

Foodmate: A Social Networking Web Application for Foodies

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Abstract - Foodmate is a social media platform built for the community of foodies. It overcomes the drawbacks of food delivery platforms which is that they majorly focus on selling products and quality of food is neglected and solely depends on what the vendor sells. Foodmate provides a platform to the Food Vloggers to showcase their talent and content over the platform. This also helps the foodies to keep a check on what's yummy around themselves by watching the reviews posted by various food vloggers. This also provides the restaurant with a better tool to have insights of what foodies are interested in their place and various insights regarding them. The images uploaded by the food vloggers are tagged with the help of ML & Image based tagging, this will provide a better personalized feed for the user. The ML based recommendation will use content-based recommendation implemented using cosine similarity between user's previously liked posts to determine the user with similar likes and fetching similar posts with the help of Word Vectorization and TF-IDF. The Image based tagging will be done using CNN and Deep Learning. Graph based structure will be designed to efficiently generate post insights data. A revenue model will be added where restaurants can do promotion and some part of the revenue will be contributed to an NGO for their social work

Key Words: Social Media Platform, Food, Recommendation System, Image Recognition, Web Application

1. INTRODUCTION

Now-a-days ordering food online has become a major part of daily life for the majority of population. Millions of people across the globe order food online, but in most of the cases, it has been observed that the food items that the customers receive in hand are way different than the item as perceived by the customer based on the thumbnail and advertisement images shown in food delivery applications. Here the customer or the end-user is in need of actual images of the items they are going to order along with some genuine reviews about the restaurant or the food they decided to order. Currently, there is no such platform available in the market that gives the customer such a clear view. Also, no separate platform exists for food vloggers to showcase their content.

Foodmate is a social media application which enables to share, exchange and discover the information. In our case it is the reviews/posts with pictures of food. These posts are discoverable to the end user in a personalized way where each and every post is placed in the feed according to the geo-spatial distance between the user and the restaurant to

which the posts belong to and also the user preferred cuisines are given a priority in the posts feed taking into consideration their likes and dislikes. Foodmate focuses on providing a platform for vloggers where their content is catered to only those who are interested in the niche of that particular post. We focus on making foodmate usable for everyone, hence Foodmate will be designed to be usable for more than 90% of devices with different screen sizes. In addition to this, the platform consists of a Content Based Recommendation for the users to provide content which is tailored based on their history of interest. The Vloggers can view insightful data of the users who have interacted with their content which helps them in producing their content in an efficient way. The restaurant owners will be able to hire vloggers from the platform to promote their food and services through sponsored posts and pay the vlogger based on the CPC (Cost Per Click) rate. A fixed percentage of this revenue will be donated towards NGO funds for helping their social needs and deeds.

2. LITERATURE SURVEY

A. TF-IDF & Cosine Similarity: Author One et al. [1] makes use of TF-IDF (Term Frequency-Inverse Document Frequency) for implementing Content Based Recommendation system. This technique is a measure of originality of a word by comparing the number of times a word appears in a given document to the number of documents in which that particular word appears. It is used to recommend content to the user based on the similarity with the content previously viewed by the user. The similarity score between the contents is calculated using cosine similarity which is a measure of similarity between two vectors.

B. Tags Based Recommendation: This technique is used by Author Two et al. [3] and proves to be a better approach for recommendation when the user is new to the platform. It is a Content Based Recommendation technique. It makes use of tags given to the food posts at the time of uploading the posts. These tags and user preferred tags (selected by the user) are used to recommend posts and render the customized feed for the user.

C. Geopositioning: It is one of the techniques explained by Author [4] et al. which is used to fetch details about a user's location. In this technique, user's location is fetched by using the Global Positioning System (GPS) installed in user's device. While it achieves a high accuracy in devices having GPS,

its accuracy falls down drastically working with devices without GPS (Eg: Laptop, Desktop, etc)

D. Geocoding: It is one of the techniques explained by Author [4] et al. which is used to fetch details about a user's location. It is divided into 2 types: Forward Geocoding and Reverse Geocoding. Forward Geocoding is a technique of converting an address into coordinates (latitude and longitude) whereas in Reverse Geocoding, coordinates are converted into a textual address. Foodmate uses forward geocoding technique to get coordinates of the address entered by the user and display the restaurants and posts of restaurants in that location.

E. Convolutional Neural Network (CNN): It is a deep learning technique used by the Author [5] et al. to recognize the food images. After recognizing the image, it will be dynamically tagged which will be used later for recommendation.

2.1 Comparison of techniques in Literature Survey

The overview of the two major techniques explained by Author [2] et al. to fetch location is given in the following table.

Table -1: Summary of literature survey

Parameters	Geopositioning	Geocoding
Accuracy in devices with GPS	High	High
Accuracy in devices without GPS	Low	High
Requirement of a dataset of addresses	Not required	Required

The overview of comparison of different parameters are given in Table 2

Table -2: Summary of Recommendation techniques

Parameter	TF-IDF & Co-sine Similarity	Tags Based Recommendation
Efficiency	High	Low

Accuracy when a user is new	Low	High
Performance with large dataset	Fast	Slow

3. PROPOSED WORK

The Foodmate has been designed to provide a platform for the user to have a glance at the food available in his/her surroundings. The content posted on the foodmate platform is provided by the local vloggers which is browsed by the users of foodmate. Foodmate has its own algorithm to serve its users with different feeds lists personalized according to the geo-spatial distance between the user and the restaurant to which the posts belong. Once the platform is familiar with the user's interests, they are served with only those posts which are most similar to their own interests. The different modules of Foodmate are discussed below.

3.1 Architecture Overview

The diagram below describes the Architecture of Foodmate involving the various users of the system. The Appflow for each and every user is described further in this section.

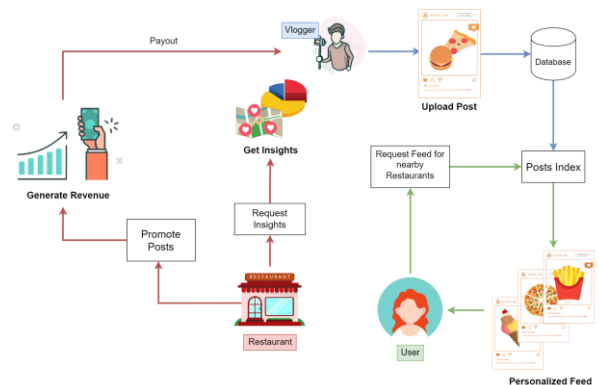


Fig. 3.1 Proposed system architecture

The whole architecture is been divided into three separate parts for the three different user roles - Users, Vloggers & Restaurant.

A. For Vloggers: The below figure represents the parts of the architecture which works for the vloggers of Foodmate. Foodmate stores and processes the posts of the vloggers in a way it is shown to only the audience/foodies who are interested in the niche of that content. Following the figure, is the detailed explanation of each block in the above represented architecture.

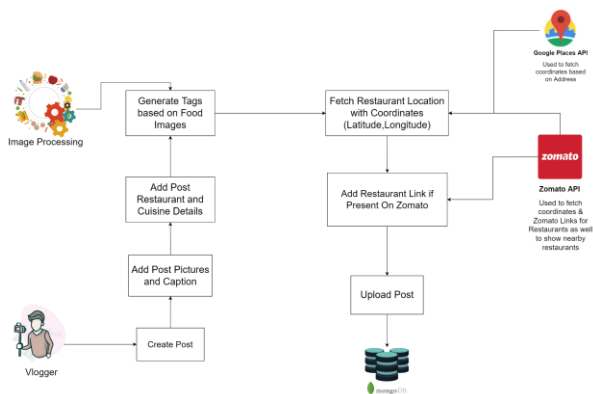


Fig. 3.2 Vlogger - Architecture of Foodmate

- **Create Posts & Add Pictures and Caption:** Here the vlogger uploads the pictures of the food/places they have experienced recently. They also add a caption to the post which describes the food in the picture and/or about the restaurant to which the post belongs.

- **Add Restaurant & Cuisine Details:** The Vlogger adds the restaurant details which can be used by the user to further order from the same restaurant and also the vlogger adds the tags which describes the types of cuisines the particular food belongs to. These tags are later utilized by the system for personalizing the user feed.

- **Fetch Restaurant Location:** Once the Restaurant details are added the location coordinates are generated with the help of Zomato API. The Restaurant coordinates can be generated using Zomato API only if the restaurant is available on Zomato or else The Restaurant coordinates are generated using Google Maps API.

- **Generate Zomato Link:** If the restaurant is present on Zomato then the Zomato Profile Link is also Generated and saved with the post which can be accessed by the user viewing the post to enable them as well to order from that specific restaurant.

- **Upload:** The post is then finally stored in the Database and simultaneously it is added into the Posts Index which will be elaborated in the further topics. At the same time the post is also converted into a string which contains the post details such as, post owner details, post restaurant details, post cuisine details, post caption & post tags. These strings are stored separately on the server to later utilize for Word Vectorization & TF-IDF.

B. For Users/Foodies: The below figure represents the architecture of the proposed system for Users of the foodmate. The each and every block of the below diagram is explained further.

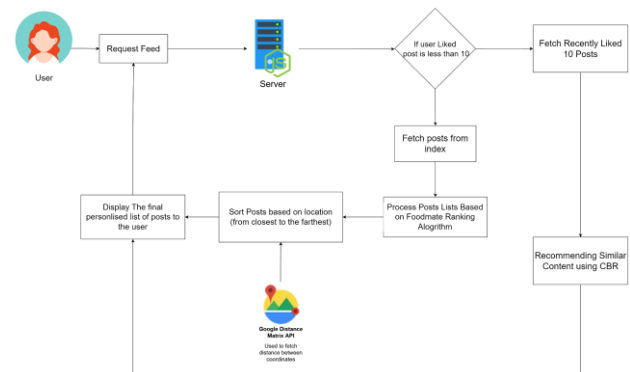


Fig. 3.3 User - Architecture of Foodmate

- **Request Feed:** Here the registered users are logged in through their accounts and while registering on Foodmate it requires the User to provide User's City & Locality. When the user is new to the platform and has interacted with enough posts then the user is served with content similar to its previously liked posts using CBR or else if the user is new to the platform hasn't interacted with enough posts, then the following blocks are executed.

- **Server & Post Index:** The server whenever receives the requests for feeds the server uses the fetched user details from the previous block and looks into the index for relevant posts and fetches only those posts which are located within 10 kms range from the user and only those posts posted in the last 24 hours.

- **Process Posts Feed using Foodmate Ranking Algorithm:** The Foodmate's Ranking Algorithm Processes the feed lists in such a way that only the posts which are closer and are latest in time are visible. The FRA provides users with a list of feed posts which are closer to the user and also latest in time

- **Sort based on location:** Here the posts with the same number of matched tags are further sorted based on restaurants being the nearest to the farthest from the user.

- **Display the final personalized list:** This step involves fetching the posts details and building the actual feed list with post pictures and details along with post comments. This feed list is the final feed rendered in front of the user.

C. For Restaurants: The above figure represents the architecture for the Restaurants. restaurants are provided with the feature to promote their food and services through Foodmate by hiring vloggers on the platform.

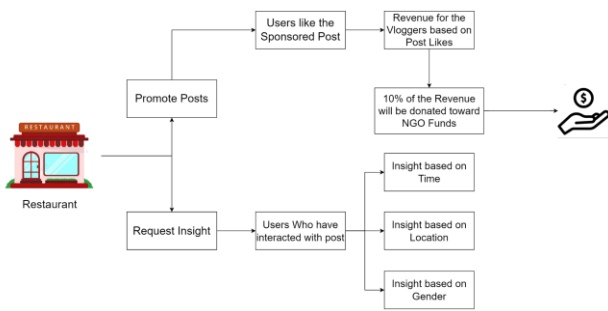


Fig. 3.4 Restaurant - Architecture of Foodmate

The various blocks of the whole architecture can be explained as follows:

- **Hire Vloggers:** The restaurants can hire vloggers on Foodmate for creating special posts covering the restaurant food & services. This is done collaboratively by the vlogger and the restaurant to make sure each and every aspect of the restaurant is covered. The vlogger creates and produces the content as a post on the platform.

- **Promote Post:** The Sponsored post is then promoted by Foodmate all over the platform and served to only those who actually might be interested in seeing the posts.

- **Revenue based on User Interaction:** The promoted post is when served to the user the interested ones like the post and based on that interaction the vlogger is paid by the restaurant on the basis of a pre decided CPC rate.

- **Donation towards NGOs:** From the revenue generated for the vloggers the fixed percentage is donated towards NGO funds which can be leveraged by NGOs to utilize it for their social works.

Post Insights: The restaurant as well as the vlogger can access the insight of their promoted posts so that they can have a better idea of the kind of audience they are serving. This insight contains details of the users who have interacted with their posts and the details are classified based on user's age, gender, locality, and time when they have interacted with the post.

4. IMPLEMENTATION

The implementation of Foodmate is discussed in the following section.

4.1 Modules

The whole system of Foodmate is being designed and implemented using the following modules. These modules help Foodmate to achieve its objectives and provide a solution to the problem statement. The Foodmate is divided into following modules.

4.1.1 Content Based Recommendation

The Content Based Recommendation (CBR) is used for the prediction of posts that might interest the user. The whole process is divided into a few steps as follows:

1. **Pre-Processing:** In this step the posts uploaded by the vlogger are converted into a string. This string is obtained by concatenating the post caption, post owner details, restaurant details and tags.

2. **Word Vectorization & TF-IDF:** The string converted post details are processed through word vectorization and the post is converted into a vector of words. This vector is then processed through TF-IDF for calculating the importance of each word in the post string with respect to the whole corpus ,i.e, all the other posts.

3. **Similar content using Cosine Similarity:** whenever a feed is requested the important words from the user's previously liked posts are fetched. Then the content similar to the user's previously liked posts are fetched where similarity is determined by the number of common important words between the posts and higher the number of common important words higher is the similarity between the content. The following expression mathematically explains the working of the Cosine Similarity used in our project.

$$g(u_m, i_n) = \cos_{tf-idf}(u_m, i_n) = \frac{\sum_i tf_{u_m}(t_i) \cdot iuf(t_i) \cdot tf_{i_n}(t_i) \cdot iif(t_i)}{\sqrt{\sum_i (tf_{u_m}(t_i) \cdot iuf(t_i))^2} \cdot \sqrt{\sum_i (tf_{i_n}(t_i) \cdot iif(t_i))^2}}$$

Fig. 4.1 Implemented Formula for Cosine Similarity

4. **Finalizing Feed List:** once the similar posts are fetched the top posts with highest similarity are fetched and processed as a list of feed posts and served to the user

4.1.2 Revenue Model for Vloggers

The restaurants are provided with an opportunity to promote their food and services over the Platform by hiring vloggers for creation of Sponsored content. A Sponsored content is a Post where the Vlogger describes about the Restaurant and/or it's food and/or it's services and this post will be promoted all over the platform and the Vlogger will be paid by the Restaurant based on the Interactions happening on their Posts on the basis of CPC (Cost Per Click) rate. A fixed percent of this amount will be donated towards NGOs which they can utilize for their social services.

4.1.3 Posts/Restaurants Insights

The posts insights are generally the information regarding the users who have interacted with a particular post. These details of the users are furthermore classified on the basis of few metrics, i.e., gender, age, time and location of the users

who have interacted with their posts. This gives them a better understanding of the kind of audience they are serving and contribute with better content towards their audience. Restaurants can leverage this feature to examine the reach of the sponsored posts and have a better look of each and every penny spent on the interaction of the posts.

4.1.4 Foodmate Ranking Algorithm (FRA)

FRA or Foodmate Ranking Algorithm is specially designed for those users who are new to the platform and haven't interacted with any of the posts on the platform. The FRA utilizes the geo spatial data of user as well as of the restaurants of the posts to push the posts from the closest restaurants and uses the time when the post has been published to again minutely personalize the feed. The whole process is divided into 2 phases as follows:

1. Fetching:

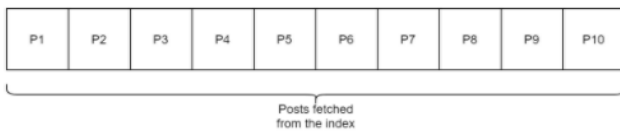


Fig. 4.2 Posts Fetched from the Index

In this phase the posts are fetched from the index. Index is a special place where we store the metadata of the posts. The fetching is done in such a way that only the posts which are published before 24 hours in time and are located in the 10kms range of the user. Also, the content with similar number of tags is grouped together keeping the posts with higher number of common tags at the top of the list.

2. Processing:

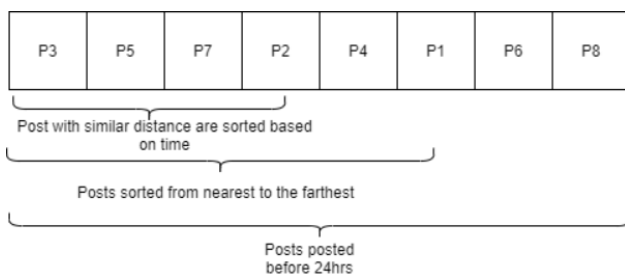


Fig. 4.3 Post Queue after processing using FRA

Here, from the posts fetched from the previous phase, the posts which are having similar tags are partially sorted based on the geo spatial distance between the user and post restaurant and for posts with similar tags and geo-spatial distance between user and restaurant is less than 0.3kms (300 meters) are sorted based on time when the post was posted in the ascending order.

Following is an example using different Phases of FRA:

● Fetching

Here the index is looked up for posts lists which are in the 10kms range from the user and only those posts which have been posted less than 24 hours ago.

The index prepared by the system has the structure as follows:

post id, tagname, cityname, location, time						

Fig. 4.4 Index Structure

The index is used to store the metadata of all the posts that are posted and stored in the database. While the posts are added into the database simultaneously, some meta data of the posts are added into the index.

The main aim behind building this index is to minimize the number of records searched in the table by narrowing down the columns and filtering out with conditions. so that after the processing is done only those records are fetched from the database which are relevant to the user's feed. This reduces the memory consumption and increases the speed of fetching the posts from the database.

● Processing

In this phase the data fetched from the index, needs to be processed in a 2-step operation. These operations are required to process and rearrange the list of posts in a personalized manner. The steps are listed as follows

Step 1: Sort Posts Based on Geo-Spatial Distance: Here we can observe that in the queue fetched from the index there are a few posts with the same number of match count. In such cases, the list is partially sorted based on the geo-spatial distance between the user and the restaurant to which the post belongs. Considering the output of the fetching phase as an input to this step:



Fig. 4.5 Queue fetched from index

and the match counts are as follows:

P3=3, P5=3, P2=2, P4=2, P7=2, P1=1, P6=1, P8= None

so let's calculate the geo-spatial distance:

P3=2.3, P5=2.7, P2=2.6, P4=2.5, P7=1.8, P1=1.3, P6=1.7, P8=0

So according to our logic, the following should be the new sequence

P3	P5	P7	P4	P2	P1	P6	P8
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Fig. 4.6 Output of step 1

Step 2: If the algorithm encounters any such posts where the match count is same as well as the difference between geo-spatial distance of the posts and the user is minimum, then the algorithm partially sorts the posts based on the posted time keeping the latest posts at the top.

Considering the output of the previous step. Here the distance evaluated in the previous steps are as follows,

P3=2.3, P5=2.7, P7=1.8, P4=2.5, P2=2.6, P1=1.3, P6=1.7, P8=0

The time when the posts were posted are as follows,

P3=1hr ago, P5=23m ago, P7=45m ago, P4=50m ago, P2=38m ago, P1=55m ago, P6=34m ago, P8=50m ago

as we can see P4 and P2 are close to each other so these posts will be sorted based on the time they were posted. And hence here is the final list of posts.

P3	P5	P7	P2	P4	P1	P6	P8
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Fig. 4.6 Final output of FRA

After performing all the operations of the algorithm, the final output is a list of feed which has been personalized for the location and is ensured that fresh content is served to the user

4.1.5 Image Recognition

For recommending the tags based on the images of the food uploaded by the vlogger, Convolutional Neural Network (CNN) is used. We have opted for CNN as it is a preferred technique for food-based image tagging [5]. The images uploaded by the Vlogger will be processed using CNN to predict the food tags dynamically and also allowing the Vlogger to particularly add or edit tags as per their convenience.

4.2 Database and Authentication

We have used MongoDB database to store the user details and the database server is hosted on MongoDB Atlas. For user authentication while logging in to the platform, we have used hashing along with salting to provide an extra layer of security to the database and thus, prevent it from dictionary attack.

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BIOGRAPHIES



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