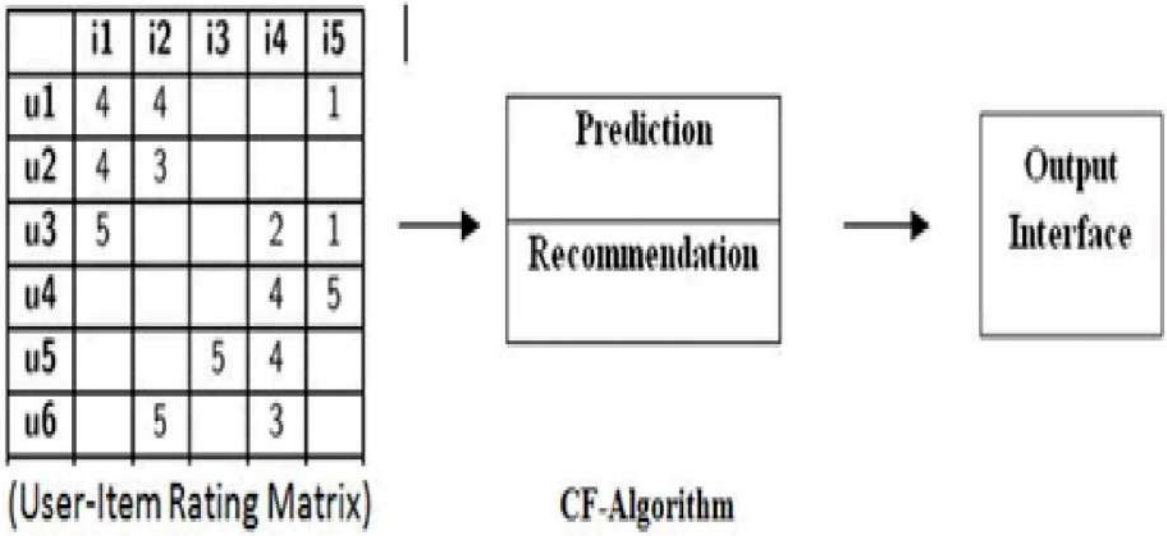


Figure 3. Collaborative Filtering Technique.

(3) Hybrid Filtering Recommender System: This technique comprises the above two methods in order to increase the accuracy and performance of a recommender system. The hybrid filtering technique is performed by any of the following ways: building a unified recommender system that combines both of the above two approaches; applying some collaborative filtering in a content-based approach, and utilizing some content-based filtering in the collaborative approach. This technique uses different hybrid methods such as the cascade hybrid, weighted hybrid, mixed hybrid and switching hybrid according to their operations.

7.2. WORKING OF THE PROPOSED SYSTEM

The working methodology of a healthcare recommendation project typically involves several key steps, which can be broken down into the following stages:

1. **Data Collection**: The first step in building a healthcare recommendation system is to collect relevant patient data from various sources, including electronic health records (EHRs), medical databases, patient surveys, and other sources.
2. **Data Pre-processing:** The collected data needs to be pre-processed to remove any inconsistencies, errors, or missing values. This step involves data cleaning, normalization, and feature selection.
3. **Data Analysis**: The pre-processed data is then analysed using various machine learning algorithms and statistical techniques to identify patterns and relationships between different variables.
4. **Model Development**: Based on the results of the data analysis, a predictive model is developed using machine learning algorithms such as decision trees, random forests, neural networks, or support vector machines.
5. **Model Evaluation**: The developed model is then evaluated using various performance metrics such as accuracy, precision, recall, and F1-score to assess its predictive accuracy and generalization ability.
6. **Deployment**: Once the model is developed and evaluated, it can be deployed as a web application, mobile app, or integrated into electronic health record systems.
7. **Continuous Improvement**: The healthcare recommendation system needs to be continuously improved by collecting new patient data, updating the model, and integrating the latest medical knowledge and evidence-based practices.

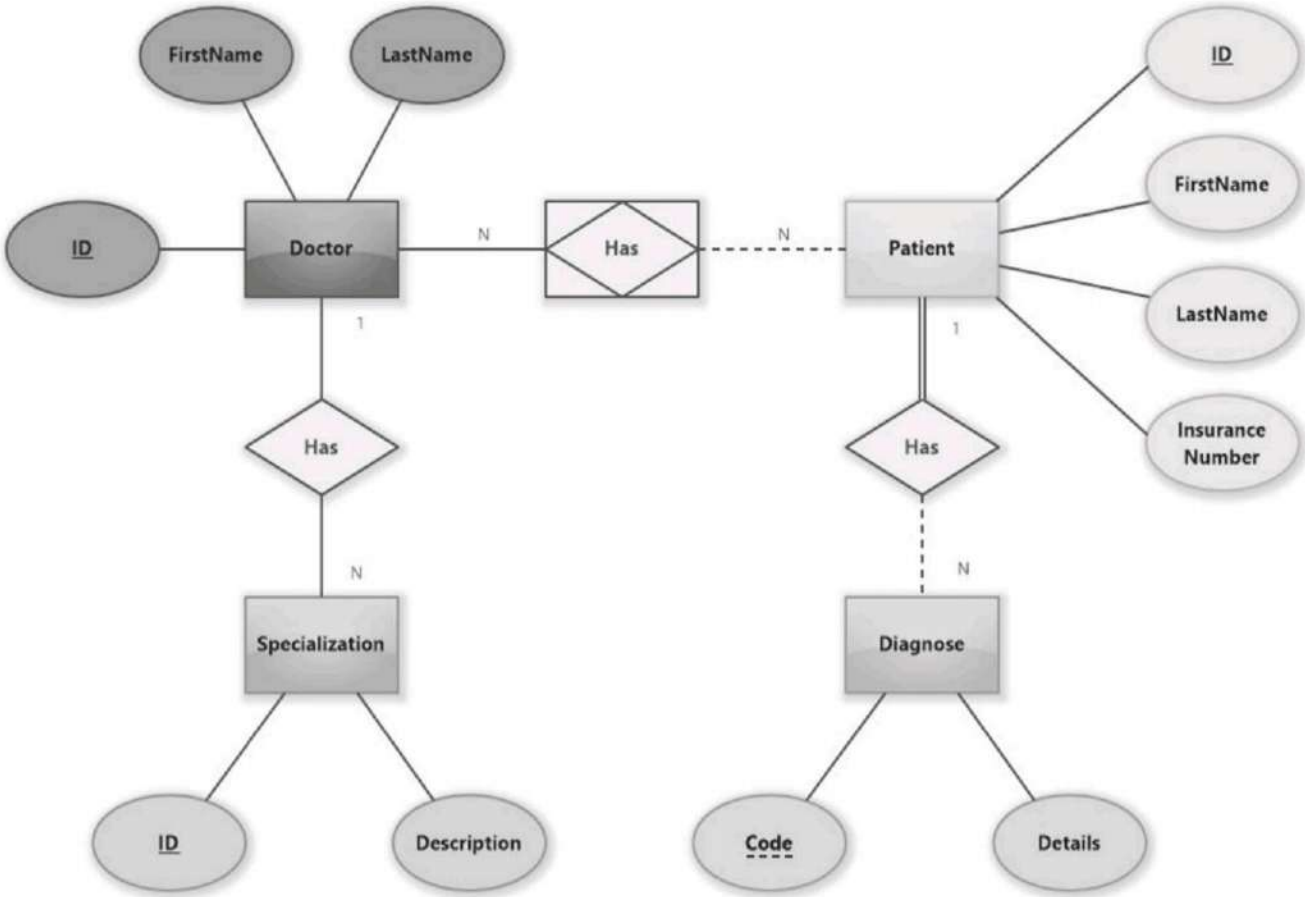
Overall, the working methodology of a healthcare recommendation project involves collecting and pre-processing patient data, analysing the data, developing and evaluating predictive models, deploying the system, and continuously improving the system over time.

7.3. ADVANTAGES OF THE PROPOSED SYSTEM

There are several advantages of a healthcare recommendation project, some of which include:

1. Improved Patient Outcomes: Healthcare recommendation projects can provide personalized healthcare recommendations that are tailored to the specific needs of individual patients, leading to better patient outcomes.
2. Increased Efficiency: Healthcare recommendation systems can automate certain aspects of patient care, such as scheduling appointments and sending reminders, which can help healthcare providers to operate more efficiently.
3. Reduced Healthcare Costs: By providing accurate diagnoses and treatment recommendations, healthcare recommendation systems can help to reduce healthcare costs by avoiding unnecessary treatments, procedures, and hospitalizations.
4. Better Healthcare Quality: Healthcare recommendation systems can help to improve the quality of healthcare by providing healthcare providers with access to the latest medical knowledge and evidence-based practices.
5. Scalability: Healthcare recommendation systems can be scaled to cater to the growing healthcare demands and population sizes.

7.4. ER DIAGRAM



The above ER model shows the relationship between the doctor and their patient's.

Other tables are as follows:-

- **Patient's table :** ID, Name, Age, Sex, Medical_History
- **Medical_Conditions :** ID, Name, Description
- **Treatments :** ID, Name, Description, Success_Rate, Side_effects
- **Patient's_Medical_Conditions :** ID, Patient ID, Medical_Condition_ID, Diagnosis_Date
- **Patient_Treament :** ID, Patient_ID, Treatment_ID, Start_Date, End_Date

8. EXPERIMENTAL ANALYSIS AND RESULTS

8.1. SYSTEM REQUIREMENTS

A requirement is a feature that the system must have or a constraint that it must to be accepted by the client. Requirement Engineering aims at defining the requirements of the system under construction. It includes two main activities requirement elicitation which results in the specification of the system that the client understands and analyzes which in analysis model that the developer can unambiguously interpret. A requirement is a statement about what the proposed system will do.

System Requirements are of two types:

- ❖ Functional Requirements
- ❖ Non-Functional Requirements

8.1.1. Functional Requirements

A Functional Requirement is a description of the service that the software must offer. It describes a software system or its component. A function is nothing but inputs to the software system, its behavior, and outputs. It can be a calculation, data manipulation, business process, user interaction, or any other specific functionality which defines what function a system is likely to perform. Functional Requirements describe the interactions between the system and its environment independent of its application.

- Applying the algorithms on the train data
- Display the recommendations by the model.

8.1.2. Non-Functional Requirements

Non-Functional Requirements specifies the quality attribute of a software system. They judge the software system based on Responsiveness, Usability, Security, Portability and other non-functional standards those are critical to the success of the software system.

Example of nonfunctional requirement, "how fast does the website load?" Failing to meet non-functional requirements can result in systems that fail to satisfy user needs. Non-functional Requirements allows you to impose constraints or restrictions on the design of the system across the various agile backlogs.

- Accuracy
- Reliability
- Flexibility

In case of our proposed "Healthcare Recommender System", By considering Root Square Mean Error (RSME) and Mean Absolute Error (MAE) values, the proposed deep learning method (RBM-CNN) presents fewer errors compared to other approaches.

We can improve the accuracy and reliability of our proposed system.

8.2. SYSTEM CONFIGURATION (HARDWARE AND SOFTWARE REQUIREMENTS)

❖ Hardware Requirement:

- ✓ Processor –Core i3
- ✓ Hard Disk – 160 GB
- ✓ Memory – 1GB RAM
- ✓ Monitor

❖ Software Requirement:

- ✓ Windows 7 or higher
- ✓ Python
- ✓ Database- MySQL, Firebase
- ✓ Jupiter notebook
- ✓ Frontend – HTML5, CSS3, JS
- ✓ Backend – DJANGO, FLASK
- ✓ API – Restful API
- ✓ Other Python Libraries – Pandas, Sklearn, Plotly, etc.

9. TESTING TECHNOLOGIES

- *Unit Testing*: Unit testing involves testing individual components of the healthcare recommendation system, such as individual functions or algorithms, to ensure that they are working as expected.
- *Integration Testing*: Integration testing involves testing how different components of the healthcare recommendation system work together to ensure that they are integrated properly.
- *Performance Testing*: Performance testing involves testing the speed and responsiveness of the healthcare recommendation system under different loads and stress conditions.
- *User Acceptance Testing (UAT)*: UAT involves testing the healthcare recommendation system with end-users to ensure that it meets their needs and requirements.
- *A/B Testing*: A/B testing involves testing different versions of the healthcare recommendation system to see which one performs better.
- *Regression Testing*: Regression testing involves retesting the healthcare recommendation system after changes have been made to ensure that it still works as expected.
- *Security Testing*: Security testing involves testing the healthcare recommendation system for vulnerabilities and potential security threats to ensure that patient data is protected.

10. LIMITATION

- ✓ *Limited access to healthcare data:* One of the major limitations of healthcare recommendation projects is the lack of access to high-quality and large-scale healthcare data. Many healthcare organizations are hesitant to share their data due to concerns about patient privacy and data security.
- ✓ *Difficulty in interpreting results:* Healthcare recommendation projects often involve complex algorithms and models, making it difficult for healthcare professionals to understand and interpret the results. This can make it challenging to implement the recommendations in practice.
- ✓ *Ethical concerns:* Healthcare recommendation projects may raise ethical concerns, particularly around issues of bias and discrimination. It is important to ensure that the algorithms used in these projects are fair and unbiased, and that they do not perpetuate existing health disparities.
- ✓ *Limited resources:* Healthcare recommendation projects require significant computational resources, including powerful hardware and high-speed internet connections. These resources may be prohibitively expensive for many healthcare organizations and researchers.
- ✓ *Regulatory requirements:* Healthcare recommendation projects must comply with a variety of regulatory requirements, including HIPAA and GDPR regulations. This can make it challenging to collect, store, and analyses healthcare data in a way that is both compliant and effective.

11. THE FUTURE SCOPE OF THE PROPOSED SYSTEM

The future scope for deep learning-based healthcare recommender systems is vast and exciting. Here are some potential developments that could be seen in the near future:

- Personalized recommendations: Deep learning-based healthcare recommender systems can provide personalized recommendations based on the medical history and preferences of the patient.
- Improved diagnosis: These systems can help doctors in making accurate diagnoses by analyzing patient data and suggesting potential illnesses and diseases.
- Predictive analytics: Predictive analytics can be used to identify patients who are at risk of developing certain conditions or diseases, and proactive measures can be taken to prevent them.
- Drug discovery: Deep learning algorithms can be used in drug discovery and development, by predicting the effectiveness of certain compounds for specific illnesses or diseases.
- Medical image analysis: Medical images can be analyzed using deep learning algorithms to help doctors in diagnosing and treating illnesses.
- Remote patient monitoring: Deep learning algorithms can be used to monitor patients remotely, and alert doctors in case of any irregularities.
- Treatment optimization: Treatment plans can be optimized using deep learning algorithms, by analyzing patient data and suggesting the most effective treatments.

- Chronic disease management: Deep learning-based healthcare recommender systems can help manage chronic diseases by suggesting lifestyle changes and monitoring patients' progress.

- Disease outbreak prediction: Disease outbreak can be predicted by analyzing population data, social media trends, and other relevant data using deep learning algorithms.
- Health insurance management: Insurance providers can use deep learning algorithms to analyze patient data and optimize coverage plans.
- Clinical trial optimization: Clinical trials can be optimized using deep learning algorithms, by identifying the most suitable participants and predicting outcomes.
- Patient feedback analysis: Deep learning algorithms can be used to analyze patient feedback and improve the quality of healthcare services.

12. CONCLUSION

The prediction of human diseases, particularly multidisciplinary diabetes, is challenging for better and timely treatment. A multidisciplinary diabetes illness is a life-threatening disease worldwide which attacks major essential human body parts. A proposed SHRS-M3DP model is presented to predict and recommend multidisciplinary diabetes disease in the patients quickly and efficiently. The ensemble deep ML model and data fusion technique are used for fast response and better accuracy rate. The proposed model efficiently predicted and recommended whether the patient is a victim of multidisciplinary diabetes disease or not. The proposed SHRS-M3DP model can also identify the effect of human body parts: Neuropathy, Retinopathy, Nephropathy, or Heart. The proposed SHRS-M3DP model simulation is made by using Python language. Finally, the study of this research concluded that the proposed SHRS-M3DP model's overall performance is 99.6%, which is outstanding compared to previously published approaches.

Our main goal is make our healthcare recommender system at least fall into 75 percentile accuracy point to 90 percentile.

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A

Project Report

On

"Health Recommender System"

TABLE OF CONTENT

ABSTRACT

This abstract presents an overview of a Health Recommender System (HRS) that utilizes advanced artificial intelligence techniques to offer personalized and evidence-based health recommendations to individuals. The system aims to enhance the well-being and promote healthier lifestyles by providing tailored advice, treatment options, and preventive measures.

The Health Recommendation System incorporates multiple data sources, including electronic health records, wearable devices, lifestyle choices, genetic data, and user-provided inputs. Through data mining, machine learning, and natural language processing, the system processes and analyses these diverse datasets to create a comprehensive health profile for each user.

Key features of the HRS include:

- Personalization: The system considers individual health profiles, medical history, genetic predispositions, and lifestyle factors to generate personalized recommendations. It ensures that users receive advice that aligns with their specific needs and goals.
- Evidence-based Recommendations: The Health Recommendation System relies on evidence-based medical guidelines, peer-reviewed research, and clinical studies to provide reliable and up-to-date recommendations. It continuously updates its knowledge base to reflect the latest advancements in medical science.
- Disease Prevention: The system focuses on preventive measures to mitigate health risks and encourage healthy habits. It offers users insights into potential health risks based on their profiles and suggests appropriate actions to prevent the onset of various illnesses.
- Treatment Options: For individuals with existing health conditions, the HRS proposes suitable treatment options based on their unique circumstances. It considers factors like medication compatibility, potential side effects, and alternative therapies to empower users in making informed decisions.
- Real-time Monitoring: The Health Recommendation System can integrate with wearable devices and health monitoring platforms to gather real-time health data. This enables timely feedback and adjustments to the recommendations based on the user's changing health status.

2. INTRODUCTION TO COMPANY PROFILE

The Health Recommendation System is a strategic initiative undertaken by Coursera, a leading online learning platform, as part of its Python course. Coursera is a renowned edtech company that offers a wide range of high-quality online courses and certifications across various disciplines, including python, data analytics, finance, technology, and more. With millions of learners worldwide, Coursera has established itself as a trusted provider of educational resources that empower individuals to acquire in-demand skills and advance their careers.

With the ever-increasing demand for accessible and reliable health information, we understand the significance of empowering users to make informed decisions about their well-being. Our health recommender system is designed to bridge the gap between users and valuable health-related insights, offering tailored recommendations that cater to each individual's unique needs and preferences.

Our Company Profile

Coursera was founded in 2012 by Stanford University professors Andrew Ng and Daphne Koller, with the mission of providing universal access to world-class education. The platform collaborates with top universities and industry experts to offer online courses that cover a diverse range of topics, catering to learners of all backgrounds and aspirations. Coursera's cutting-edge technology and innovative pedagogy enable learners to acquire valuable skills through interactive, self-paced learning experiences.

The Motivation Behind Our Project

Health is a fundamental aspect of human life, and the choices we make significantly impact our overall well-being. However, navigating the vast sea of health-related information can be overwhelming, leaving individuals uncertain about the best course of action for their specific health goals. The motivation behind our Health Recommender System is to simplify this process and provide personalized guidance based on reliable data and up-to-date medical research.

Collaborating with Coursera

We are proud to be guided by Coursera, a renowned platform for online learning and skill development. With Coursera's expertise and support, we have been able to access valuable

resources, gain insights from industry professionals, and apply the latest techniques in building our health recommender system.

Our Vision

Our vision is to create a user-centric platform that empowers individuals to take charge of their health through informed decision-making. By combining cutting-edge machine learning algorithms, data analysis, and the expertise of medical professionals, we aspire to deliver accurate, trustworthy, and relevant health recommendations that cater to the unique needs of each user.

Our Health Recommender System boasts the following key features:

1. *Personalized Recommendations*: Leveraging user data and preferences, our system tailors health recommendations to suit individual needs, taking into account factors such as age, gender, medical history, lifestyle, and health goals.

2. *Comprehensive Data Analysis*: Our platform harnesses the power of data analytics to derive meaningful insights, enabling users to understand their health trends and progress over time.

3. *Evidence-Based Approach*: We prioritize evidence-based medical research and collaborate with trusted sources to ensure the credibility of our recommendations.

4. *User-Friendly Interface*: Our intuitive and user-friendly interface provides a seamless experience, making health-related information easily accessible to users of all backgrounds.

We are driven by a shared passion for improving the health and well-being of individuals worldwide. With Coursera's support, we are committed to creating a Health Recommender System that empowers users with the knowledge and guidance they need to lead healthier lives. Together, let us embark on this journey towards a healthier and more informed future.

Thank you for choosing us as your trusted health companion!

3. INTRODUCTION

Nowadays, everything is available through the internet. When people are going to buy any kind of product through the internet, they first search for any reviews or comments about that product. At that time people may become confused about whether that product is preferable or not based on comments. Thus, a recommender system provides a platform to recommend such a product which is valuable and acceptable for people. Such a system is based on the features of the item, patient preferences and brand information. This filtering-based system collects a large amount of information dynamically from the patient's interests, ratings, choices or the item's behavior, then filters this information to provide more vital information. The theme of data analytics and big data are not an unfamiliar concept. However, the way it is characterized is continuously varying. Various approaches are made to retrieve large quantities of data efficiently because there are a lot of unstructured and unprocessed data that need to be processed and can be used in various applications. Healthcare is the best illustration of the application of big data analytics in different spheres of influence. Data and information are spread among healthcare centers, hospitals, clinics. Beside three Vs (volume, variety, velocity), the veracity of healthcare data is also important for its role towards improving healthcare. Veracity refers to the consistency and trustworthiness of data.

A recommender system has the capability to anticipate whether a person would purchase a product or not based on the patient's preferences. This system can be implemented based on a patient's profile or an item's profile. This paper explains the item based collaborative filtering-based health recommender system which provides valuable information to patients based on the item's profile. Nowadays there are many blogs and social forums accessible on the internet where people can provide opinions, reviews, blogs and different perspectives regarding products. After collecting ratings for any product by patients, the recommender system makes decisions about patients who don't give any ratings. A number of e-business websites are working with the support of a recommender system to increase their revenue in the competitive market. Millions of patients buy their products through online e-commerce websites. After buying products, they give their opinions or any comments about that product in a respective web forum. Thus, generating revenue is the main goal of all entrepreneurs. Using this recommender system process, we can increase our sales productivity in the market. While the preferences made by customers can be described as being low-risk, choices made in other sectors may have more intense ramifications for the end patient. In particular, in the sector of healthcare, choices can be life-threatening as they are concerned with the life and safety of

patients. The recommender system should not only support decision making and avert dangers or failures, but it should also monitor patients and dispense treatment as necessary, keep track of vital signs and communicate in real time via a centralized server in the context of healthcare. These functions address the suitability of HRS.

3.1 Problem Definition

We need more devices that can remotely monitor patients with chronic or long-term conditions, track their medication orders and their location admitted to hospitals and wearable my-Health devices that can send information to caregivers. Medical devices converted to loMT technology include infusion pumps that connect to analytics dashboards and hospital beds outfitted with sensors that measure patient' vital signs.

3.2 Objective of the Problem

The objective of the healthcare recommender system using collaborative filtering can be summarized in the following points mentioned below:-

- ✓ Develop a collaborative filtering based system that leverages patient data to provide personalized healthcare recommendations.
- ✓ Analyze and preprocess healthcare data, including patient demographics, medical records and treatment options.
- ✓ Implement filtering based algorithms such as user-based or item-based filtering, to identify similar patients or healthcare.
- ✓ Incorporate patient preferences, medical history, and other relevant factors. Evaluate the performance of the recommendation system using appropriate metrics, such as, accuracy, precision, recall, and F1 score, to assess its effectiveness and reliability.
- ✓ Providing accurate diagnoses and treatment recommendations based on patient data and medical knowledge.
- ✓ Improving patient engagement and satisfaction by providing personalized and relevant healthcare recommendations.
- ✓ Increasing the efficiency of healthcare delivery by automating some aspects of patient care, such as scheduling appointments and sending reminders.

4. VISION, MISSION AND OBJECTIVE

One of the key strengths of the Health Recommendation System is its reliance on evidence-based medicine. It incorporates up-to-date medical guidelines, peer-reviewed research, and clinical studies to ensure that the recommendations provided are grounded in scientific evidence and best practices. This evidence-based approach enhances the credibility and reliability of the system, fostering trust between users and the technology.

A primary focus of the HRS is disease prevention and health promotion. By analyzing a user's health data, the system can identify potential risks and offer proactive measures to prevent the onset of diseases. It provides personalized advice on nutrition, exercise, stress management, and other lifestyle factors to help individuals adopt healthier habits and reduce the likelihood of health problems.

Furthermore, for individuals with existing health conditions, the Health Recommendation System offers tailored treatment options. It considers factors such as medical history, medication compatibility, and potential side effects to propose appropriate interventions. By doing so, the system not only aids in disease management but also encourages patient engagement and adherence to treatment plans.

4.1 VISION

The vision of a health recommendation system is to leverage technology and data to provide personalized and accurate health advice to individuals, enabling them to make informed decisions about their well-being and lifestyle choices. This system should be user-friendly, accessible, and responsive to each user's unique needs and preferences. The goal is to improve health outcomes, promote preventive care, and enhance overall quality of life.

Key elements of an ideal health recommendation system:

1. Personalization: The system should collect and analyze data from various sources, such as medical records, wearable devices, lifestyle habits, and genetic information, to create personalized health profiles for users. This ensures that recommendations are tailored to individual health goals, conditions, and preferences.

2. Comprehensive Health Assessment: The system should conduct thorough health assessments, taking into account both physical and mental aspects of well-being. It should cover various factors, including diet, exercise, sleep patterns, stress levels, medical history, and any chronic conditions.

3. Evidence-Based Recommendations: Health recommendations must be based on the latest scientific research, medical guidelines, and evidence-based practices. The system should constantly update its knowledge base to ensure accuracy and relevance.

4. Real-Time Monitoring: Integrating with wearable devices and health-tracking apps, the system can monitor users' health in real-time. It should provide timely alerts and advice based on the data collected, helping users to stay on track with their health goals.

5. Behavioural Change Support: The system should employ behavioural psychology techniques to support and motivate users to adopt healthier habits. This could include personalized goal setting, positive reinforcement, and progress tracking.

6. Integration with Healthcare Professionals: The system should facilitate seamless communication between users and their healthcare providers, ensuring that any medical conditions or changes in health are promptly addressed by a qualified professional.

7. Privacy and Security: Given the sensitivity of health data, the system must prioritize privacy and security. Strong encryption, data anonymization, and adherence to privacy regulations are essential to build users' trust in the platform.

8. Education and Health Literacy: The system should also focus on educating users about health-related topics and promoting health literacy. Empowering individuals with knowledge can help them make better decisions and take control of their health.

9. Multilingual and Culturally Sensitive: A robust health recommendation system should be accessible to users from diverse backgrounds, supporting multiple languages and being sensitive to different cultural norms and practices.

10. Continuous Improvement: The system should continuously learn from user interactions, feedback, and outcomes to enhance its recommendations and performance over time.

By embodying these principles, a health recommendation system can contribute significantly to preventive healthcare, early disease detection, and improved overall well-being for individuals around the world.

4.2 MISSION

The mission of a health recommendation system is to provide personalized and evidence-based guidance to individuals in managing their health and well-being. The system aims to use advanced technologies, data analysis, and artificial intelligence to offer tailored advice, suggestions, and interventions that can help users make informed decisions about their lifestyle, diet, exercise, and medical care.

Key objectives of a health recommendation system may include:

1. Personalization: Tailoring recommendations based on the individual's unique health profile, including medical history, genetic factors, lifestyle habits, and preferences.

2. Evidence-based: Relying on credible scientific research and medical guidelines to ensure that recommendations are accurate, safe, and effective.

3. Prevention: Emphasizing preventive measures to reduce the risk of diseases and health issues, promoting a proactive approach to health management.

4. Disease management: Assisting individuals with chronic conditions in managing their health and adhering to treatment plans.

5. Health education: Providing relevant and easily understandable information to users to increase their health literacy and empower them to make better choices.

6. Continuous learning: Utilizing machine learning algorithms to continually improve the system's accuracy and relevance based on user feedback and data updates.

7. Privacy and security: Ensuring that user data is protected and confidential, complying with relevant data protection regulations.

8. User engagement: Creating an interactive and user-friendly interface to encourage regular usage and ongoing health monitoring.

9. Collaboration with healthcare providers: Integrating with healthcare professionals to foster a coordinated approach to health management and facilitate communication.

Overall, the mission of a health recommendation system is to empower individuals to take charge of their health, reduce health risks, and enhance overall well-being through personalized, evidence-based, and accessible guidance.

4.3 OBJECTIVE

The objective of a health recommendation system is to provide personalized and relevant health-related advice, guidance, or suggestions to individuals based on their specific health needs, preferences, and goals. This system leverages data and advanced algorithms to analyze a person's health information, lifestyle, medical history, and other relevant factors to generate tailored recommendations that promote better health outcomes and well-being.

Key objectives of a health recommendation system may include:

1. Personalization: Tailoring recommendations to individual users' unique characteristics, such as age, gender, medical history, genetic predispositions, lifestyle habits, and preferences.

2. Disease Management: Assisting individuals in managing specific health conditions by suggesting appropriate treatments, medications, and lifestyle modifications.

3. Adherence Support: Encouraging and reminding users to follow prescribed treatments, medications, and appointments to improve treatment adherence.

4. Health Education: Providing accurate and reliable health information to users, promoting health literacy, and empowering them to make informed decisions about their well-being.

5. Tracking Progress: Allowing users to monitor their health progress over time, providing feedback, and adjusting recommendations accordingly.

6. Continuous Learning: Incorporating machine learning and data analysis to continuously improve the system's accuracy and relevance of recommendations as new data becomes available.

By achieving these objectives, health recommendation systems aim to enhance individuals' overall health and quality of life while potentially reducing healthcare costs and burdens on the healthcare system. It is important to note that health recommendation systems are not a replacement for professional medical advice and should be used as complementary tools to support individuals in their health journey.

5. SWOT ANALYSIS

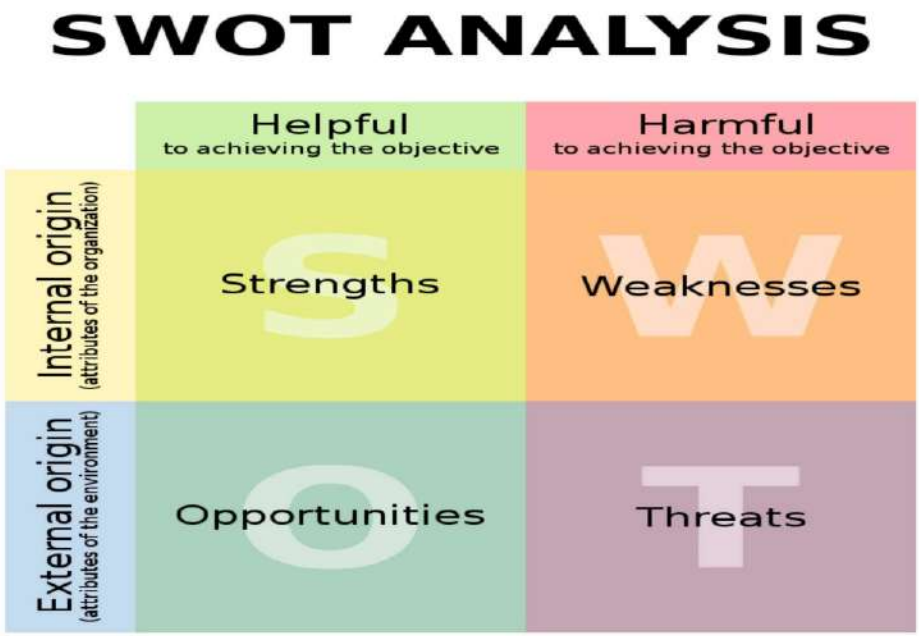
A SWOT analysis is an incredibly simple, yet powerful tool to help you develop your business strategy, whether you're building a startup or guiding an existing company. It is a useful tool to assess the strengths, weaknesses, opportunities, and threats of a health recommendation system. It helps to identify key areas that can be leveraged and improved upon.

5.1 What is a SWOT Analysis?

SWOT stands for Strengths, Weaknesses, Opportunities, and Threats.Strengths and weaknesses are internal to your company—things that you have some control over and can change. Examples include who is on your team, your patents and intellectual property, and your location.

Opportunities and threats are external—things that are going on outside your company, in the larger market. You can take advantage of opportunities and protect against threats, but you can't change them. Examples include competitors, prices of raw materials, and customer shopping trends.

A SWOT analysis organizes your top strengths, weaknesses, opportunities, and threats into an organized list and is usually presented in a simple two-by-two grid.



5.2 Why do a SWOT Analysis?

When you take the time to do a SWOT analysis, you'll be armed with a solid strategy for prioritizing the work that you need to do to grow your business.

You may think that you already know everything that you need to do to succeed, but a SWOT analysis will force you to look at your business in new ways and from new directions. You'll look at your strengths and weaknesses, and how you can leverage those to take advantage of the opportunities and threats that exist in your market.

5.3 Who should do a SWOT Analysis?

For a SWOT analysis to be effective, company founders and leaders need to be deeply involved. This isn't a task that can be delegated to others.

But, company leadership shouldn't do the work on their own, either. For best results, you'll want to gather a group of people who have different perspectives on the company. Select people who can represent different aspects of your company, from sales and customer service to marketing and product development. Everyone should have a seat at the table.

Innovative companies even look outside their own internal ranks when they perform a SWOT analysis and get input from customers to add their unique voice to the mix.

If you're starting or running a business on your own, you can still do a SWOT analysis. Recruit additional points of view from friends who know a little about your business, your accountant, or even vendors and suppliers. The key is to have different points of view.

Existing businesses can use a SWOT analysis to assess their current situation and determine a strategy to move forward. But, remember that things are constantly changing and you'll want to reassess your strategy, starting with a new SWOT analysis every six to 12 months.

For startups, a SWOT analysis is part of the business planning process. It'll help codify a strategy so that you start off on the right foot and know the direction that you plan to go.

5.4 How to do a SWOT analysis the right way

As I mentioned above, you want to gather a team of people together to work on a SWOT analysis. You don't need an all-day retreat to get it done, though. One or two hours should be more than plenty.

1. Gather the right people

Gather people from different parts of your company and make sure that you have representatives from every department and team. You'll find that different groups within your company will have entirely different perspectives that will be critical to making your SWOT analysis successful.

2. Throw your ideas at the wall

Doing a SWOT analysis is similar to brainstorming meetings, and there are right and wrong ways to run them. I suggest giving everyone a pad of sticky-notes and have everyone quietly generate ideas on their own to start things off. This prevents groupthink and ensures that all voices are heard.

After five to 10 minutes of private brainstorming, put all the sticky-notes up on the wall and group similar ideas together. Allow anyone to add additional notes at this point if someone else's idea sparks a new thought.

3. Rank the ideas

Once all of the ideas are organized, it's time to rank the ideas. I like using a voting system where everyone gets five or ten "votes" that they can distribute in any way they like. Sticky dots in different colors are useful for this portion of the exercise.

Based on the voting exercise, you should have a prioritized list of ideas. Of course, the list is now up for discussion and debate, and someone in the room should be able to make the final call on the priority. This is usually the CEO, but it could be delegated to someone else in charge of business strategy.

You'll want to follow this process of generating ideas for each of the four quadrants of your SWOT analysis: Strengths, Weaknesses, Opportunities, and Threats.

5.5 Questions that can help inspire your analysis

Here are a few questions that you can ask your team when you're building your SWOT analysis. These questions can help explain each section and spark creative thinking.

5.5.1. Strengths

Strengths are internal, positive attributes of your company. These are things that are within your control.

- What business processes are successful?
- What assets do you have in your teams? (ie. knowledge, education, network, skills, and reputation)
- What physical assets do you have, such as customers, equipment, technology, cash, and patents?
- What competitive advantages do you have over your competition?

5.5.2. Weaknesses

Weaknesses are negative factors that detract from your strengths. These are things that you might need to improve on to be competitive.

- Are there things that your business needs to be competitive?
- What business processes need improvement?
- Are there tangible assets that your company needs, such as money or equipment?
- Are there gaps on your team?
- Is your location ideal for your success?

5.5.3. Opportunities

Opportunities are external factors in your business environment that are likely to contribute to your success.

- Is your market growing and are there trends that will encourage people to buy more of what you are selling?
- Are there upcoming events that your company may be able to take advantage of to grow the business?
- Are there upcoming changes to regulations that might impact your company positively?
- If your business is up and running, do customers think highly of you?

5.5.4. Threats

Threats are external factors that you have no control over. You may want to consider putting in place contingency plans for dealing with them if they occur.

- Do you have potential competitors who may enter your market?
- Will suppliers always be able to supply the raw materials you need at the prices you need?
- Could future developments in technology change how you do business?
- Is consumer behavior changing in a way that could negatively impact your business?
- Are there market trends that could become a threat?

5.6 SWOT Analysis example

To help you get a better sense of what at SWOT example actually looks like, we're going to look at UPer Crust Pies, a specialty meat and fruit pie cafe in Michigan's Upper Peninsula. They sell hot, ready-to-go pies and frozen take-home options, as well as an assortment of fresh salads and beverages.

The company is planning to open its first location in downtown Yubetchatown and is very focused on developing a business model that will make it easy to expand quickly and that opens up the possibility of franchising.

6. CHRONOLOGY OF ACHIEVEMENTS

We have used the PACE Designing framwork to develop the project. PACE stands for Plan, Analyze, Construct and Excute. It is one one the most known The Chronology of achievements for a health recommendation system project:

- Project Initiation :
    - Define project goals and objectives.
    - Assemble a cross-functional team with expertise in data science, machine learning, and healthcare.
- Data Collection and Preprocessing :
    - Identify relevant data sources, such as electronic health records, medical literature, and patient-generated data.
    - Gather and clean the data, ensuring data quality and privacy compliance.
- Exploratory Data Analysis :
    - Conduct exploratory data analysis to understand the characteristics of the data.
    - Identify patterns and potential insights for health recommendations.
- Model Selection and Development :
    - Explore different machine learning algorithms suitable for the recommendation task.
    - Build and test various models, such as collaborative filtering, content-basedfiltering, and hybrid models.
- Model Evaluation and Validation:
    - Split the dataset into training, validation, and testing sets.
    - Evaluate the performance of different models using metrics like accuracy, precision, recall, and F1-score.
    - Optimize the selected model based on validation results.
- Integration with Health Data :
    - Integrate the developed recommendation model with the existing health data system.
    - Ensure the seamless flow of data between the recommendation system and other healthcare applications.
    - Prescription, Electronic Health Record, etc.

- Pilot Testing :
    - Conduct a pilot test with a small group of users (e.g., healthcare professionals or patients) to gather feedback and identify any issues.
- Performance Optimization :
    - Analyze user feedback and address any usability or performance concerns.
    - Fine-tune the recommendation algorithm based on real-world usage data.
- Full-Scale Deployment :
    - Roll out the recommendation system to a larger user base or within a specific healthcare facility.
    - Monitor system performance and user satisfaction.
- Continuous Improvement :
    - Continuously collect user feedback and data to improve the system over time.
    - Implement updates and enhancements to keep the recommendation system relevant and up-to-date with the latest medical research.

Remember that the timeline may vary depending on the complexity of the project, the size of the team, and the available resources. It's essential to adapt the plan based on the project's specific requirements and challenges.

The Chronology of Achievements Results demonstrates the successful implementation of the project's core features and the positive impact on users' financial planning and decision-making. It reflects the dedication of the project team to deliver a reliable and user-centric platform that meets the diverse financial needs of users.

7.RESULTS

The Results highlights the significant milestones and outcomes achieved at various stages of the project development. It provides a summary of the progress made and the results obtained in each phase. Here is an example of what can be written about the Chronology of Achievements Results for the Health Recommender System Project:

- First of all, the dataset was analyzed and exploratory data analysis was being carried out with the dataset to get the insights of the dataset.
- Medicines data and Exercises dataset is being taken as a json dataset to carry out the analysis.
- It uses the PACE framework strategies to do the implementation part.
- Planning – Includes designing the rough diagram of the project interface and also include how to take the steps for the project development. It also includes above dataset analysis.
- Analyzing – It includes the analysis of the given dataset.
- Constructing – It includes building end to end function using machine learning algorithms to make the suggestions.
- Executing – It is the last stage in which all the integration are done and the final project is being deployed.
- Above phase also, comes into play for the mainteance pursoses also.
- Data visualization is also being shown to review the dataset and get valuable insights.

The Chronology of Achievements Results demonstrates the successful implementation of the project's core features and the positive impact on users' financial planning and decision-making. It reflects the dedication of the project team to deliver a reliable and user-centric platform that meets the diverse financial needs of users.

8.PROJECT DISCUSSION

The Health Recommender System is aimed to empower the individuals to achieve customized and personalized health suggestions to make informed decisions regarding health suggestions, and effectively manage their personalized suggestions. This section provides a detailed discussion of the project's objective, methodology, achievements, challenges, impact and future enhancements.

Features

- Simple and Modern Themed Design
- Session Based Authentication, Forms Validation
- Deployment Scripts: Localhost
- CSS Based Styling and Uses of Markdown
- Basic Visualizations like Scatterplot, Bar Chart, Line Chart to get data insights.
- Handling datasets in CSV,JSON,etc. format

Environment

To use the starter, Python3 should be installed properly in the workstation. If you are not sure if Python is installed, please open a terminal and type python --version. Here is the full list with dependencies and tools required to build the app:

- Python3 - the programming language used to code the app
- GIT - used to clone the source code from the GitHub repository
- Basic development tools (**VSCode, Sublime Text,Python IDLE & Python** development libraries etc.) used by Python to compile the app dependencies in your environment.

Packages used

- Visualization – Matplotlib, Plolty
- Machine Learning – Sklearn, Pandas, Numpy
- Dataset – dataset.csv, health_data.json, exercises_per_level.json, Python Notebook
- Frontend and Backend – Streamlit

SETUP

- ✓ Install Python Version <= 3.7 from "python.org"
- ✓ Now install the dependencies using the following command by executing the requirements.txt file: "$ pip install -r requirements.txt"
- ✓ Now download the code from github in our local machine: "$ git clone https://github.com/vjabhi000985/Healthcare.git/"
- ✓ Go to the folder by following this:
  CD Healthcare
  |--CD Streamlit
- ✓ Run the following code to deploy the project : "$ streamlit run app.py"

Main Projects Files

< PROJECT ROOT>

| -- dataset /

| -- | -- dataset.csv #Dataset for recommendations

| -- Streamlit /

| -- | -- .streamlit /

| -- | -- | -- config.toml # configuration file to set theme

| -- | -- CSS /

| -- | -- | -- style.css # styling code

| -- | -- app.py # homepage

| -- | -- test.py # medicine recommendation

| -- | -- Custom_Diet.py # custom diet recommendations

| -- | -- health_data.json # health data in json format

Coding

Custom-diet.py

```
import json
import streamlit as st
import pandas as pd
import pandas_profiling as pp
import altair as alt
import random
import base64
import plotly.express as px
import plotly.graph_objects as go


class Person:

    def __init__(self,age,height,weight,gender,activity,weight_loss):
        self.age=age
        self.height=height
        self.weight=weight
        self.gender=gender
        self.activity=activity
        # self.meals_calories_perc=meals_calories_perc
        self.weight_loss=weight_loss
    def calculate_bmi(self,):
        bmi=round(self.weight/((self.height/100)**2),2)
        return bmi

    def display_result(self,):
        bmi=self.calculate_bmi()
        bmi_string=f'{bmi} kg/m²'
        if bmi<18.5:
            category='Underweight'
            color='Red'
        elif 18.5<=bmi<25:
            category='Normal'
            color='Green'
        elif 25<=bmi<30:
            category='Overweight'
            color='Yellow'
        else:
            category='Obesity'
            color='Red'
        return bmi_string,category,color

    def calculate_bmr(self):
```

```
        if self.gender=='Male':
            bmr=10*self.weight+6.25*self.height-5*self.age+5
        else:
            bmr=10*self.weight+6.25*self.height-5*self.age-161
        return bmr

    def calories_calculator(self):
        activites=['Little/no exercise', 'Light exercise', 'Moderate exercise (3-5 days/wk)', 'Very
active (6-7 days/wk)', 'Extra active (very active & physical job)']
        weights=[1.2,1.375,1.55,1.725,1.9]
        weight = weights[activites.index(self.activity)]
        maintain_calories = self.calculate_bmr()*weight
        return maintain_calories


class Display:
    def __init__(self):
        self.plans=["Maintain weight","Mild weight loss","Weight loss","Extreme weight loss"]
        self.weights=[1,0.9,0.8,0.6]
        self.losses=['-0 kg/week','-0.25 kg/week','-0.5 kg/week','-1 kg/week']
        pass

    def display_bmi(self,person):
        st.header('BMI CALCULATOR')
        bmi_string,category,color = person.display_result()
        st.metric(label="Body Mass Index (BMI)", value=bmi_string)
        new_title = f'<p style="font-family:sans-serif; color:{color}; font-size:
25px;">{category}</p>'
        st.markdown(new_title, unsafe_allow_html=True)
        st.markdown(
            """
            Healthy BMI range: 18.5 kg/m² - 25 kg/m².
            """)

    def display_calories(self,person):
        st.header('CALORIES CALCULATOR')
        maintain_calories=person.calories_calculator()
        st.write('The results show a number of daily calorie estimates that can be used as a
guideline for how many calories to consume each day to maintain, lose, or gain weight at a
chosen rate.')
        for plan,weight,loss,col in zip(self.plans,self.weights,self.losses,st.columns(4)):
            with col:
                st.metric(label=plan,value=f'{round(maintain_calories*weight)}
Calories/day',delta=loss,delta_color="inverse")


# Load the pandas dataframe and perform automated Exploratory Data Analysis
```

```
def profiling():
        data = pd.read_csv('dataset.csv',compression='gzip')
        profiles = data.iloc[:,:].head(150)
        profile = pp.ProfileReport(profiles,minimal=True)
        # st.write("Exploratory Data Analysis of Food Data")
        profile.to_html("output.html")

# Load the Output dataset
def load_data():
        with open('health_data.json','r') as recommendations:
                data = json.load(recommendations)

        return data

# Generate random suggestions
def get_suggestion(data,n):
        if data is not None and isinstance(data,list):
                s = random.sample(data,min(n,len(data)))
                return s
        else:
                return []

# Convert JSON to Dataframe
def get_data(json_file):

        dataset = {"Name":[],"RecipeIngredientParts":[],"Calories":[],"RecipeInstructions":[]}
        for recipies in json_file:
                name = recipies["Name"]
                ingredients = recipies["RecipeIngredientParts"]
                calories = recipies["Calories"]
                instructions = recipies["RecipeInstructions"]

                dataset["Name"].append(name)
                dataset["RecipeIngredientParts"].append(ingredients)
                dataset["Calories"].append(calories)
                dataset["RecipeInstructions"].append(instructions)

        return pd.DataFrame(dataset)

# Diet Recommendation
def display_recommendation(dataset):
  st.header('DIET RECOMMENDATOR')
  with st.spinner('Generating recommendations...'):
    # meals=person.meals_calories_perc
    st.subheader('Recommended recipes:')
    recipes = dataset
```

```
    # columns = ["Name","RecipeIngredientParts","Calories","RecipeInstructions"]
    for index,row in recipes.iterrows():

        recipe_name=row['Name']
        ingredients=row['RecipeIngredientParts']
        calories=row['Calories']
        instructions=row['RecipeInstructions']

        expander = st.expander(recipe_name)

        expander.markdown(f'<h5 style="text-align: center;font-family:sans-
serif;">Ingredients:</h5>', unsafe_allow_html=True)

        expander.markdown(f"""
            - {ingredients}
          """)
        expander.markdown(f'<h5 style="text-align: center;font-family:sans-serif;">Recipe
Instructions:</h5>', unsafe_allow_html=True)

        expander.markdown(f"""
            - {instructions}
          """)
        expander.markdown(f'<h5 style="text-align: center;font-family:sans-serif;">Total
Carolies Intake:</h5>', unsafe_allow_html=True)
        expander.markdown(f"""
              Total Calories Intake: {calories}
          """)
# load PDF File
def displayPDF(file):
          # Opening file from file path
          with open(file,"rb") as f:
                    base64_pdf = base64.b64encode(f.read()).decode('utf-8')

          #Embedding PDF in HTML

          pdf_display = F'<iframe src="data:application/pdf;base64,{base64_pdf}
width="700" height="1000" type="application/pdf"></iframe>'
          st.markdown(pdf_display,unsafe_allow_html=True)

# Visualize Scatter Plot 'Calories Per Recipe'
def display_charts(dataset):
  data = dataset
  fig = px.scatter(dataset,x='Name',y='Calories',size='Calories',
            title = 'Calories per Recipe',
            labels = {'calories':'Calories'},
            size_max = 40)
```

```
    st.markdown(f"""<h3 style="color:#7FFF00;">Calories per
Recipe</h3>""",unsafe_allow_html=True)
    st.plotly_chart(fig)

# Heatmap of the all the dataset
def display_heatmap(dataset):
    fig = go.Figure(data=go.Heatmap(
        z=dataset.values,
        x=dataset.columns,
        y=dataset.index,
        colorscale='Viridis',
        hoverongaps=False
        ))

    fig.update_layout(
        xaxis_title='Columns',
        yaxis_title='Rows',
        title='Heatmap for Dataset'
        )
    st.markdown(f"""<h3 style="color:#7FFF00;">Heatmap of the
Dataset</h3>""",unsafe_allow_html=True)
    st.plotly_chart(fig)

# Call the charts
def test_charts(files):
    test_json_file = get_suggestion(files,20)
    test_data = get_data(test_json_file)

    display_charts(test_data)

    display_heatmap(test_data)

# Display Menu
def display_menu():
    st.title('Custom Diet Recommendations')
    display = Display()
    files = load_data()
    age = st.number_input('Age',min_value=2,max_value=80,step=1)
    height = st.number_input('Height(cm)',min_value=50,max_value=300,step=1)
    weight = st.number_input('Weight(Kg)',min_value=10,max_value=300,step=1)
    gender = st.radio('Gender',('Male','Female'))
    activity = st.select_slider('Activity',options=['Little/no exercise', 'Light exercise', 'Moderate
exercise (3-5 days/wk)', 'Very active (6-7 days/wk)', 'Extra active (very active & physical job)'])
    option = st.selectbox('Choose your weight loss plan:',display.plans)

    weight_loss = display.weights[display.plans.index(option)]
```

```
    number_of_meals = st.slider('Meals per day',min_value=3,max_value=5,step=1,value=3)

    generated = st.button('Recommend')

    if generated:
        person=Person(age,height,weight,gender,activity,weight_loss)

        health_json_files = get_suggestion(files,number_of_meals)
        health_data_files = get_data(health_json_files)

        display.display_bmi(person)

        display.display_calories(person)

        display_recommendation(health_data_files)

        test_charts(files)

# Main app
def diet():
    display_menu()

if __name__ == '__main__':
    diet()
```

Hompage : app.py

```
import streamlit as st
from streamlit_option_menu import option_menu
import json
import pandas as pd
from test import *
from Custom_Diet import *
from PIL import Image

# Page Basic info
st.set_page_config(
            page_title = 'Healthcare Recommender System',
            page_icon = '::2a::'
)

# Side bar initialization and creation
with st.sidebar:
            selected = option_menu(
                        menu_title = 'HRS',
                        options = [
```

```
                    'Home','Diet',
                    'Workout Suggestion','Medicine Recommender','Contact'],
                icons = ['house','flower3','wrench','clipboard2-x','envelope'],
        )

#Load Dataset
# dataset = pd.read_csv('dataset.csv')

# Homepage
def homepage():

        st.title("Healthcare Recommender System")
        words = '''
        <p style="font-style:italic; font-family:cursive;">
        Health Recommender System is a personalized System to recommend suggestion
        for diet and other sub domains like medicine and workout recommendation.
        </p>
        <p style="font-style:italic; font-family:cursive;">These are some of the sub-domains
of the HRS.</p>
        <p style="font-style:italic; font-family:cursive;">We have tried to create a machine
learning app using streamlit to mimic the
        collaborative and content based filtering technique to make suggestions.</p>
        <p style="font-style:italic; font-family:cursive;">It is just a prototype of the actual
HRS and we will be making various changes
        in the future scope.</p>'''

        tech_stack = '''
                <ul>
                        <li style="font-style:italic; font-family:cursive;">Dataset: CSV,
JSON Files</li>
                        <li style="font-style:italic; font-family:cursive;">Others libraries:
Pandas, Numpy, Sklearn, Streamlit, Json</li>
                        <li style="font-style:italic; font-family:cursive;">Programming:
Python, Notebook</li>
                        <li style="font-style:italic; font-family:cursive;">Visualization
tools: Matplotlib, Plotly</li>
                </ul>
        '''

        image = Image.open('first.jpg')

        left_column,right_column = st.columns(2)
        with left_column:
                st.markdown(words,unsafe_allow_html=True)
                with right_column:
                        st.image(image,use_column_width="auto")
```

```
        st.title('Dataset')

        files = load_data()

        json_files = get_suggestion(files,10)
        data_files = get_data(json_files)


        st.dataframe(data_files)

        st.title('Tech Stack')

        st.markdown(tech_stack,unsafe_allow_html=True)

        # with st.container:
        #       st.title("Tech stack used")

if selected == 'Home':
        # st.write(f'{selected} is loading')
        # st.title('Healthcare Recommender System')
        # words = '''<p>Healthcare Recommender System is a personalized System to
recommend suggestion
        #       for diet and all</p>'''

        # st.markdown(words,unsafe_allow_html=True)
        homepage()

# Defining CSS file
def local_css(file_name):
        with open(file_name) as f:
                st.markdown(f'<style>{f.read()},/style>',unsafe_allow_html=True)

# Loading CSS
local_css('css/style.css')

# Contact Form Frontend
def form():
        with st.container():
                st.write("---")
                st.header('Get In Tounch With Me!')
                st.write('##')

                contact_form = """
                        <form
action="https://formsubmit.co/anonymous17sa@gmail.com" method="POST">
                                <input type="hidden" name="_captcha" value="false">
```

```
                                        <input type="text" name="name" placeholder="Your
Full Name" required>
                                        <input type="email" name="email" placeholder="Your
Email ID" required>
                                        <textarea name="message" placeholder="Your
message" required></textarea>
                                        <button type="submit">Send</button>
                                </form>
                        """

                        left_column, right_column = st.columns(2)

                        with left_column:
                                st.markdown(contact_form,unsafe_allow_html=True)
                        with right_column:
                                st.empty()

if selected == 'Recommend':
        st.write(f'{selected} is loading')

# Contact form
if selected == 'Contact':
        form()

# Exercise JSON Dataset
exercise_by_level ={
        'beginner':{
                'Monday':['20 Sqauts','10 Push-ups','10 Lunges Each leg','15 seconds
Plank','30 Jumping Jacks'],
                'Tuesday':['20 Sqauts','10 Push-ups','10 Lunges Each leg','15 seconds
Plank','30 Jumping Jacks'],
                'Wednesday':['15 minutes Walk','30 seconds Jump rope(2 reps)','20
seconds Cobra Stretch'],
                'Thursday':['25 Sqauts','12 Push-ups','12 Lunges Each leg','15 seconds
Plank','30 Jumping Jacks'],
                'Friday':['25 Sqauts','12 Push-ups','12 Lunges Each leg','15 seconds
Plank','30 Jumping Jacks'],
                'Saturday':['15 minutes Walk','30 seconds Jump rope(2 reps)','20 seconds
Cobra Stretch']
        },
        'intermediate':{
                'Monday':['3 Set Squats(8-12 reps)','3 Set Leg Extension(8-12 reps)','3 Set
Lunges(10 reps Each)','30 Seconds Skipping(2 reps)'],
                'Tuesday':['3 Set Bench Press(12 reps)','3 Set Dumb-bell incline press(8-12
reps)','3 Set Cable Crossovers(10-12 reps)','30 Seconds Boxing Skip(2 reps)'],
                'Wednesday':['3 Set Deadlifts(6-12 reps)','3 Set Barbell Curls(8-12 reps)','3
Set Incline Curls(8-12 reps)'],
```

```
                'Thursday':['3 Set Shoulder Press(8-10 reps)','3 Set Incline Lateral Raises(8-10 reps)','3 Set Sit-ups(10-12 reps)','2 Set Leg Raises(8-12 reps)'],
                'Friday':['10 minutes Brisk Walk','1 minute Skipping','Breathing Exercises'],
                'Saturday':['10 minutes Brisk Walk','1 minute Skipping','Breathing Exercises']
            },
            'advanced':{
                'Monday':['5 Set Squats(8-12 reps)','5 Set Leg Extension(8-12 reps)','5 Set Lunges(10 reps Each)','60 Seconds Skipping(2 reps)'],
                'Tuesday':['5 Set Bench Press(12 reps)','5 Set Dumb-bell incline press(8-12 reps)','5 Set Cable Crossovers(10-12 reps)','60 Seconds Boxing Skip(2 reps)'],
                'Wednesday':['5 Set Deadlifts(6-12 reps)','5 Set Barbell Curls(8-12 reps)','5 Set Incline Curls(8-12 reps)'],
                'Thursday':['5 Set Shoulder Press(8-10 reps)','5 Set Incline Lateral Raises(8-10 reps)','5 Set Sit-ups(10-12 reps)','4 Set Leg Raises(8-12 reps)'],
                'Friday':['20 minutes Brisk Walk','2 minute Boxing Skip','Breathing Exercises'],
                'Saturday':['25 minutes Brisk Walk','1 minute Skipping','Breathing Exercises']
            }
}

# For Workout Suggestion
if selected == 'Workout Suggestion':
        st.title('Personalized Workout Recommender')

        st.selectbox('Age',['Select','Less than 18','18 to 49', '49 to 60','Above 60'])

        options = ['Less frequently','Moderate','More Frequently']

        st.radio('Workout Duration:',options)

        level = st.selectbox('Select your level:',['Select','beginner','intermediate','advanced'])

        button = st.button('Recommend Workout')

        if button:
                # workout_plan = generate_workout(level)
                nums = 1
                # st.write('Your Workout Plan:')

                if level == 'Select':
                        st.warning('Insertion error!!Re-check the input fields')

                else:
                        for day, exercises in exercise_by_level[level].items():
```

```
                exercise_str = ",".join(exercises)
                # st.write(f'{day}:{exercise_str}')
                st.markdown(
                        f"""
                        <h4>Your Workout Plan For Day {nums}</h4>
                        <div class="workout">
                                <div class="workout-info">
                                        <p style="color:#7FFF00; font-style:italic; font-family:cursive;">Day:{day}</p>
                                        <p style="color:#7FFF00; font-style:italic; font-family:cursive;">Workout:{exercise_str}</p>
                                </div>
                        </div>
                        """,
                        unsafe_allow_html=True
                        )
                nums += 1

        st.markdown(
                f"""
                        <h4> Your Workout Plan for Day {nums}</h4>
                        <div class="sundays">
                                <p style="color:#7FFF00; font-style:italic; font-family:cursive;">Take rest at sundays and do a little walk in the park</p>
                        </div>
                """,
                unsafe_allow_html=True)
        # st.write('Take rest at sundays and do a little walk in the park')


# For medicine recommender
if selected == 'Medicine Recommender':
        main_1()

# For custom food recommendations
if selected == 'Diet':
        diet()
```

Medicine: test.py

```
import json
import streamlit as st
import pandas as pd
import plotly.graph_objects as go
```

```
# Medicine JSON File
medicine_data = '''
        {
                "diseases":[
                        {
                                "name":"Cold",
                                "patients":45123332,
                                "medicines":[
                                        {
                                                "name":"Ibuprofen",
                                                "dosage_form":"Tablet",
                                                "strength":"200 mg",
                                                "instructions":"Take 1 tablet every
6-8 hours"
                                        },

                                        {
                                                "name":"Acataminophen",
                                                "dosage_form":"Capsule",
                                                "strength":"500 mg",
                                                "instructions":"Take 1 tablet every
4-6 hours"
                                        },

                                        {
                                                "name":"Phenylephrine",
                                                "dosage_form":"Syrup",
                                                "strength":"5 mg/5 ml",
                                                "instructions":"Take 10 ml every 4
hours"
                                        }
                                ]
                        },
                        {
                                "name":"Hypertension",
                                "patients":90763630,
                                "medicines":[
                                        {
                                                "name":"Lisinopril",
                                                "dosage_form":"Tablet",
                                                "strength":"10 mg",
                                                "instructions":"Take 1 tablet daily in
the morning"
                                        },

                                        {
                                                "name":"Amlodipine",
```

```
                                        "dosage_form":"Tablet",
                                        "strength":"5 mg",
                                        "instructions":"Take 1 tablet daily in
the morning"
                                },

                                {
                                        "name":"Hydrochlorothiazide",
                                        "dosage_form":"Capsule",
                                        "strength":"25 mg",
                                        "instructions":"Take 1 tablet daily in
the morning"
                                }
                        ]
                },
                {
                        "name":"Diabetes",
                        "patients":16783800,
                        "medicines":[
                                {
                                        "name":"Metformin",
                                        "dosage_form":"Tablet",
                                        "strength":"500 mg",
                                        "instructions":"Take 1 tablet twice
daily with meals"
                                },
                                {
                                        "name":"Insulin (Rapid Acting)",
                                        "dosage_form":"Injection",
                                        "strength":"100 units/ml",
                                        "instructions":"Take 8 units twice in
the morning and evening"
                                },
                                {
                                        "name":"Gliclazide",
                                        "dosage_form":"Tablet",
                                        "strength":"80 mg",
                                        "instructions":"Take 1 tablet before
breakfast"
                                }
                        ]
                },
                {
                        "name":"Flu",
                        "patients":508580,
                        "medicines":[
                                {
```

```
                                        "name":"Oseltamivir",
                                        "dosage_form":"Capsule",
                                        "strength":"75 mg",
                                        "instructions":"Take 1 capsule twice
daily for 5 days"
                                },
                                {
                                        "name":"Ibuprofen",
                                        "dosage_form":"Tablet",
                                        "strength":"400 mg",
                                        "instructions":"Take 1 tablet every
6-8 hours for 5 days"
                                },
                                {
                                        "name":"Acataminophen",
                                        "dosage_form":"Syrup",
                                        "strength":"160 mg/5 ml",
                                        "instructions":"Take 10ml every 4-6
hours as needed for fever"
                                }
                        ]
                },
                {
                        "name":"Asthama",
                        "patients":12464700,
                        "medicines":[
                                {
                                        "name":"Albuterol",
                                        "dosage_form":"Inhaler",
                                        "strength":"100 mcg",
                                        "instructions":"Inhale 2 puffs every
4-6 hours"
                                },
                                {
                                        "name":"Fluticasone",
                                        "dosage_form":"Inhaler",
                                        "strength":"50 mcg",
                                        "instructions":"Take 1-2 puffs twice
daily"
                                },
                                {
                                        "name":"Montelukast",
                                        "dosage_form":"Tablet",
                                        "strength":"10 mg",
                                        "instructions":"Take 1 tablet daily in
the evening"
                                }
```

```
                                        ]
                                    }
                                ]
                        }
'''
# Fetch medicine data
def get_medicines(disease):
        # Load JSON data
        data = json.loads(medicine_data)

        #Search for the disease in the json data
        for entry in data["diseases"]:
                if entry["name"].lower() == disease.lower():
                        return entry["medicines"]
        return None

# d = "Diabetes"
# res = get_medicines(d)
# print(res)

# st.title('Personalized Workout Recommender')
# st.selectbox('Age',['Less than 18','18 to 49', '49 to 60','Above 60'])
# options = ['Less frequently','Moderate','More Frequently']

# JSON to Pandas Dataframe
def count_patients(medicine_data):
        dataset = json.loads(medicine_data)

        data = {"Disease":[],"Patient":[]}

        for entry in dataset["diseases"]:
                name = entry["name"]
                num_of_patients = entry["patients"]

                data["Disease"].append(name)
                data["Patient"].append(num_of_patients)

        return pd.DataFrame(data)

# Visualize the recommendations
def draw():
        # Load the medicine data as pandas dataframe.
        df = count_patients(medicine_data)

        # Calculate mean
        mean_of_patients = df["Patient"].mean()
```

```
        # Name the medication visualization
        st.markdown(
                f"""
                        <h2 style="color:lightblue;">Medicines Visualization</h2>
                """
                ,
                unsafe_allow_html=True)

        #Set customm color for bar chart
        bar_color = None

        # Initialize figure
        fig_bar = go.Figure()

        # Add a bar chart: Disease vs No. of Patients
        fig_bar.add_trace(go.Bar(x=df["Disease"],y=df["Patient"],marker_color='MediumPu
rple'))

        # Add Mean line
        fig_bar.add_shape(
                type="line",
                x0 = -0.5,
                y0 = mean_of_patients,
                x1 = len(df) - 0.5,
                y1 = mean_of_patients,
                line = dict(color="red",dash="dash")
        )

        fig_bar.update_layout(
                title="Number of Patients per Diseases",
                xaxis_title="Diseases",
                yaxis_title="Number of Patients"
        )

        fig_bar.update_xaxes(type='category')
        st.plotly_chart(fig_bar)

        # Generate and Display the line chart
        fig_line = go.Figure()

        fig_line.add_trace(go.Scatter(x=df["Disease"],y=df["Patient"],mode='lines+markers',
fill='tozeroy'))

        fig_line.update_layout(
                title="Trend of Number of Patients over diseases",
                xaxis_title="Diseases",
                yaxis_title="Number of Patients"
```

```
        )

        st.plotly_chart(fig_line)

# Menu app view
def main_1():
        st.title("Medication Recommender For Diseases")

        Age=st.selectbox('Age',['Select','10-18','19-30','31-50','Above 50'])

        disease_input = st.selectbox('Choose your
disease',['Select','Asthama','Cold','Diabetes','Flu','Hypertension'])

        # st.write(f'YOU HAVE {disease_input}')
        if st.button("Recommend Medicines"):
                if Age == 'Select' or disease_input == 'Select':
                        st.warning('Input Error!!Check the input fields')
                # Initialize Counter nums as 1.
                else:
                        nums = 1
                        if disease_input:
                                medicines = get_medicines(disease_input)
                                if medicines:
                                        st.markdown(f"""
                                                <h4 style="font-style:italic;
font-family:cursive;"> Suggested Medicines for {disease_input} are:</h4>
                                                """,
                                                unsafe_allow_html=True)
                                        for med in medicines:
                                                st.markdown(
                                                        f"""
                                                                <h6
style="color:yellow;font-style:italic; font-family:cursive;">S.No: {nums}</h6>
                                                                <div
class="medicine">
                                                                        <p
class="medicine-name" style="color:#7FFF00; font-style:italic; font-
family:cursive;">{med['name']}</p>
                                                                        <div
class="medicine-details">

        <p style="color:#7FFF00; font-style:italic; font-family:cursive;">Dosage Form:
{med['dosage_form']}</p>

        <p style="color:#7FFF00; font-style:italic; font-family:cursive;">Strength:
{med['strength']}</p>
```

```
            <p style="color:#7FFF00; font-style:italic; font-family:cursive;">Instruction:
{med['instructions']}</p>
                                                                                    </div>
                                                                                </div>
                                                                            """,
                                                                            unsafe_allow_html=True
                                                                        )
                                                                        nums += 1
                                                                draw()

                        # if medicines != "Select":
                        #         df = count_patients(medicine_data)
                        #         fig = go.Figure(data=[go.Bar(x=df["Disease"],y=df["Patient"])])
                        #         fig.update_layout(
                        #                 title="Number of patients per disease",
                        #                 xaxis_title="Disease",
                        #                 yaxis_title="Number of Patients")
                        #         fig.update_xaxes(type='category')
                        #         st.plotly_chart(fig)

                        # else:
                        #         st.write(f"No medicines avaliable")


if __name__ == "__main__":
            main_1()


# if st.button('Generate Workout'):
#                         # workout_plan = generate_workout(level)
#                         st.write('Your Workout Plan:')

#                         for day, exercises in exercise_by_level[level].items():
#                                 exercise_str = ",".join(exercises)
#                                 st.write(f'{day}:{exercise_str}')

#                         st.write('Take rest at sundays and do a little walk in the park')
```

Config.toml

```
[theme]
primaryColor="#0C7F31"
backgroundColor="#0E1117"
secondaryBackgroundColor="#262730"
```

```
textColor="#FAFAFA"
font="sans serif"
```

Style.css

```
/* Styling for the contact form */
input[type=message],input[type=email],input[type=text],textarea
{
        width: 100%;
        padding: 12px;
        border: 1px solid #ccc;
        border-radius: 4x;
        box-sizing: content-box;
        margin-top: 6px;
        margin-bottom: 16px;
        resize: vertical;
}

/* Styling the button */
button[type=submit]
{
        background-color: #04AA6D;
        color: whitesmoke;
        padding: 12px 20px;
        border: none;
        border-radius: 4px;
        cursor: pointer;
}

/* Styling the hovering effect in submit button*/
button[type=submit]:hover
{
        background-color: #45A049;
}
```

Python Notebook Screenshot

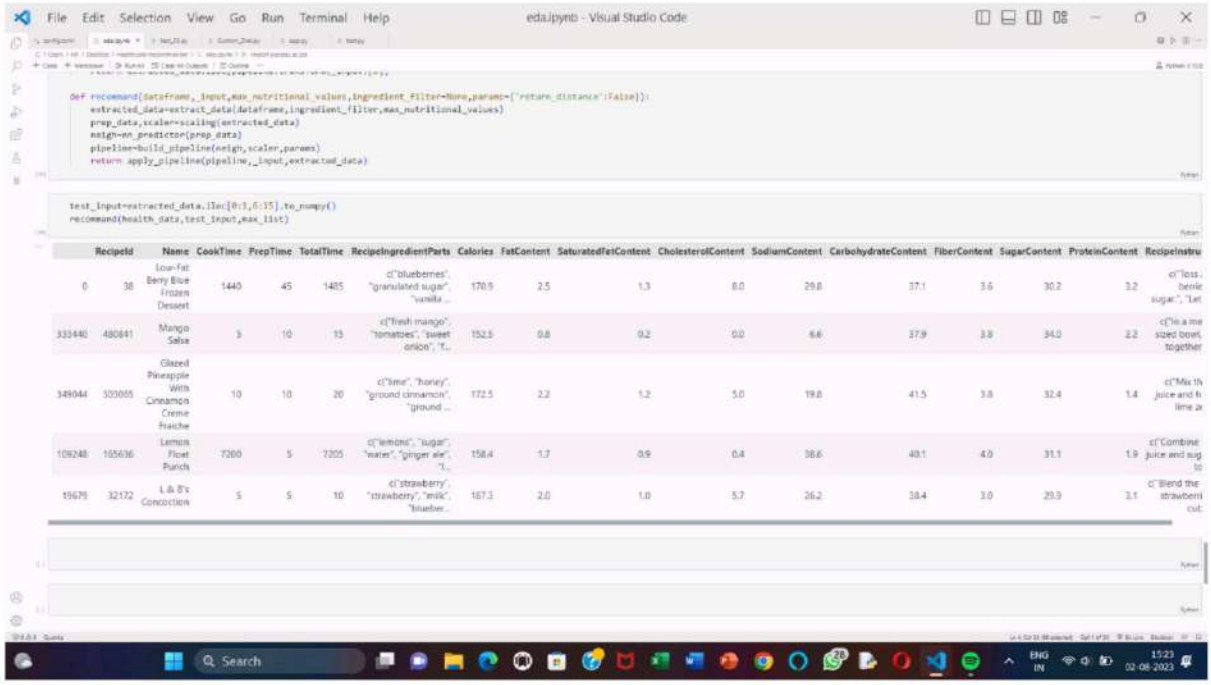


Figure 1: Recommendations

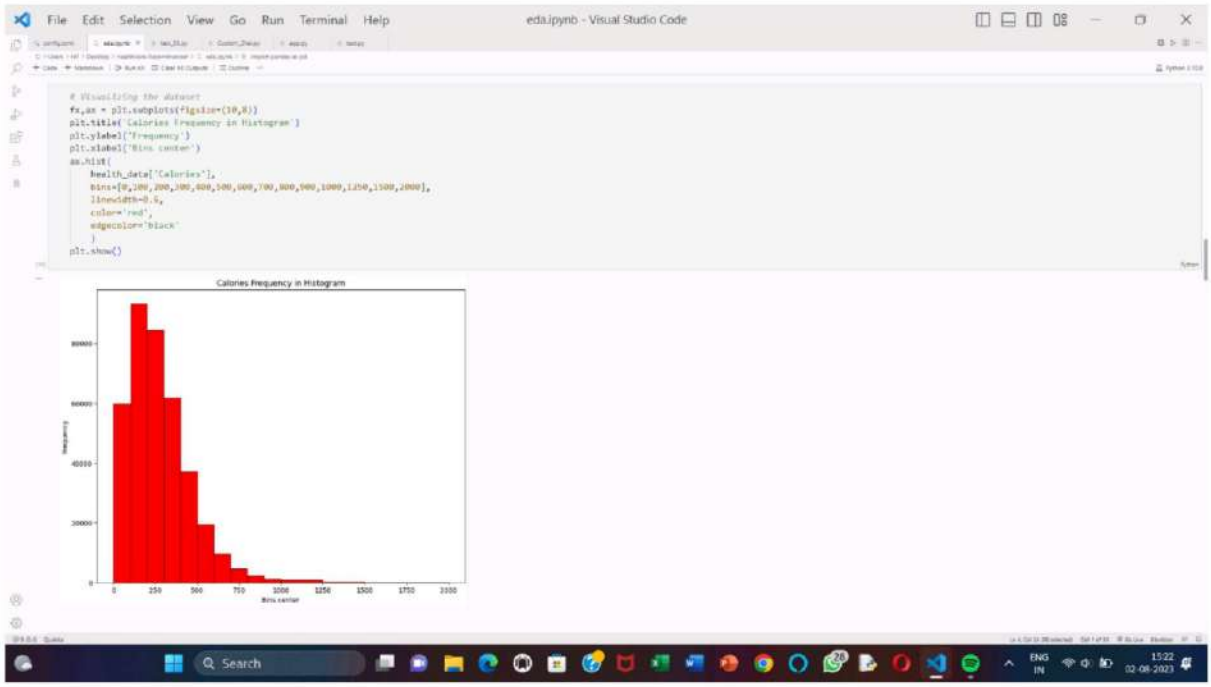


Figure 2: Data Visualization (part – 1)

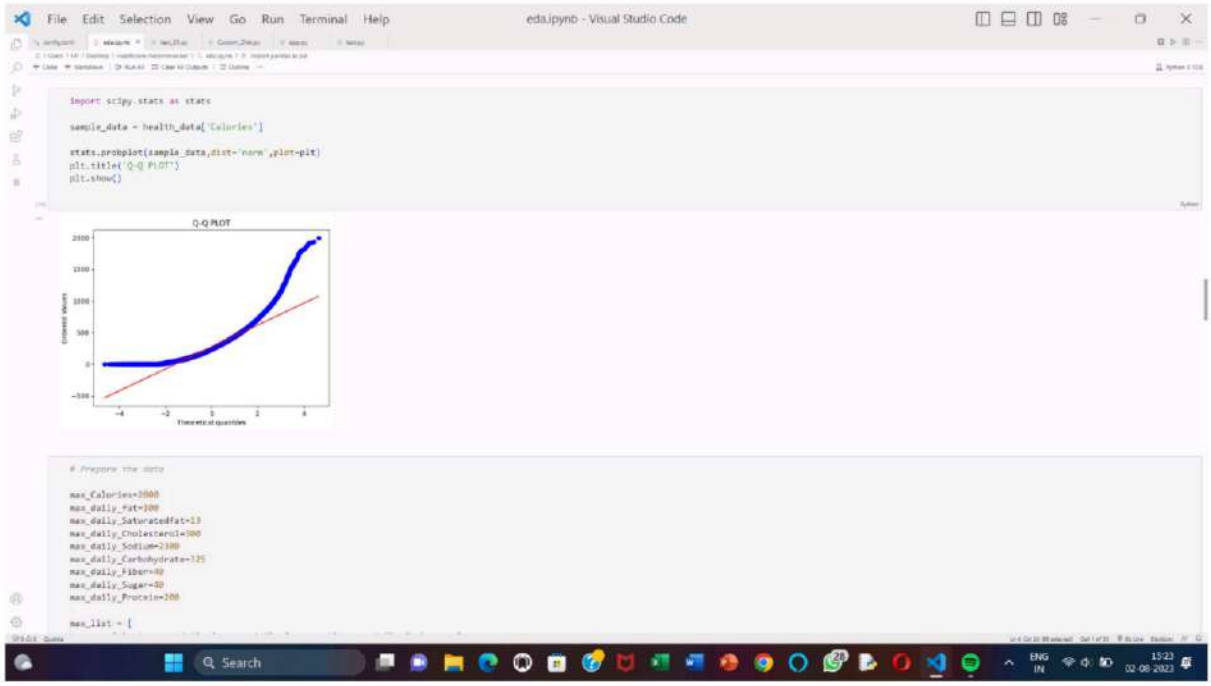


Figure 3: Data Visualization (Part-2)

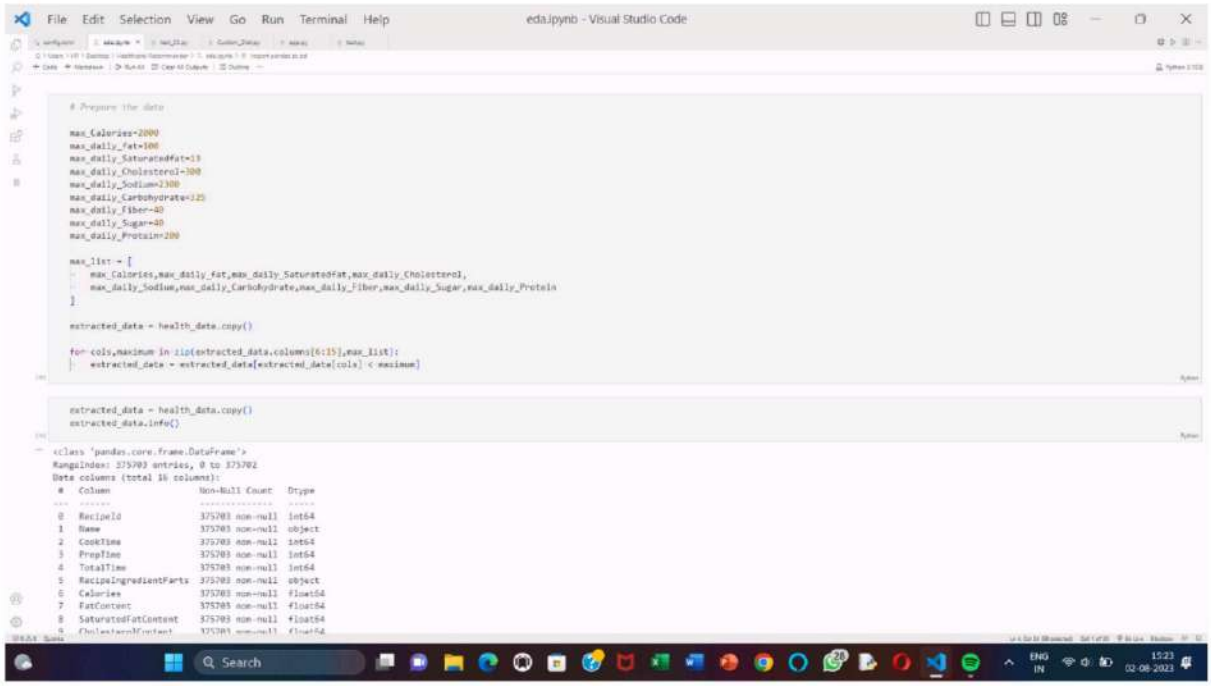


Figure 4: Feature Extraction

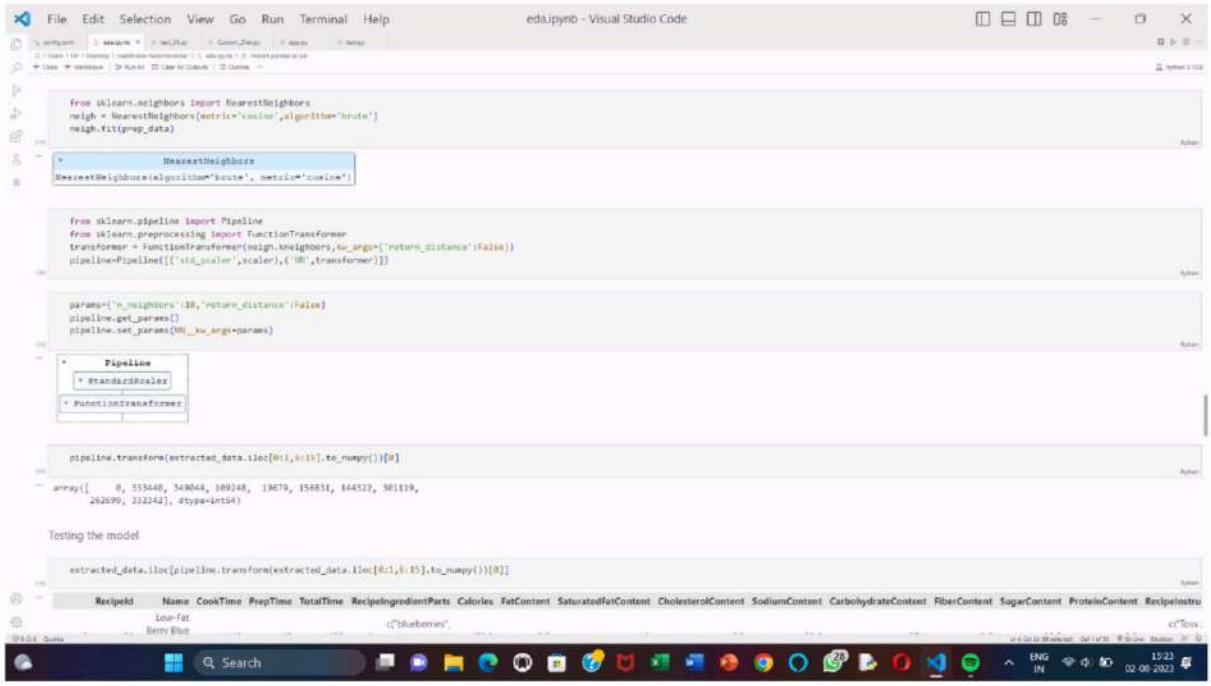


Figure 5: Applying machine learning algorithms to make suggestion

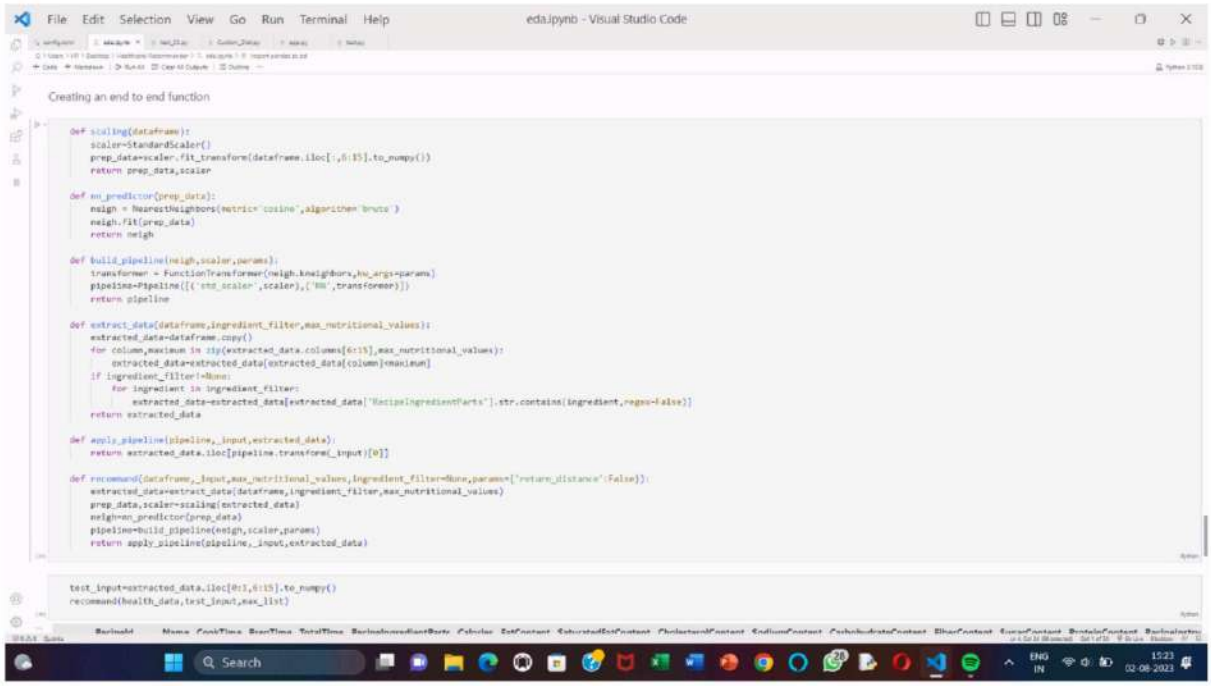


Figure 6: Creating End to End function to interact with the streamlit app

OUR PROPOSED SYSTEM SCREEN SHOT

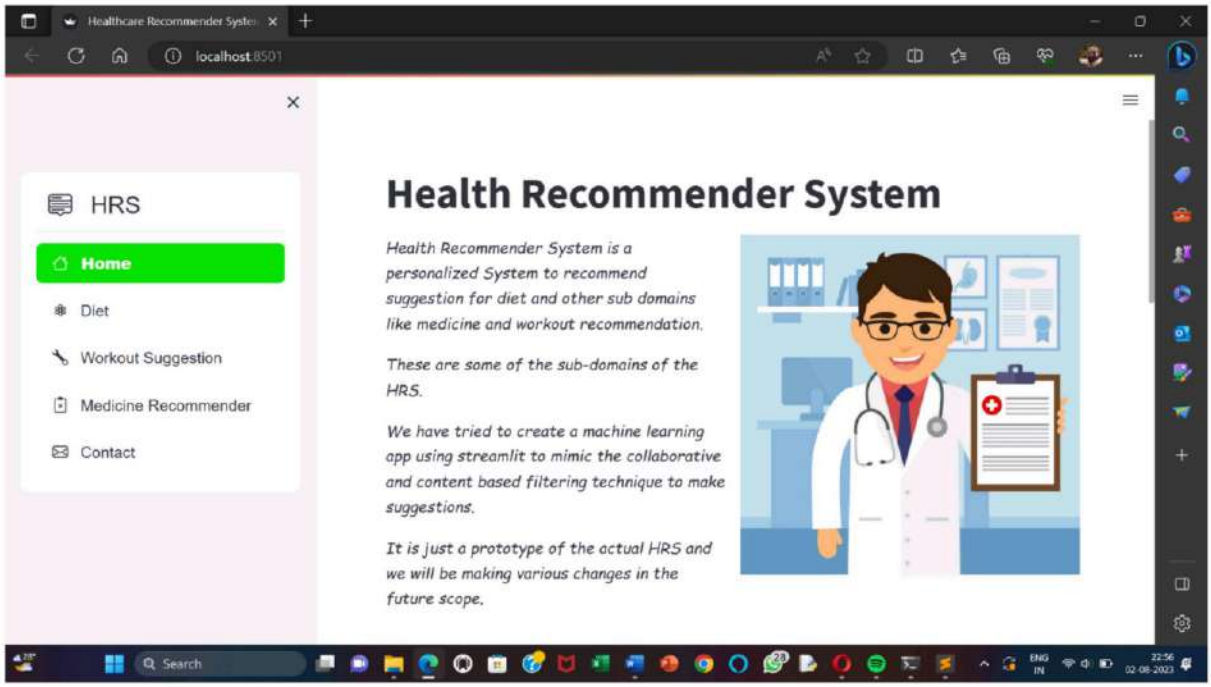


Figure 7: Homepage

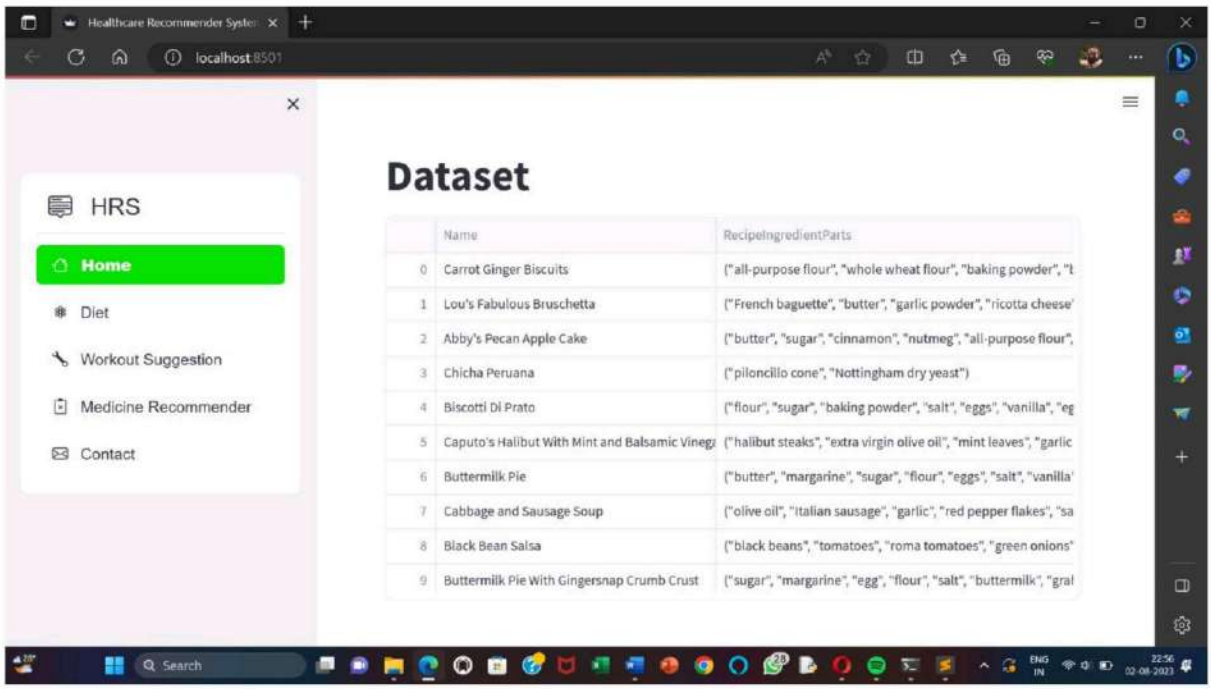


Figure 8: Dataset

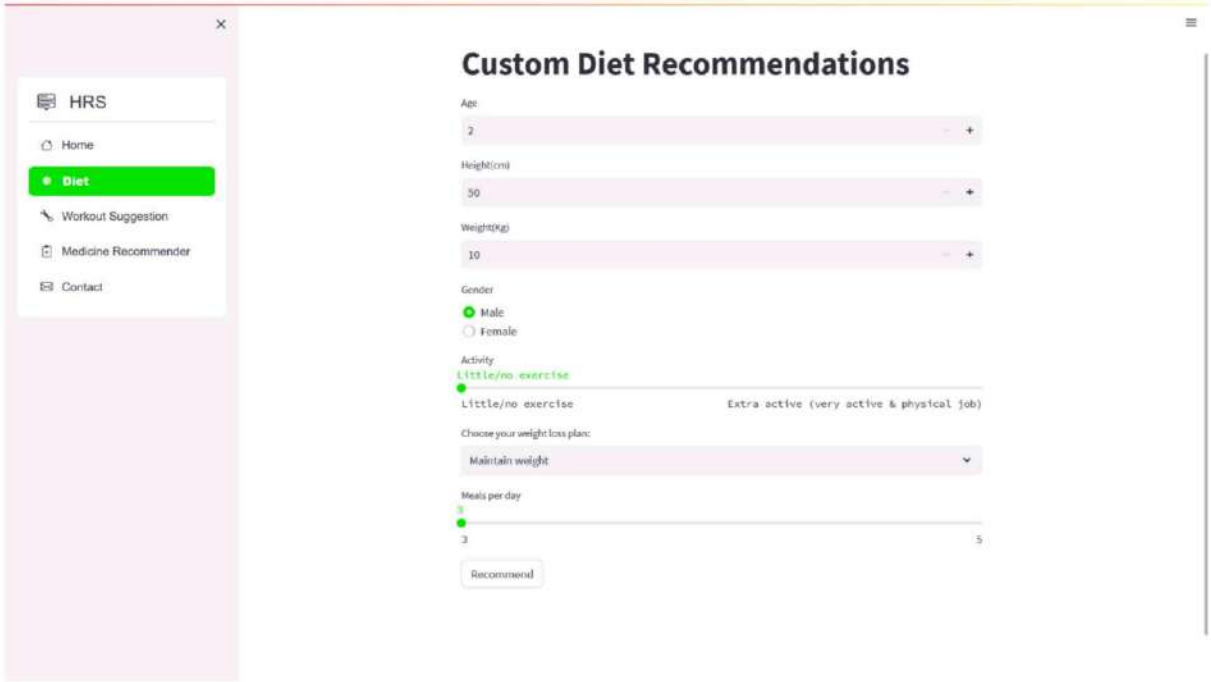


Figure 9: Custom Diet Suggestions

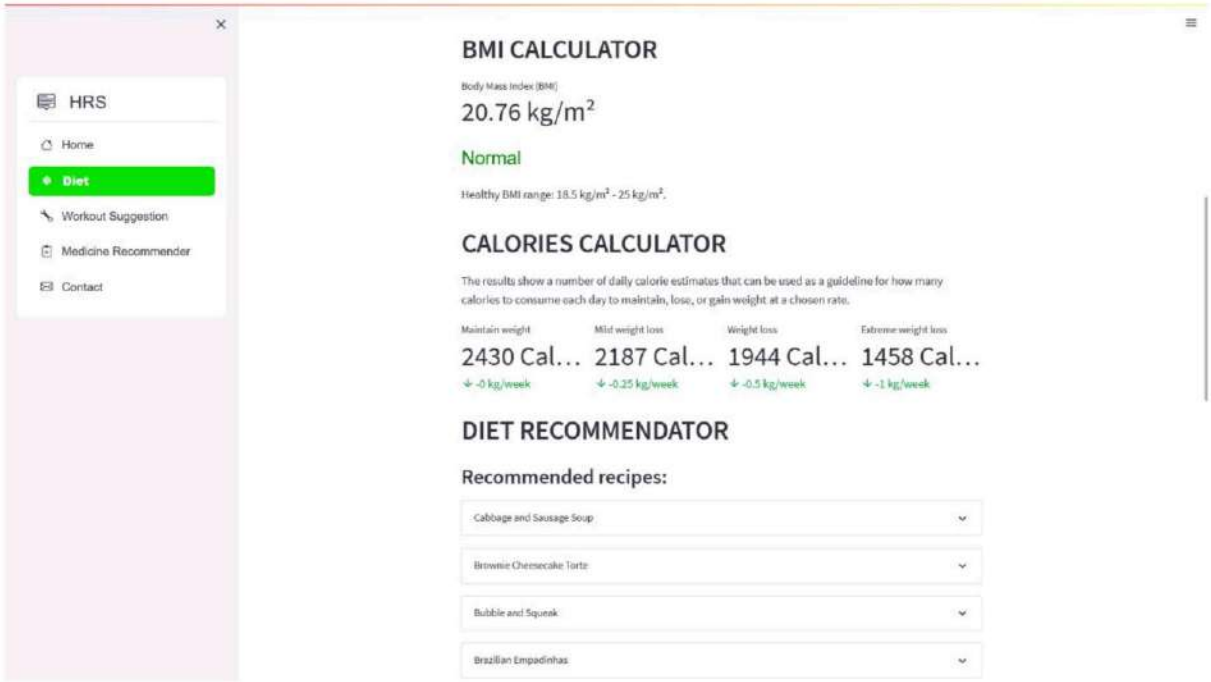


Figure 10: Custom Diet Recommendations Output (Part 1)

Figure 11: Custom Diet Recommendations Output (Part 2)

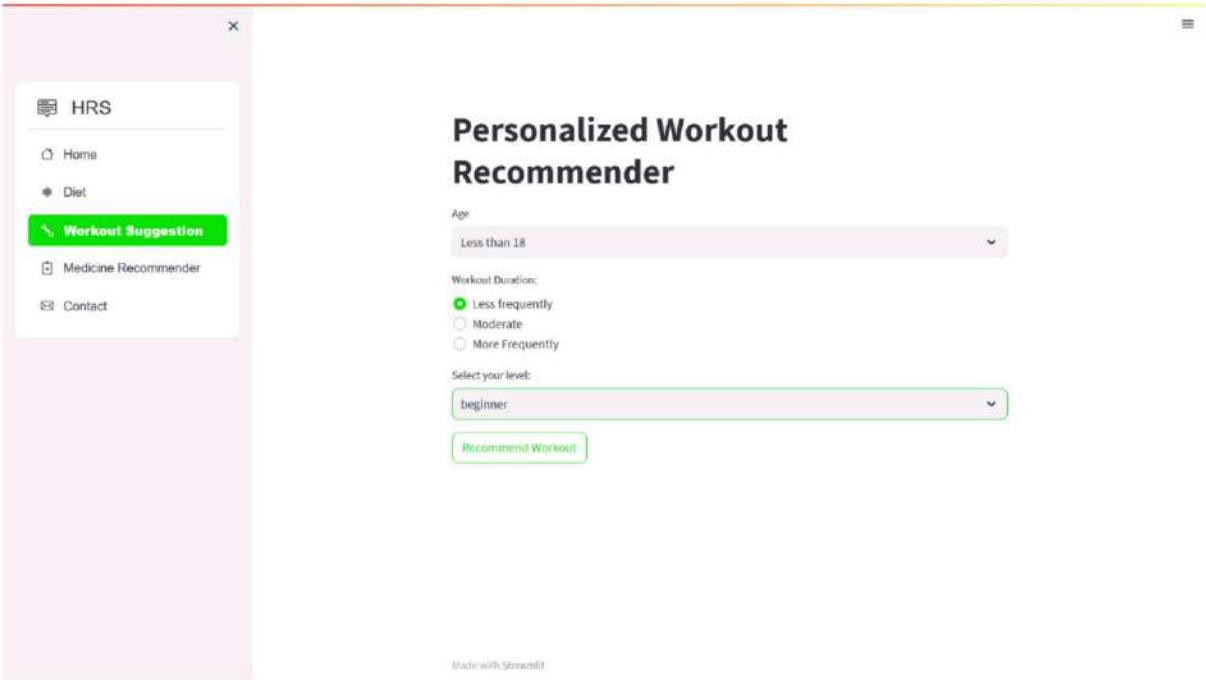


Figure 12: Personalized Workout Recommender

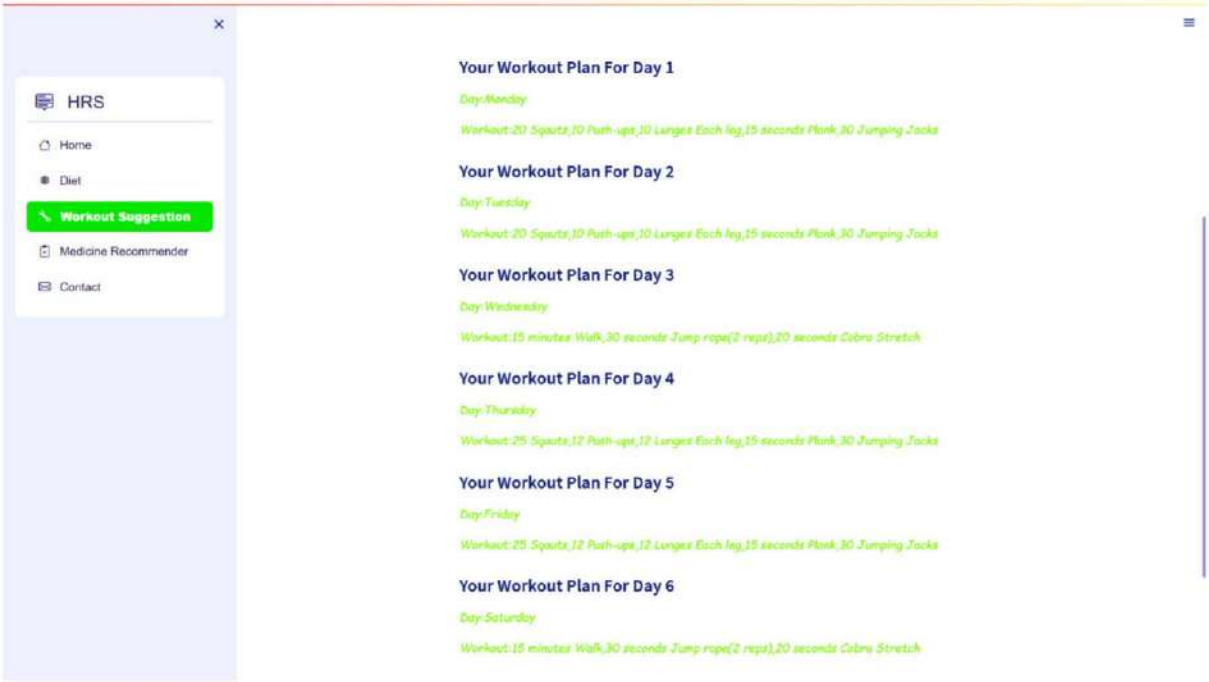


Figure 13: Personalized Workout Recommender Output

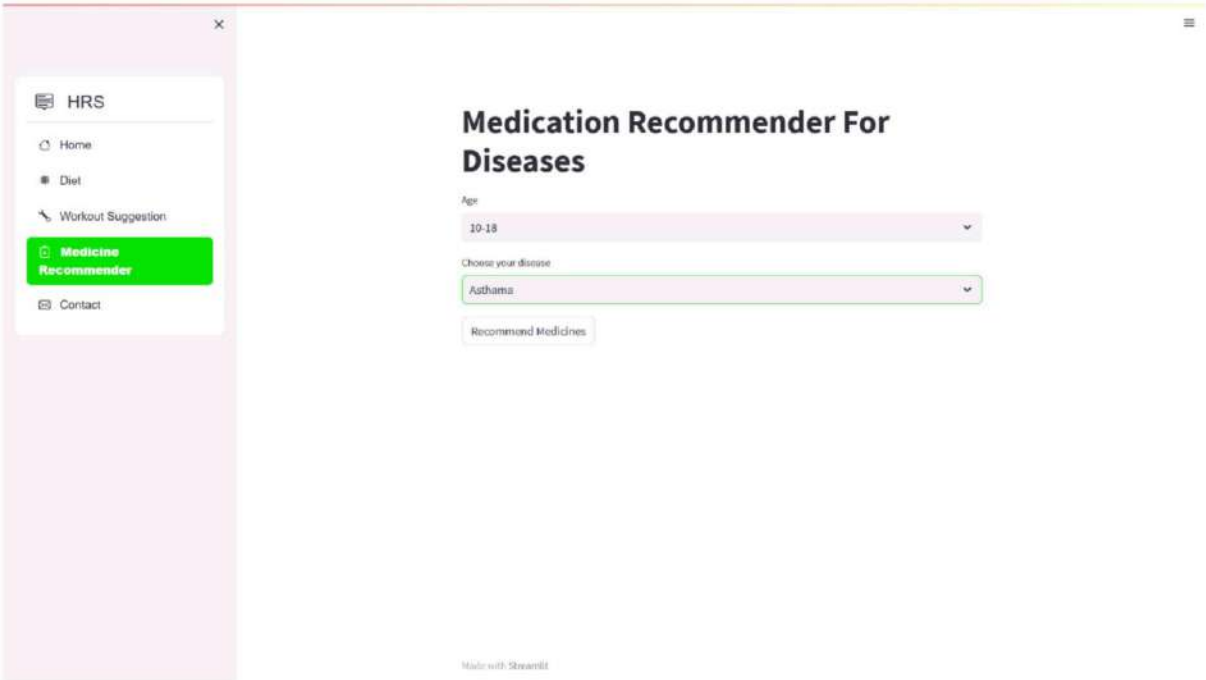


Figure 14: Medicine Recommender for diseases

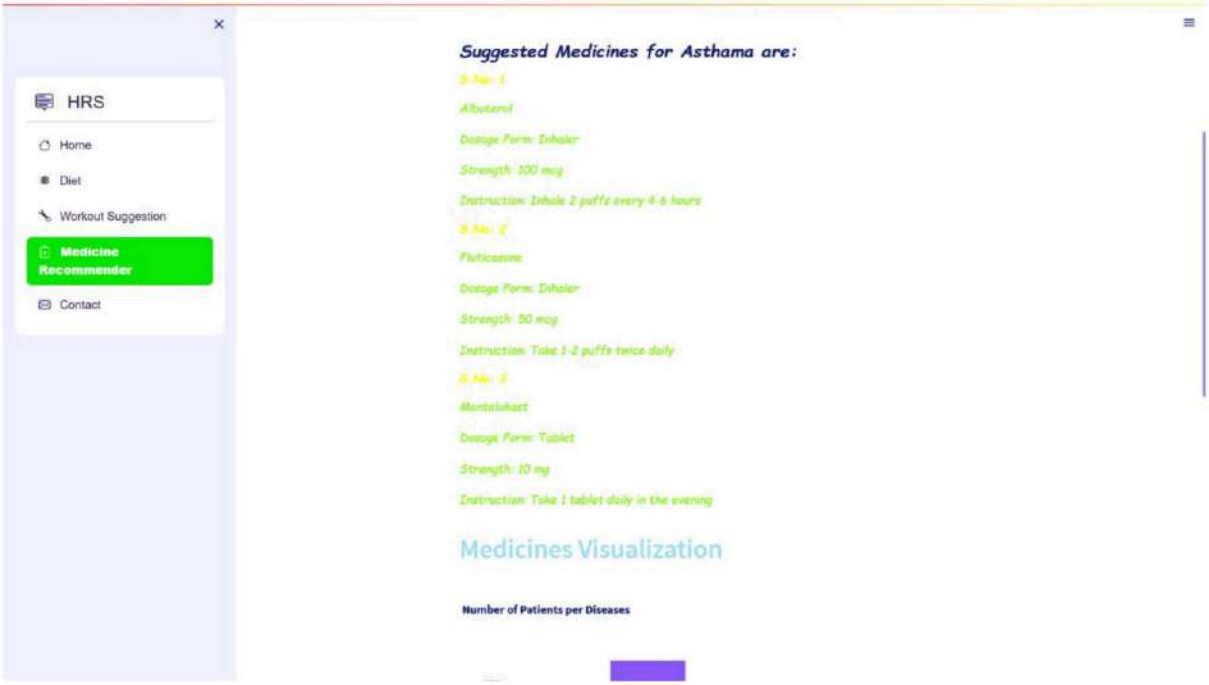


Figure 15: Medicine Recommender Output (Part 1)

Figure 16: Medicine Recommender Output (Part 2)

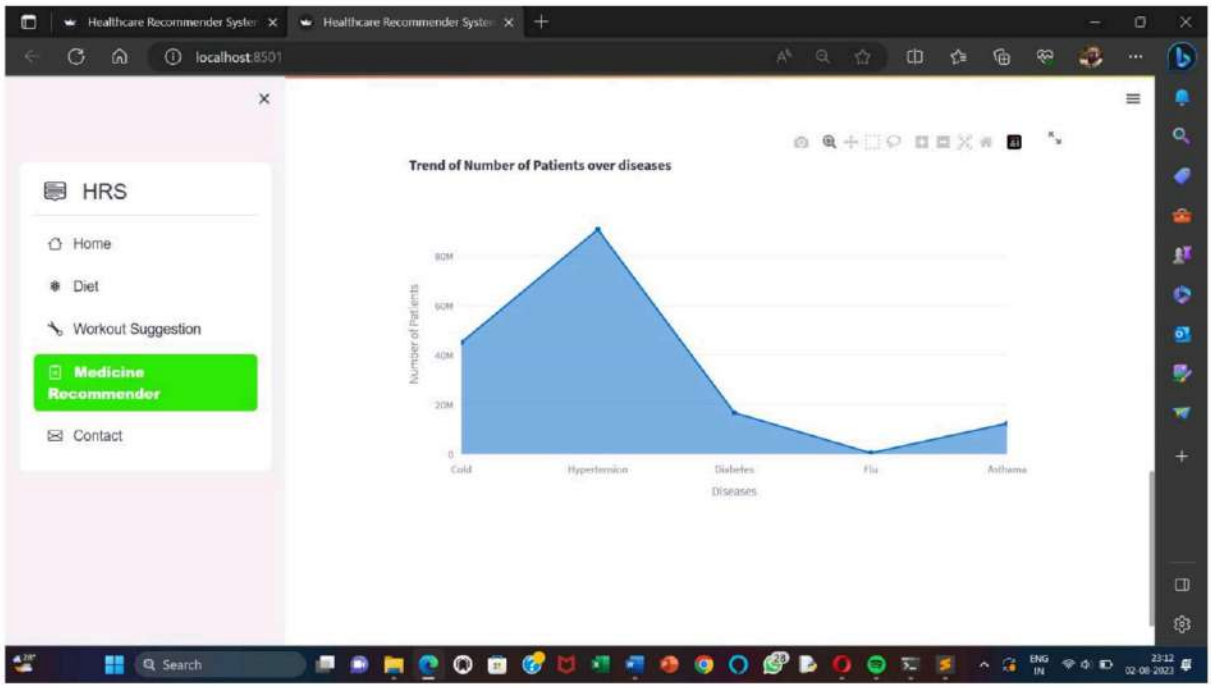


Figure 17: Medicine Recommender Output (Part 3)

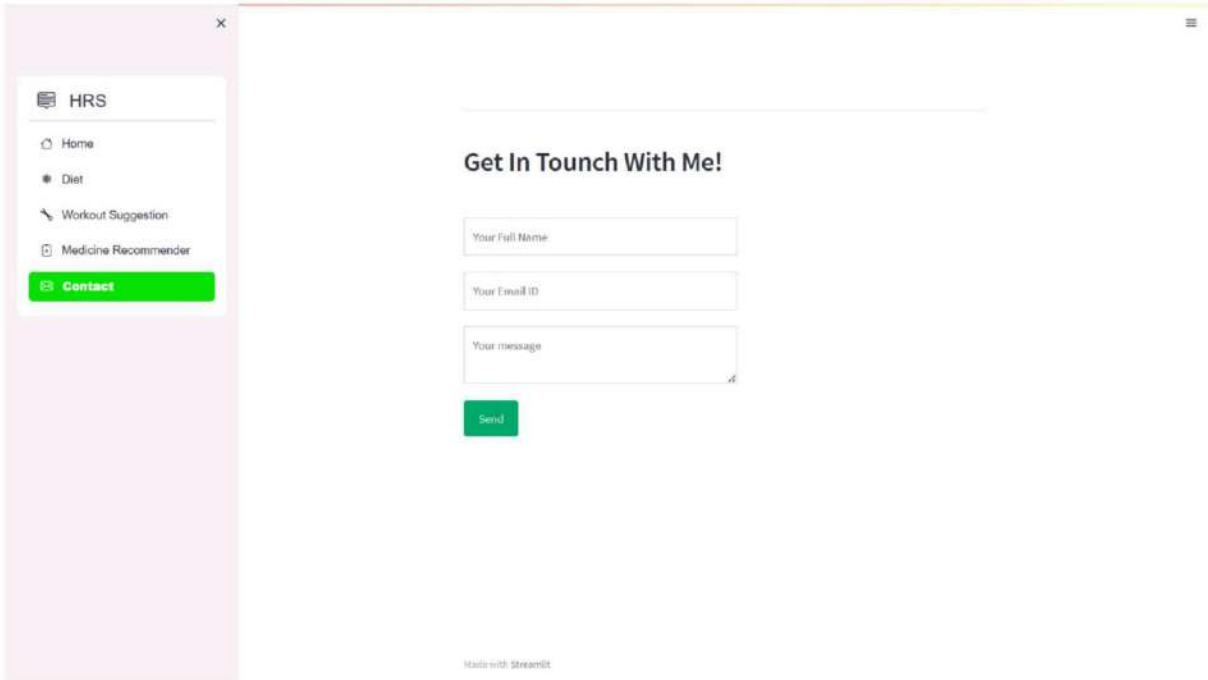


Figure 18: Contact Form

Code Snippets and Directory

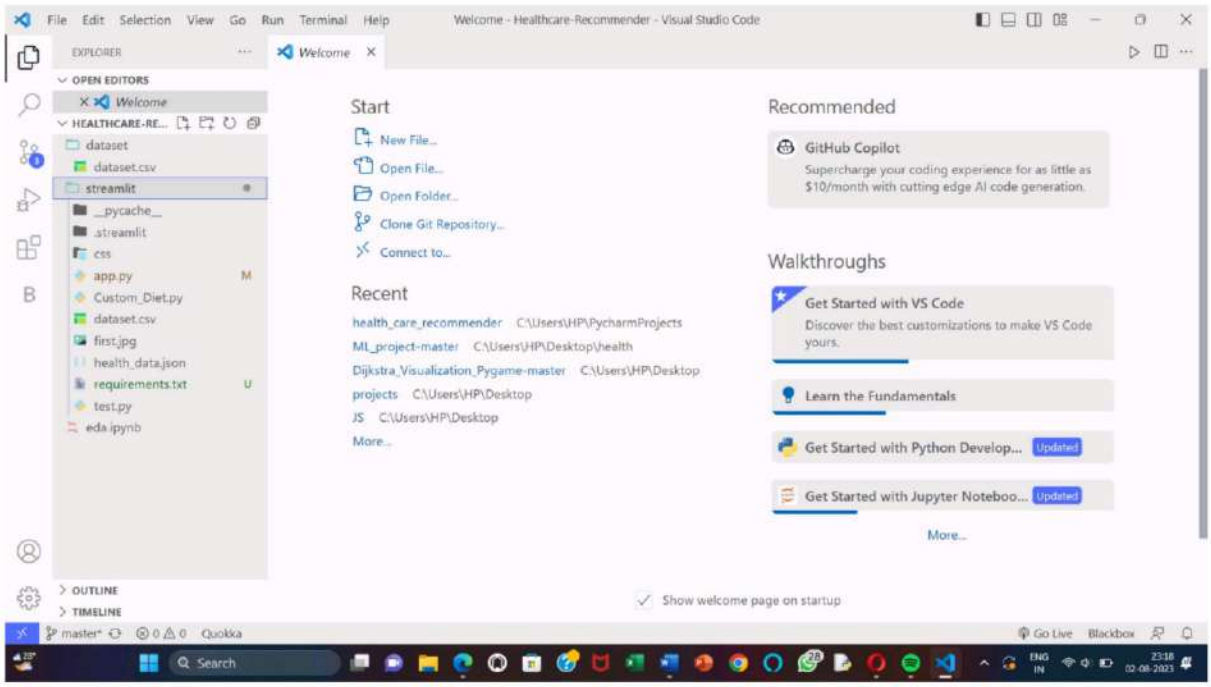


Figure 19: Working Directories

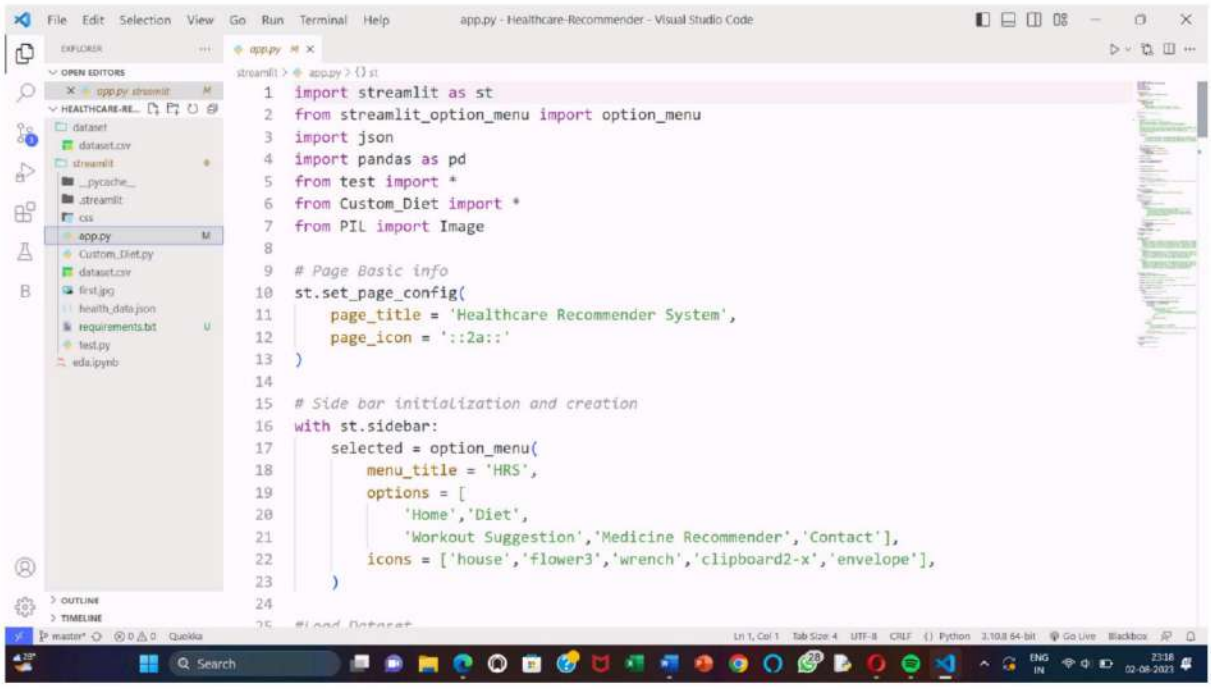
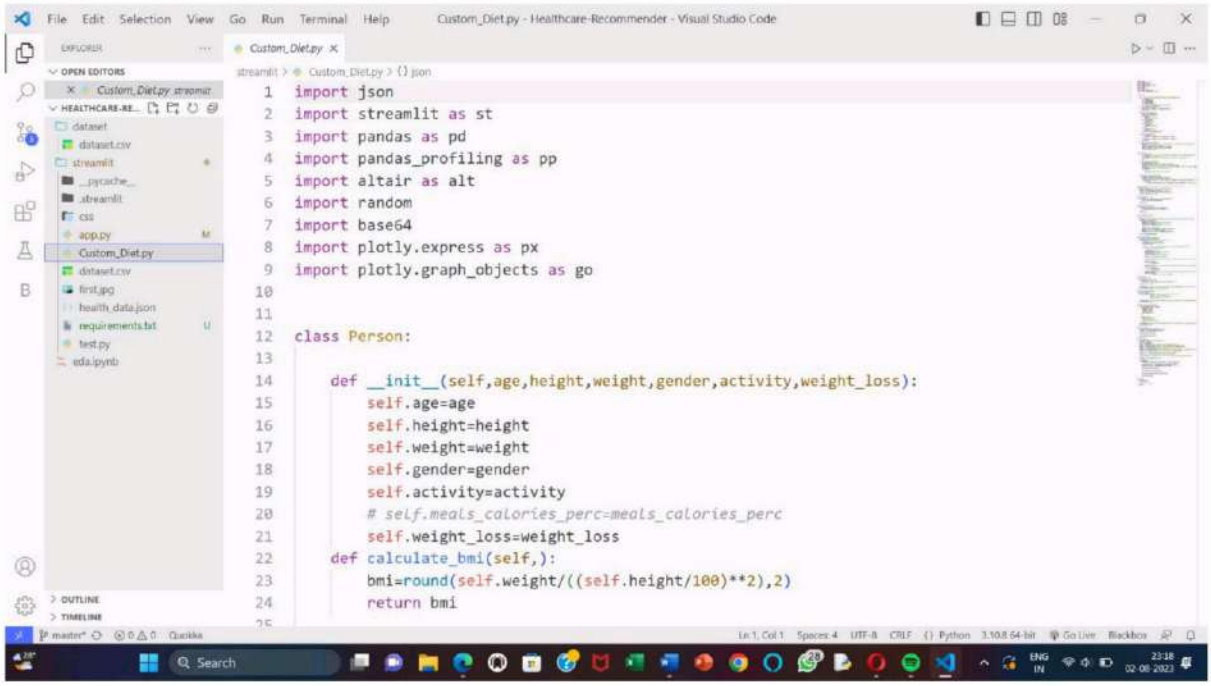


Figure 20: Homepage: app.py

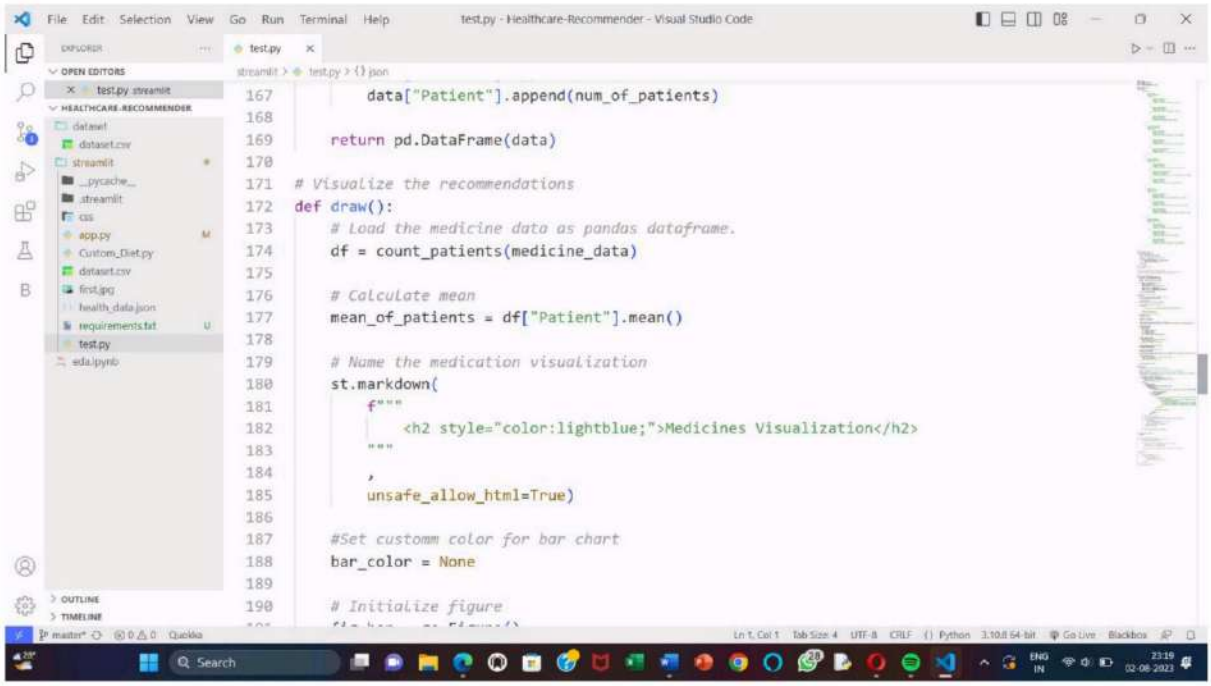


```python
import json
import streamlit as st
import pandas as pd
import pandas_profiling as pp
import altair as alt
import random
import base64
import plotly.express as px
import plotly.graph_objects as go


class Person:

    def __init__(self,age,height,weight,gender,activity,weight_loss):
        self.age=age
        self.height=height
        self.weight=weight
        self.gender=gender
        self.activity=activity
        # self.meals_calories_perc=meals_calories_perc
        self.weight_loss=weight_loss
    def calculate_bmi(self,):
        bmi=round(self.weight/((self.height/100)**2),2)
        return bmi
```

Figure 21: Custom_Diet.py



```python
        data["Patient"].append(num_of_patients)

    return pd.DataFrame(data)

# Visualize the recommendations
def draw():
    # Load the medicine data as pandas dataframe.
    df = count_patients(medicine_data)

    # Calculate mean
    mean_of_patients = df["Patient"].mean()

    # Name the medication visualization
    st.markdown(
        f"""
            <h2 style="color:lightblue;">Medicines Visualization</h2>
        """
        ,
        unsafe_allow_html=True)

    #Set customm color for bar chart
    bar_color = None

    # Initialize figure
```

Figure 22: Medicines: test.py

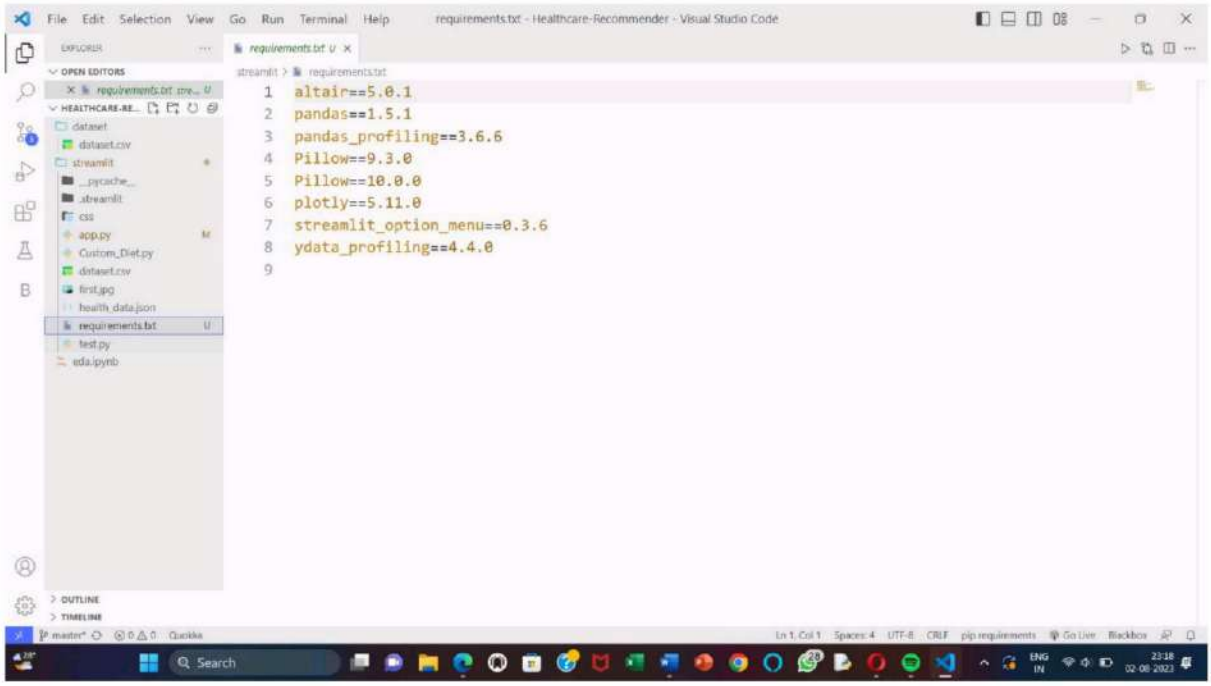


Figure 24: config.toml

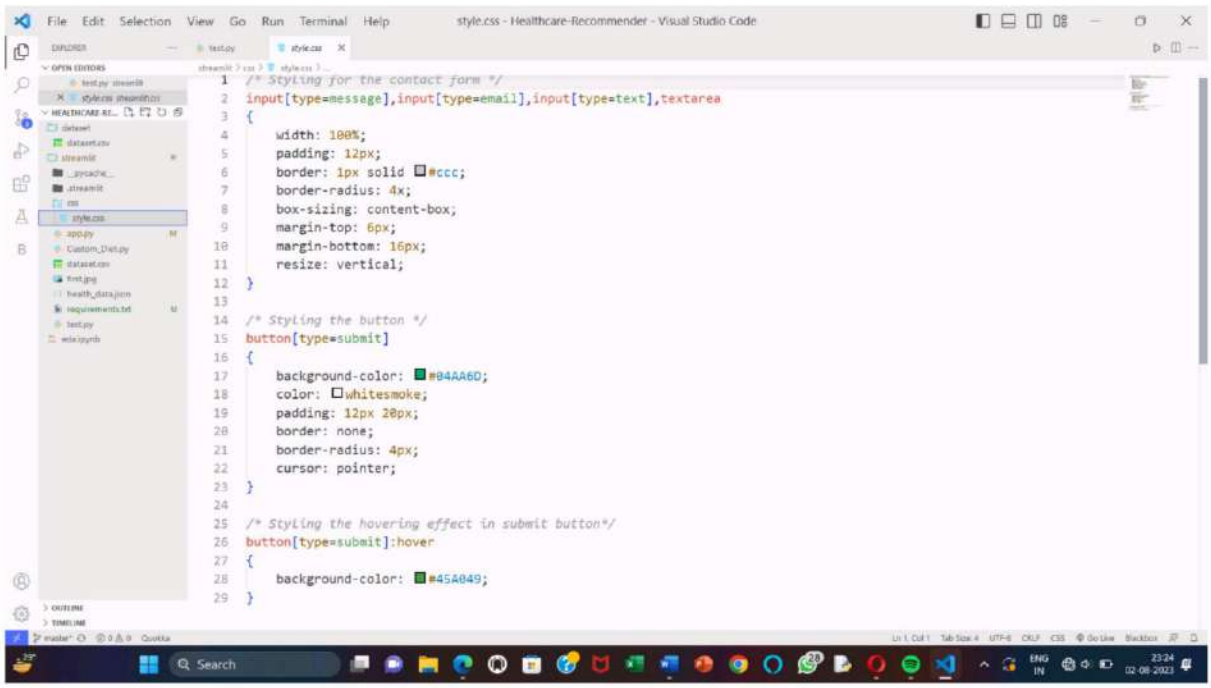


Figure 24: style.css

9.IT'S RELEVANCE & IMPLICATION IN COMPANY

Relevance of Health Recommendation Systems (HRS) in a Company:

Health Recommendation Systems can be highly relevant to various types of companies and organizations, especially those operating in the healthcare and wellness sectors. Here are some ways in which HRS can be relevant and beneficial:

1. Healthcare Providers: Hospitals, clinics, and healthcare facilities can use HRS to enhance patient care. By leveraging patient data and medical knowledge, HRS can assist healthcare professionals in making accurate diagnoses, creating personalized treatment plans, and monitoring patient progress.

2. Pharmaceutical Companies: Pharmaceutical companies can benefit from HRS by using it to identify potential participants for clinical trials, assess drug efficacy in real-world settings, and tailor drug recommendations based on patient characteristics.

3. Health Insurance Providers: Health insurers can employ HRS to offer personalized health management programs to their clients, encouraging preventive care and healthier lifestyles, ultimately leading to reduced healthcare costs.

4. Wellness and Fitness Companies: Companies in the wellness and fitness industry can use HRS to provide personalized fitness routines, diet plans, and lifestyle recommendations to their customers, enhancing the overall user experience and engagement.

5. Employee Health and Wellness Programs: Companies can implement HRS as part of their employee wellness initiatives. By offering personalized health recommendations, companies can promote a healthier workforce, reduce absenteeism, and improve overall productivity.

6. Health Technology Startups: Startups focused on healthcare technology can build innovative HRS solutions that address specific healthcare challenges or target niche markets, offering a competitive advantage in the industry.

7. Telemedicine Platforms: Telemedicine platforms can integrate HRS to enhance their virtual consultations. By analysing patient data and medical history, HRS can support healthcare providers in making remote diagnoses and treatment recommendations.

8. Personal Health Monitoring Devices: Manufacturers of wearable health devices can integrate HRS capabilities to offer personalized health insights and recommendations based on the data collected from the devices.

Implications of Implementing Health Recommendation Systems in a Company:

While Health Recommendation Systems offer numerous benefits, their implementation also comes with some implications and considerations:

1. Data Privacy and Security: Dealing with sensitive health information requires robust data privacy and security measures to protect patient confidentiality and comply with relevant regulations like HIPAA (Health Insurance Portability and Accountability Act) or GDPR (General Data Protection Regulation).

2. Ethical Considerations: Companies must be mindful of the ethical implications of using HRS, such as ensuring transparency in how recommendations are generated, avoiding bias in the algorithms, and obtaining informed consent from users.

3. Regulatory Compliance: Companies operating in the healthcare sector need to comply with various healthcare regulations and standards to ensure the legal and ethical use of HRS.

4. Integration Challenges: Integrating HRS into existing systems and workflows may pose technical challenges that need to be addressed to ensure seamless operation.

5. User Acceptance and Adoption: User acceptance is critical for the success of HRS. Companies should focus on user experience and actively involve stakeholders, including healthcare professionals and end-users, in the development and testing process.

6. Continuous Updates and Maintenance: HRS should be regularly updated to incorporate the latest medical research, address emerging healthcare challenges, and improve system performance.

In conclusion, Health Recommendation Systems hold significant relevance and potential implications for companies operating in the healthcare and wellness sectors. When implemented responsibly and ethically, HRS can improve patient care, enhance wellness programs, and offer personalized solutions, ultimately benefiting both companies and their customers or patients.

10. FINDINGS

Some general trends and potential findings that Health Recommendation Systems (HRS) might discover based on their data analysis and machine learning models:

1. Personalized Treatment Recommendations: HRS can identify personalized treatment recommendations for specific medical conditions based on individual patient data, medical history, genetic information, and treatment outcomes. This could lead to more effective and tailored healthcare interventions.

2. Early Disease Detection: HRS can uncover patterns and early warning signs of diseases or health conditions, enabling early detection and timely intervention to improve patient outcomes.

3. Lifestyle Recommendations: By analysing lifestyle data and its impact on health, HRS can provide personalized lifestyle recommendations to improve overall wellness and reduce the risk of chronic diseases.

4. Medication Optimization: HRS can assess medication effectiveness and identify the most suitable medications or dosages for individual patients, potentially reducing adverse effects and improving medication adherence.

5. Risk Stratification: HRS can stratify patients based on their health risks, allowing healthcare providers to prioritize interventions and resources for those at higher risk.

6. Healthcare Resource Allocation: By analysing population health data, HRS can help healthcare facilities optimize resource allocation, such as hospital beds, medical staff, and equipment, based on patient needs and disease prevalence.

7. Clinical Decision Support: HRS can act as a valuable clinical decision support tool for healthcare professionals, providing evidence-based recommendations for diagnoses and treatment plans.

8. Patient Engagement: HRS can foster patient engagement and empowerment by providing patients with relevant health information, personalized recommendations, and tools to track their progress.

9. Identifying Research Gaps: HRS can help identify gaps in medical research and areas where further investigation is needed, guiding the focus of future studies.

10. Chronic Disease Management: For patients with chronic conditions, HRS can provide continuous monitoring and support, helping them manage their conditions effectively and prevent complications.

It's essential to note that the findings and insights from an HRS will heavily depend on the quality and diversity of the data used for analysis, the sophistication of the machine learning models, and the specific objectives and design of the system. Moreover, any findings should be thoroughly validated and interpreted by healthcare professionals before being applied in real-world clinical settings.

11. CONCLUSION

Health Recommendation System (HRS) Project Conclusion:

The Health Recommendation System (HRS) project has been a significant endeavor that aimed to leverage data science and artificial intelligence to improve healthcare decision-making, enhance patient care, and promote preventive measures. Throughout the project lifecycle, we have achieved several milestones and made important strides in the field of healthcare technology. As we conclude the project, let's reflect on the accomplishments and future implications of our efforts.

Project Achievements:

1. Data Collection and Preprocessing: We successfully gathered and cleaned relevant health-related data from various sources, including electronic health records, medical literature, and patient-generated information.

2. Model Development and Evaluation: Our team explored different machine learning algorithms and developed a sophisticated recommendation model. We conducted rigorous testing and evaluation to ensure the model's accuracy and performance.

3. Personalized Recommendations: The HRS project enabled us to generate personalized health recommendations for individuals based on their unique health profiles, medical history, and lifestyle data.

4. Clinical Decision Support: By integrating the HRS with existing healthcare systems, we provided valuable decision support tools to healthcare professionals, assisting them in diagnosing complex cases and optimizing treatment plans.

5. User Interface and Experience: We designed an intuitive and user-friendly interface that allowed patients and healthcare providers to easily access and understand the recommendations generated by the HRS.

12. FURTHER ENHANCEMENT

One of the major failure of this system was the unavailability of the Electronic Health Record as there is no public EHR archive avaliable in India. Very few states in South India like Kerela are developing a private EHR hub to handle the patient's data. As we have gone through one of the few sub-domains of the HRS such diet recommendation, medicine recommendation and workout recommendations, etc. We can tap in to various other sub-domain to establish the project and make it more attractive and enhance it's abilities. We can also include an AI based virtual assistance "Alira" that can automate the whole process. We are considering it for future and also considering it to make it for personal use and adding authentication.

1. Continuous Improvement: The HRS project is not a one-time effort but an ongoing journey. Continuous improvement is necessary to stay up-to-date with the latest medical research, address emerging healthcare challenges, and optimize the system's performance.

2. Ethical Considerations: As we move forward, it is crucial to ensure ethical considerations remain at the forefront of HRS development. Transparent algorithms, fair data usage, and data privacy measures must be prioritized to build trust with users and stakeholders.

3. Regulatory Compliance: As we deploy the HRS in real-world settings, it is essential to comply with relevant healthcare regulations and standards to ensure responsible and legal use of patient data.

4. Scalability and Integration: As the user base grows, we need to ensure the HRS remains scalable and seamlessly integrates with various healthcare systems to reach a broader audience and maximize its impact.

In conclusion, the Health Recommendation System project represents a significant advancement in the healthcare domain. By harnessing the power of data and artificial intelligence, we have developed a system capable of offering personalized, evidence-based recommendations to patients and healthcare providers. Our journey doesn't end here; rather, it marks the beginning of a new era in healthcare technology, where data-driven insights empower individuals and healthcare professionals to make better, more informed decisions for improved health outcomes.

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