Ramrao Adik Education Society's

Ramrao Adik Institute of Technology

(Affiliated to D. Y. Patil Deemed to be University)

Dr. D. Y. Patil Vidyanagar,Sector 7, Nerul, Navi Mumbai 400 706.

Certificate

This is to certify that, TE VI Semester Mini Project report titled

"Food Recomendation System "

is a bonafide work done by

Prachitee Thakur (20IT1072)
Anushri Agarwal (20IT1022)
Bhakti Mestry (20IT1057)
Arpita Acharya (20IT1041)

and is submitted in the partial fulfillment of the requirement for the degree of

B.Tech.

(Information Technology)

to the

Ramrao Adik Institute of Technology, D. Y. Patil Deemed to be University.

_____   _____
Examiner   Supervisor
(Prof. Puja Vakhare)

_____   _____   _____
Mini-Project Coordinator   Head of Department   Principal
(Dr.Pallavi Chavan)   (Dr.Sangita Chaudhari)   (Dr.Mukesh D.Patil)

Declaration

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

_____

(Signatures)

_____

Prachitee Thakur 20IT1072

Anushri Agarwal 20IT1022

Bhakti Mestry 20IT1057

Arpita Acharya 20IT1041

Date: _____

Abstract

The food recommendation system is a popular and emerging technology that utilizes machine learning, and natural language processing techniques to suggest suitable food items to users. It recommends other types of food, such as meals in restaurants or products. This system provides personalized and accurate food recommendations and result based on the user's preferences, and past consumption patterns. The goal of this system is to enhance the user's experience and satisfaction by providing relevant and appealing food choices. The food recommendation system has vast potential in the food industry, including restaurants, food delivery services, and grocery stores. The recommendation system also provides accurate reviews for food. This abstract will discuss the importance and benefits of food recommendation systems and how they can be implemented in the food industry to improve customer satisfaction and loyalty.

Keywords:
Machine learning, KNN model, Recommendation system, Food Bank, Restaurants, Accurate result, Accurate reviews, Customer satisfaction

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Abbreviations

(note: sample of abbreviations is given below, remove this note once you listed abbriviations)

AI   Artificial Intelligence

NLP   Natural Language Processing

API   Application Programming Interface

Chapter 1

Introduction

Food recommendation systems have become increasingly popular in recent years due to the growth of technology and the widespread use of mobile devices. These systems are designed to provide personalized and accurate recommendations for food items or restaurants based on a user's preferences and past consumption patterns. The system is powered by machine learning, which enable it to understand and analyse user data to provide tailored recommendations and predict products that users have an interest. By providing relevant and appealing restaurants or food items to users, these systems can enhance the customer experience and satisfaction, leading to increased loyalty. The restaurants are suggested based on users' location, cuisines and ratings, which are classified using KNN algorithm . The user can also rate the recommended food items and this explicit form of feedback taken from the user thereby helps in making the recommendation engine more accurate. Recommender systems help users make informed decisions by collecting information about their preferences making it possible for users to choose the best of many options. In addition, food recommendation systems can also help users maintain a healthy and balanced diet by suggesting nutritious food items that meet their dietary requirements. The implementation of food recommendation systems can also have a positive impact on sustainability in the food industry.

1.1   Motivation

The motivation to present this report is from years we have seen people Struggling to get their meal choices right, to be more precise , people either fall pray to fake reviews and waste their penny on costly but disgusting foods. Our motto is create an WebApp which will get you true to stick review and help you find next good food, be it in any restaurant or local confectionery.

1.2   Organization of Report

The Report is organized as follows:

- Chapter 1 provides the introduction along with the motivation.

- Chapter 2 provides literature survey along with gaps identified,objectives and scope for work that is to be implemented.

- Chapter 3 provides the methodology for the project topic which consists of workflow and block diagram.

- Chapter 4 provides Requirement Specifications and Work Plan.

- Chapter 5 presents conclusion for the project.

Chapter 2

Literature Survey

[1] Elham Asani, Javad Sadri, Restaurant Recommender System Based On Sentiment Analysis, Volume 6, Issued on 15 December 2021, https://doi.org/10.1016/j.mlwa.2021.100114

Contribution: The recommender system proposes extractions of food preferences of individuals from their comments and make suggestions on restaurants according to these preferences. The method is based upon NLP for text processing of user comments and the desired food items. Clustering the names of the food uses a semantic approach extracted from users comments and analyse the sentiments about them. Nearby open restaurants are finally recommended based on similarities to user comments. The proposed recommender system's context aware for which by using user comments, location, time and feedback of all users, system recommends nearby restaurants that are open at that time and are matched with users comments/preferences.

Challenge: Group based recommendation is not considered in this paper. Most users frequently visit restaurants in groups so group based recommendation system is our way of light. To this extent similarity between user comments and their favorite foods in each restaurants should be mentioned.

[2] Raciel Yera Toledo, Ahmed A. Alzahrani, A Food Recommender System Considering Nutritional Information and User Preferences, Volume 7, Issued on 17 July 2019, pages 96695 - 96711, ISSN 2169-3536, https://doi.org/10.1109/ACCESS.2019.2929413

Contribution: A food recommender is a build that focuses on generating day to day personalized food preferences. The proposal comprises a pre-filtering stage that uses AHP

sort as multi criterion decision analysis tools for filtering out foods that are not accurate to current users personality. The main goal of recommender system is recommending foods highly preferred by users, not consume recently and satisfying their daily nutritious requirements.

Challenges: The purpose of long term information for the menu generation is not considered by this recommender system. Currently the only thing proposal is considering is physical user information for daily nutritional requirement calculation and system does not take into count the group based recommender which has straight application to food recommendation. Therefore it is mandatory to consider group recommendation context.

[3] R.M. Gomathi, P. Ajitha, Restaurant Recommendation System for User Preference and Services Based on Rating and Amenities, Date Of Conference 21-23 February 2019, Published in 2019 International Conference on Computational Intelligence in Data Science (ICCIDS), Chennai, India, https://doi.org/10.1109/ICCIDS.2019.8862048

Contribution: A recommendation system is upon considering the domain of hotel industry where as the feedbacks /reviews are explored to evaluate the user sentiments concerning all the hotel traits which further heals in examining users opinion.outcome results that recommender system yields in high accuracy.They proposed algorithms related to machine learning to resolve the issues of personalised restaurants selection and testing the behaviour of users employing the text data and ratings given by the users.The NLP ought for examining and taging all the previous users comments (positive/negative) for every restaurant here after computing the outstanding percentage of all the comments and storing the outputs.

Challenges: Based on the history and taste of the customer, the system does not recommend the most accurate reviews.

[4] Thi Ngoc Trang Tran, Alexander Felfernig, An overview of recommender systems in the healthy food domain, Published: 22 June 2017, Journal of Intelligent Information Systems, https://doi.org/10.1007/s10844-017-0469-0

Contribution: A recommender system in health domain is proposed in this paper.firstly,they provide a snippet of recommendation approaches for individuals. secondly,they discuss group decision making commotion whivh haave an impact on the de-

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velopment of group recommender technologies.Thirdly,on the basis of segregating food recommender systems they analyzed how rightly those systems can help persons or groups to choose nutritions that best fits there preferences and health situations. finally they extract out some challenges of food recommender systems with respect to user information,recommendation algorithms,change in eating behaviours,explanations,provisions and group decisions as topic for future works.

Challenges: some challenges with respect to user information recommendation algorithm,change in eating behaviour,explanations,provisions and group decisions as topic for future works.

1.The challenges regarding user info are the accuracy of nutritional information from user and collecting user rating data.

2. Challenges regarding recommender algorithms are by using knowledge about users examples: likes,dislikes,food intake and nutritional requirements.previous meals to calculate similarity and then appear as new recipe to users and how many recipes the system should have and how to collect on point nutritional data of recipe.

3. Another issue is regarding changing eating habits of users and challenges regarding decision making of groups.

[5] Weiqing Min, Ramesh Jain, Food Recommendation: Framework, Existing Solutions, and Challenges, Volume 22, Published in: IEEE Transactions on Multimedia, Date of Publication: 09 December 2019, Issue: 10 October 2020, Pages 2659 - 2671, ISSN: 1941-0077, https://doi.org/10.1109/TMM.2019.2958761

Contribution: Food recommender system is a promising and vital research direction for its importance to quality of life for people and potential applications in human health.This article puts forth a unified a framework for food recommendation and pointing out main issues affecting food recommendation comprising incorporating various context and regional knowledge,building the personal mechanics and analyzing food characteristics.Followed by the review existing solutions for this issues and finally elaborating research tasks and future directions in this area.It targets the knowledge of food recommendation in multimedia feild and offers a collection of research info and technologies to benefit scholars in this feild.The meals recommendation system has been proposed that provides

users with high rated food items using context and data,personal model constructed dynamically using food log and diverse food analysis to understand nutritional and test characteristics.

Challenges: There are mainly two challenges :-
1. One of the major challenge here is large-Scale Benchmark Dataset Construction.
2. Another challenge is the inaccuracy and uncertainty of measurement.

[6] Nourin Islam,Ms. Nasrin Akter,Abdus Sattar,Sentiment Analysis on Food Review using Machine Learning Approach,Published in: 2021 International Conference on Artificial Intelligence and Smart Systems (ICAIS),Date of publication: 12 April 2021,INSPEC Accession Number:19984902https://doi.org/10.1109/ICAIS50930.2021.9395874

Contribution: The sentiment analysis has been performed on food rating using ML approach. This utilizes ML models such as SVM,Logistic regression,RANDOM FOREST AND NAIVE BAYES prediction models for product review analysis.the taste are are performed on twitter yelp datasets.this information is available on web. The sentiments are estimated by food review using users rating. The SVM gives good results for this datasets followed by logistic regression giving fair accuracy.So they have applied normal ML grouping approach for finding supposition investigation for food audit dataset.SVM gives good accuracy for estimation examination.

Challenge: The challenge is that machine learning algorithm such as random forest and naive bayes decision maker for building of product review analysis gives poor accuracy.

[7] Mehrdad Rostami, Vahid Farrahi, Mourad Oussalah, A Novel Time-Aware Food Recommender-System Based on Deep Learning and Graph Clustering, Published in: IEEE Access, Date Of Publication: May 16 2022, Volume 10, https://doi.org/10.1109/ACCESS.2022.

Contribution: This article targets to build a new heterogeneous food recommender system to escape the short comment of previous systems such as ignoring meal ingredients,time factor,cold start food user and community aspects.the put forth method includes two phases- content based recommendation and user based recommendation.graph clustering is phenomenon part in first phase and is a deep learning approach used in second

phase to group both user and food items.

Challenge: The challenge is that they does not include side info of users such as gender,age,location,culture into food recommender area that further improve the final performance of the food recommendation and they does not consider nutritional data of per food as additional data and recommend food items regarding to each persons health issues.

[8] Manu Gupta,Sriniha Mourila,Sreehasa Kotte,Bhuvana Chandra.k, Mood Based Food Recommendation System, Published in : Asian Conference on Innovation in Technology (ASIANCON), Date Of Publication:04 October 2021, https://doi.org/10.1109/ASIANCON51

Contribution: The proposed method is completely personalised for users,this mechanics recommends food and available hotels based on persons current mood.It points to overcome the demerits of pre-existing systems by giving item recommendations based on moods and providing interactive appearance and personalised results. The model is developed upon pycharm,the restaurants are grouped on location criterion usin KNN algorithm.flask is used for frontend here.

Challenge: The model needs to expand to match the facial expressions and mood of users and accordingly recommend in food regarding to his interest.

[9] Aryan Jalali,Arjun Manoj Kumar P., Ayesha Siddiqua,Amulya N., Alok Kumar Singh , S.M.HariKrushna, Mobile Application for Personalized Food, Published in:7th International conference for Convergence in Technology (I2CT) Pune, Date Of Publication:18 July 2022, INSPEC Accession Number: 21882904, https://doi.org/ 10.1109/I2CT54291.2022.9

Contribution: This paper elaborate the outline of application that takes inputs from users analyzes the data feeds it to the algorithm.The model works on theory of content based filtering and group filtering model.one item feature similarity and item-user similarity matrix is created based upon values for most similar food items are recommended on the app.

Challenge: To expand including improve the pre-existing dataset consisting restaurant database also, Everytime a food item suggest restaurant who serve that particular item are also displayed and use stars feedback from users to enhance recommendation.

Figure 2.1: Comparison Of Food Recomendation System Papers

Name Of Paper	Author Name	Contribution	Challenge
Restaurant Recommender System Based On Sentiment Analysis	Elham Asani, Javad Sadri	A recommender system is proposed that extracts the food preferences of individuals from their comments and suggests restaurants in accordance with these preferences. This method is based on the use of natural language processing techniques for processing the text of user comments and extracting the desired food names.	Challenge: Group based restaurant recommendation is not considered in this paper. As users usually visit restaurants in groups, group-based restaurant recommendation is a main future direction for this research.
A Food Recommender System Considering Nutritional Information and User Preferences	Raciel Yera Toledo, Ahmed A. Alzahrani	Contribution: A food recommendation is build that focuses on generating daily personalized meal plans for the users, according to their nutritional necessities and previous food preferences.	The use of long-term information for the menu generation is not considered by this recommendation system.
Restaurant Recommendation System for User Preference and Services Based on Rating and Amenities	R.M. Gomathi, P. Ajitha	A Recommendation System has been build by considering the domain of hotel industry wherein feedbacks/reviews are extracted to evaluate the user's sentiments concerning the hotel traits which further aids in examining user's opinion.	Based on the history and taste of the customer, the system does not recommend the most accurate reviews.
An overview of recommender systems in the healthy food domain	Thi Ngoc Trang Tran, Alexander Felfernig	A recommender system in healthy food domain is proposed in this paper.they provide a short overview of recommendation approaches for individuals.	Some challenges regarding user information, recommendation algorithms, changing eating behaviors, explanations provision, are the issues for further work.
Food Recommendation: Framework, Existing Solutions, and Challenges	Weiqing Min, Ramesh Jain	This article proposes a unified framework for food recommendation, and identifies main issues affecting food recommendation including incorporating various context and domain knowledge, building the personal model, and analyzing unique food characteristics.	One of the major challenge here is large-Scale Benchmark Dataset Construction

Sentiment Analysis on Food Review using Machine Learning Approach	Nourin Islam,Ms. Nasrin Akter,Abdus Sattar	A sentiment analysis has been done on food review using machine learning approach.	machine learning algorithm such as Random Forest ,Naive Bayes classifier for development of product review analysis gives poor accuracy.
A Novel Time-Aware Food Recommender-System Based on Deep Learning and Graph Clustering	Mehrdad Rostami, Vahid Farrahi, Mourad Oussalah	This paper aims to develop a new hybrid food recommender-system to overcome the shortcomings of previous systems, such as ignoring food ingredients, time factor, cold start users, cold start food items and community aspects.	they does not consider nutritional characteristics of each food as additional information and recommend foods according to each person's health status and diseases.
Mood Based Food Recommendation System	Manu Gupta,Sriniha Mourila,Sreehasa Kotte,Bhuvana Chandra.k	The proposed system is completely personalized for users, this system recommends food and available restaurants based on user's current mood.	The model needs to be extended to recognize facial expressions and predicting mood of user and accordingly, recommend him food according to his interest.
Mobile Application for Personalized Food	Aryan Jalali,Arjun Manoj Kumar P., Ayesha Siddiqua,Amulya N., Alok Kumar Singh , S.M.HariKrushna	This paper illustrates the design of the application that takes inputs from the user, analyzes the data and feeds it to the machine learning algorithm.	To expand and improve the existing dataset.

2.1 Gaps identified

- Group based restaurant recommendation is one of the main gaps identified. As users usually visit restaurants in groups, group-based restaurant recommendation is a main future direction for this research. So the similarity between users' preferences and their favorite foods in each restaurant should be specified.

- The recommendation system does not uses the long-term information for the menu generation. This also does not consider the group based recommendation which has complete application to our project.

- Based on the history and taste of the customer, the system does not recommend the most accurate reviews.

- The issues for further work are challenges regarding user information, recommendation algorithms, changing eating behaviors, explanations provision, and group decision making.

- Another gaps identified is large-Scale Benchmark Dataset Construction. Also the inaccuracy and uncertainty of measurement.

- Random Forest and Naive Bayes classifier gives poor accuracy.

- The side information of users such as gender, age, weight, height, location, and culture are not included into the food recommendation framework.

- The recognization facial expressions and predicting mood of user and accordingly, recommend him food according to his interest also not included in the model.

- Existing dataset, include restaurant database, so whenever a food item is recommended, restaurants that serve that dish are also displayed and use ratings feedback from users to improve recommendation results are required to expand and improve.

2.2   Objectives

- To create group based recommendation system as users usually visit restaurants in groups, group-based restaurant recommendation is a main future direction.

- To develop a system based on history and taste of the customers and to provide accurate results to the users regarding their preferences.

- To include the side information of users such as age, location into the food recommendation framework for more accurate results.

- To develop a system to improve the existing dataset, include restaurant database as well, so whenever a food item is recommended, restaurants that serve that dish are also displayed and use ratings feedback from users to improve recommendation results.

2.3   Scope for work

The report aims to provide insights into the current state of the field, as well as identify gaps and challenges that need to be addressed in future research.

- To achieve more Accurate recommendation through AI-driven models.

- To refine the reviews using Natural Language Processing models.

- To have Systems' own Database

- To have a detailed structure for posting reviews.

- To replace old recommending websites by New-Gen review system like Yelp

Chapter 3

Methodology

3.1 Methodology

The first step in designing a food review system is to determine its purpose. For instance, is it to help customers make informed decisions when ordering food or to provide feedback to restaurants to help them improve their services.

Next, identify the key features of a restaurant or food item that the review system will evaluate. Examples could include the quality of the food, the level of customer service, the ambiance of the restaurant, and the value for money.

Once the features have been identified, a rating scale can be developed to quantify the quality of each feature. For instance, a scale of 1 to 5 can be used, with 1 being the lowest score and 5 being the highest score.

Data can be collected through a variety of methods, such as online surveys, in-person interviews, or by using automated systems like chatbots or interactive kiosks. The data should be collected from a representative sample of customers to ensure that the review system is accurate and fair.

After collecting the data, it is essential to analyze it to identify trends, patterns, and areas for improvement. This can be done using statistical analysis tools and techniques.

The results of the review system should be displayed in an easy-to-understand format, such as a star rating system or a summary report. This will help customers make informed decisions when choosing a restaurant or food item.

Finally, it is important to continuously monitor and improve the review system. This can be done by gathering feedback from customers, monitoring industry trends.

The systems' main component is app's database which will be consisting the user reviews and the reviews from the database are processed using models and then they appear on users feed. The system methodology has major similarities with instagram's inner working.

Our work flow diagram firstly comprises of two main steps 1. Login and 2.Register followed with a choice of either writing a review or searching for a foodspot. If the user chooses to write a review then he can do so . IF the choice is to search foodspots then the top reviews will appear and then user may select to visit that place or again write a review if he has already visited.
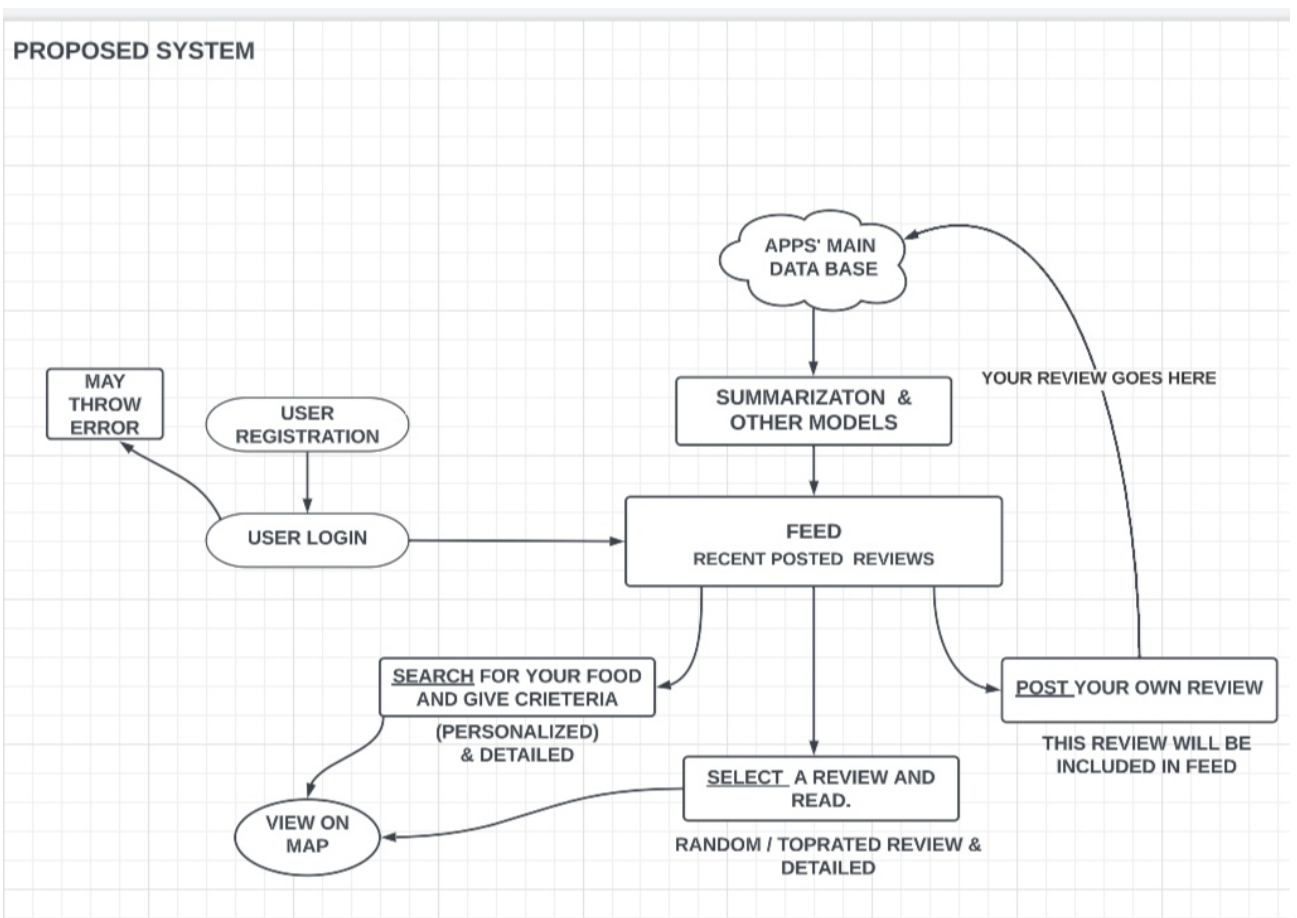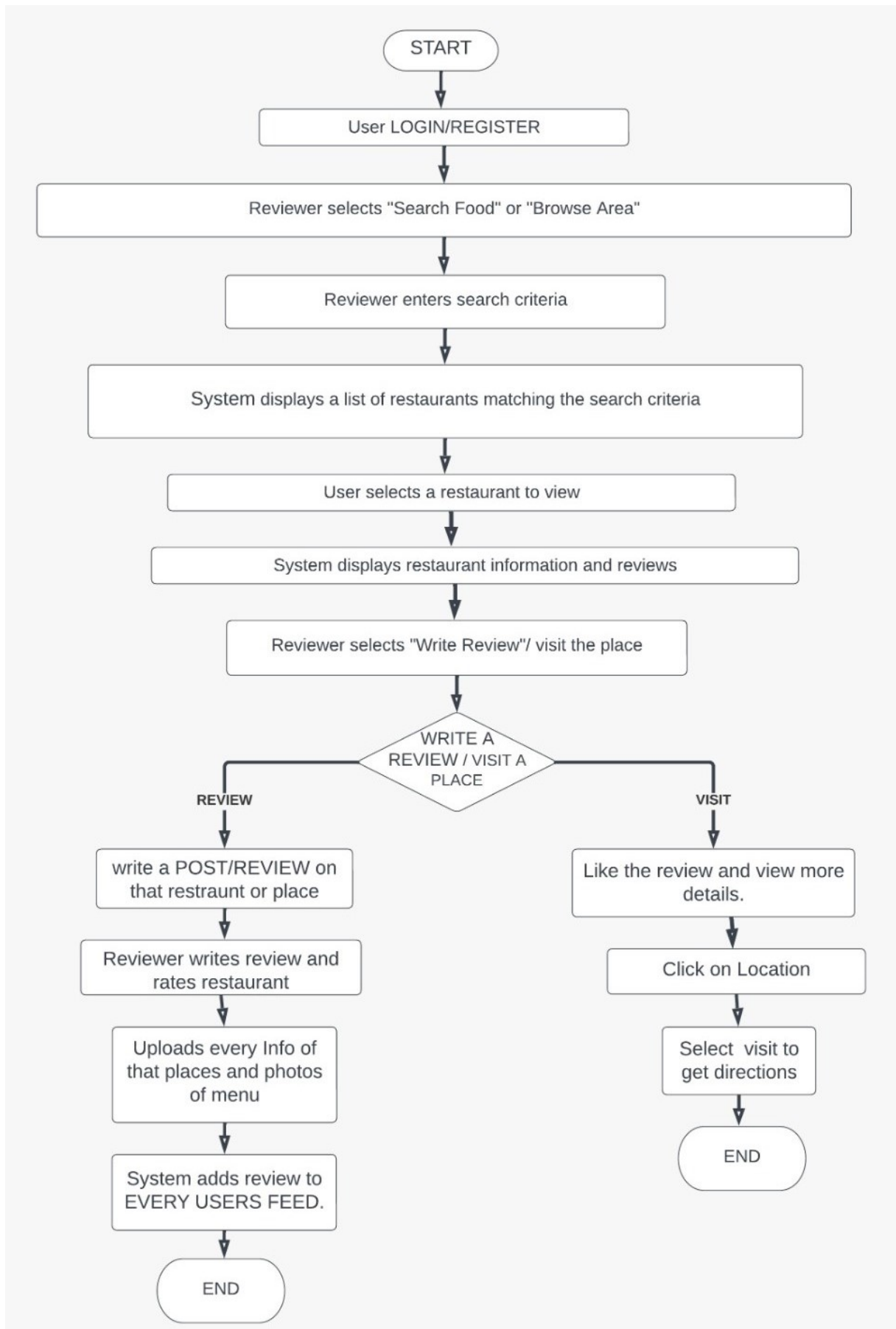
Figure 3.1: Block Diagram

Figure 3.2: Flow Chart Of Food Recomendation System

Chapter 4

Requirement Specifications and Work Plan

4.1 Requirement Specification

- Hardware Requirement: The food recommendation implementation requires a sufficient amount of hardware resources to store and process data. The hardware components needed for the food recommendation implementation are processor, storage devices, network equipment, memory,graphics processing unit.

- Software Requirement: The private cloud implementation requires various software components, including the database,machine learning framework,API framework,security tools.

- Security Requirement: Private cloud implementation should include security measures such as firewalls, intrusion detection, data encryption, and access control policies to ensure that the data is secure and protected.

- Scalability Requirement: Food recommendation implementation should be scalable to accommodate future growth and changing business needs.

4.2 Work Plan

- Define the purpose of the food review system: The first step in designing a food review system is to determine its purpose. For instance, is it to help customers make informed decisions when ordering food or to provide feedback to restaurants to help them improve their services.

- Determine the features to be evaluated: Next, identify the key features of a restaurant or food item that the review system will evaluate. Examples could include the quality of the food, the level of customer service, the ambiance of the restaurant, and the value for money.

- Develop a rating scale: Once the features have been identified, a rating scale can be developed to quantify the quality of each feature. For instance, a scale of 1 to 5 can be used, with 1 being the lowest score and 5 being the highest score.

- Collect data: Data can be collected through a variety of methods, such as online surveys, in-person interviews, or by using automated systems like chatbots or interactive kiosks. The data should be collected from a representative sample of customers to ensure that the review system is accurate and fair.

- Analyze the data: After collecting the data, it is essential to analyze it to identify trends, patterns, and areas for improvement. This can be done using statistical analysis tools and techniques.

- Display the results: The results of the review system should be displayed in an easy-to-understand format, such as a star rating system or a summary report. This will help customers make informed decisions when choosing a restaurant or food item.

- Continuously improve the system: Finally, it is important to continuously monitor and improve the review system. This can be done by gathering feedback from customers, monitoring industry trends, and incorporating new features and technologies.

Chapter 5

Conclusion

In conclusion, a food recommendation system can be a valuable tool for individuals looking for meal inspiration or personalized guidance. By utilizing user data, such as food preferences,and nutritional needs, these systems can generate tailored recommendations that are both satisfying and healthy. Additionally, the use of machine learning algorithms can improve the accuracy and relevance of the recommendations over time, as the system learns from user feedback and behavior. However, it is important to ensure that these systems prioritize user privacy and transparency in their data collection and recommendation processes. Overall, a well-designed food recommendation system can enhance the dining experience and promote healthy eating habits.

Bibliography

[1] Elham Asani, Javad Sadri, Restaurant Recommender System Based On Sentiment Analysis, Volume 6.

[2] Raciel Yera Toledo, Ahmed A. Alzahrani, A Food Recommender System Considering Nutritional Information and User Preferences, Volume 7.

[3] R.M. Gomathi, P. Ajitha, Restaurant Recommendation System for User Preference and Services Based on Rating and Amenities.

[4] Thi Ngoc Trang Tran, Alexander Felfernig, An overview of recommender systems in the healthy food domain.

[5] Weiqing Min, Ramesh Jain, Food Recommendation: Framework, Existing Solutions, and Challenges, Volume 22.

[6] Nourin Islam,Ms. Nasrin Akter,Abdus Sattar,Sentiment Analysis on Food Review using Machine Learning Approach.

[7] Mehrdad Rostami, Vahid Farrahi, Mourad Oussalah, A Novel Time-Aware Food Recommender-System Based on Deep Learning and Graph Clustering.

[8] Manu Gupta,Sriniha Mourila,Sreehasa Kotte,Bhuvana Chandra.k, Mood Based Food Recommendation System.

[9] Aryan Jalali,Arjun Manoj Kumar P., Ayesha Siddiqua,Amulya N., Alok Kumar Singh , S.M.HariKrushna, Mobile Application for Personalized Food.

[10] P. Wang, Y. Wang, L. Y. Zhang, and H. Zhu, "An effective and efficient fuzzy approach for managing natural noise in recommender systems," Inf. Sci., vol. 570, pp. 623–637, Sep. 2021.

[11] X. Yu, Y. Chu, F. Jiang, Y. Guo, and D. Gong, "SVMs classification based two-side cross domain collaborative filtering by inferring intrinsic user and item features," Knowl.-Based Syst., vol. 141, pp. 80–91, Feb. 2018.

[12] A. D. Viniski, J. P. Barddal, A. D. S. Britto, Jr., F. Enembreck, and H. V. A. D. Campos, "A case study of batch and incremental recommender systems in supermarket data under concept drifts and cold start," Expert Syst. Appl., vol. 176, Aug. 2021, Art. no. 114890

[13] Li Chen, Guanliang Chen, and Feng Wang. 2015. Recommender systems based on user reviews: the state of the art. User Modeling and User-Adapted Interaction 25, 2 (June 2015), 99–154.

[14] Y. Gao, W. Yu, P. Chao, R. Zhang, A. Zhou, and X. Yang, "A restaurant recommendation system by analyzing ratings and aspects in reviews," in International Conference on Database Systems for Advanced Applications. Springer, 2015, pp. 526–530

[15] S. Jung, J. Kim, and J. L. Herlocker, "Applying collaborative filtering for efficient document search," in Proceedings of the 2004 IEEE/WIC/ACM International Conference on Web Intelligence. Washington, DC, USA: IEEE Computer Society, 2004, pp. 640–643.