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Recommendation System Aiming To Solve General Accommodation Problems

Adarsh Totla[1] , Rajat Bucha[2], Manjitsing Valvi[3]

[1]*Department of Information Technology, K.J Somaiya College of Engineering, Somaiya Vidyavihar University.*

[2]*Department of Information Technology, K.J Somaiya College of Engineering, Somaiya Vidyavihar University.*

[3] *Asst. Professor Department of Information Technology, K.J Somaiya College of Engineering, Somaiya Vidyavihar University.*

Abstract

Recommendation systems are one of the newest trends pioneering in enhancing the user experience across the internet. These are mainly used by e-commerce portals like Amazon, Flipkart or commercial industries like Netflix, Amazon prime video etc. One of the factors in the success of these brands is Recommendation Systems. Recommendation systems influence the customers behaviour to look at and purchase products or services, by providing them a customised experience. These systems largely depend on the analysis of user ratings and preferences and then predicting and recommending the user with similar products or services. Recommendation systems find their application in almost every industry that provides services to the users. The paper describes a similar recommendation system implemented; that works in compliance with matching algorithms like stable marriage problem, collaborative filtering and helps in finding compatible roommates, recommends rooms and daily chores service providers for those in need in a user friendly manner.

Keywords: *Recommendation Systems, Recommendations, Compatible Roommate, Stable Marriage Problem, Collaborative Filtering, Rooms, Roommates.*

1. Introduction

Presently, we are in the age of transition. Everything that was conventional is now undergoing metamorphosis. The web applications and the mobile applications are constantly evolving to enhance the user experience and are working to provide seamless service. One of the major factors affecting the user experience are the recommendations/suggestions made to the user on the basis of their preferences and behaviour [1]. In the present days, almost all the Tier-I cities are experiencing a huge inflow of people for education, Job opportunities etc. The most common problem faced by them is finding a place to live and a compatible roommate. On one hand they are hustling with the new environment and on the other hand they are burdened with the mammoth task of finding accommodations and compatible roommates. Many end up paying exorbitant rents and settle with roommates of different age groups, interests etc. This is one of the few sectors where recommendations are not being made. There is a huge scope for the given problem to be solved. A system that can accept user preferences, can find compatible roommates in the user's vicinity, recommend accommodations based on the interests of both the parties and also provide the list of daily service providers in the given location, can be a solution.

The system aims to solve the above problem in 2 phases:

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Finding Compatible Roommates Phase - This phase recommends compatible profiles in the same location to the user based on the preferences set by the user at the time of registration.The user can select any of the listed profiles and see the details.

Recommending Rooms - The second phase recommends property listings to the user based on collaborative filtering. The properties searched by the compatible roommates are displayed to the user as a result of collaborative filtering.

In addition to the above two phases, the system also provides listings for daily services like laundry, cook, maid, tiffin etc in accordance with the user location.

2. Existing Issues

1) Firstly, none of the existing platforms of similar kind provide the facility of finding compatible roommates. The platforms just find the available user profiles in the user's vicinity by filtering basic attributes like Gender, Location, Age, Zodiac, etc.

2) None of the existing platforms find compatibility on the basis of Human psychology. For example, if we want to know the nature of a person then finding out how they solve an issue with other people is one of the best ways. Simply knowing these attributes of the person can be used to decide their compatibility with other users.

3) Existing platforms spam the users with unnecessary notifications and promotional messages. This is the case with almost all the platforms. This is not a good way to retain your customers.

4) For finding rooms, existing platforms display the listing on the basis of the plan subscribed by the property owner. There are no recommendations for properties based on the mutual interests of compatible profiles. For example, if user A likes some property and user A is compatible with user B, then it makes more sense to recommend that property to user B rather than showing him a list of other properties.

5) The property owners willing to list their properties are charged exorbitant rates and are not served to their purpose.

3. Concepts Referred

A. KNN Algorithm [11]

KNN stands for K-nearest neighbours. It is a classic algorithm used to cluster similar items in a dataset together. The principle idea behind KNN is that it categorizes a point in space to the category of majority of its nearest k neighbours.

B. Gale Shapley Algorithm [3][4][8]

The Gale Shapley Algorithm solves the classical stable marriage problem where equally sized itemsets are to be matched in order of the preferences set in each set. The algorithm works in iterations as follows:

a. In the first iteration, each man proposes to each woman in the opposite set and each woman replies as 'maybe' to the most preferred man and 'no' to all other men from the set. Thus, the man and woman are engaged.

b. In the next iteration, each unengaged man proposes every other woman to which he has not proposed already and each woman even if she is engaged replies as ‘maybe’ or ‘no’. Thus, every woman has the right to uptrade or jilt down her suitor.
c. Subsequently in the next iterations, everyone is engaged.

The algorithms ensures two most important things:
Everyone gets married.
All marriages are stable.

C. Collaborative Filtering [13][18]

This recommendation algorithm is categorized as user-based collaborative filtering and project-based collaborative filtering. The user-based collaborative filtering is widely used and is based on the principle idea of finding similarities between users and recommending them similar items. For example, user A likes books 1,2 and 3 whereas user B likes books 1,2. Then according to collaborative filtering user B is recommended book 3. This is used extensively by almost all the e-commerce websites to recommend products to customers with similar interests.

D. Web Scraping [9][10]

Also known as web harvesting or web data extraction, it is used to harvest data from websites over the internet. It uses the Hypertext Transfer Protocol or any web browser to extract data directly over the world wide web. Web scraping is generally used to find something from the extracted page for example - contact numbers, urls, email-ids etc. Thus, web crawler becomes an important element of the web scraping engine. It can be done manually using software and can be automated as well. Typical applications involve contact scraping, data mining, price comparison etc.

3. Implemented System

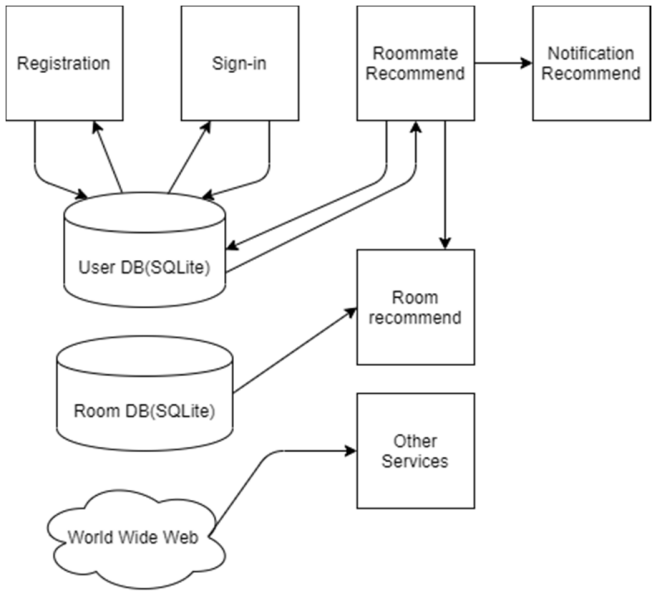

FIGURE I. System Architecture

The implemented system consists of following features:

1) Roommate Recommendation
2) Rooms Search & Recommendation
3) Searching Daily Chores Service Providers
4) Recommendation through Notifications

1) Roommate Recommendation

This module recommends compatible roommates to the user, based on the compatibility rank.

A new user needs to select a location and gender and the number of existing users profiles matching these two attributes are displayed. To see the complete profiles of the existing users the new user needs to create an account. While creating the account the user answers questions based on which the user is recommended to the compatible roommates. Once the user creates an account, he/she can view the complete profiles of other users just by Logging In into his/her account as well as the user profile is displayed to other users also. Also the complete profiles of compatible roommates are displayed in ranking order i.e the profiles which match all the attributes which the user is looking for in his/her roommate are displayed first. If there is any one attribute which is not matching and all others are matching are displayed second and so on. But while recommending the profiles the location where the user is interested to stay and gender are always taken into consideration while recommending the roommates.

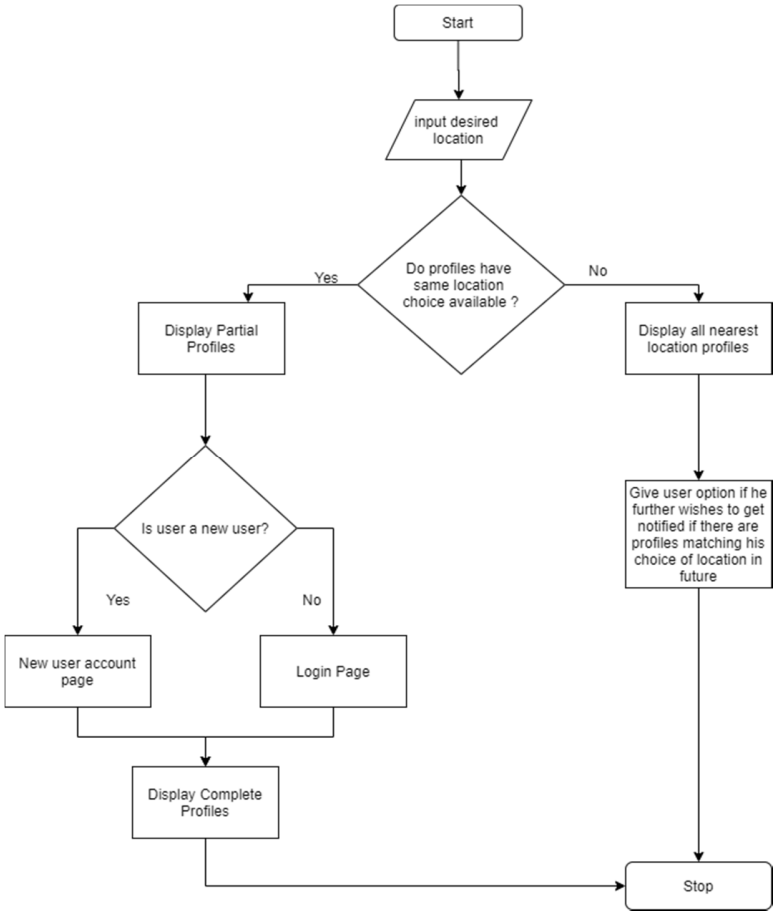

FIGURE II. Process Flow for Finding Roommates

[12] If the user wants to see more profiles having location preference near to user location, the user just needs to specify the number (say k) of nearest location and the profiles having location matching to the k nearest neighbours to the user location are recommended to the user.

Once the user finds the compatible roommates and he/she does not want his/her profile to be displayed to other users, the user just needs to Log-In and change the profile option to freeze from active state. Once the profile status is changed to freeze state, the user profile is not displayed to other users.

2) Rooms Recommendation

This module recommends rooms to the user based on the search history of the compatible roommates recommended by the above module. The user can also search the room through filters based searching.

The user needs to Log-In and then the user is able to refine his search through various filters (eg Property Type, No of bathrooms, Furnish Type, etc) options available and the rooms profiles will be recommended based on the filters. At the same time the filters option which have been used by the user during his/her search are stored. Thus a search history database is created consisting of various multiple users.

Once an existing user Log-In into his/her account, various rooms having attributes matching with the collective search history of 100% compatible roommates profile will be recommended to the user. As there are multiple profiles which are 100% compatible thus the attributes which have been used the most number of times during rooms search by the 100% compatible profiles are used to recommend the rooms to the user.

Consider there are 5 users A, B, C, D and E using the implemented system. User A is the new user of the system whereas B, C, D and E are existing users, whose rooms search history is available for the above said filters.

Now, user profiles of B, C, D and E are 100% compatible with that of user profile A.

The search history for rooms by user's B, C, D and E for the different filters is given in Table 1.

User	Property Type	No. of Bathrooms	Furnish Type
B	1BHK, 1RK	1	Semi, No
C	1RK	1	No
D	1RK, 2BHK	2	Full
E	2BHK	3+	Semi

TABLE I. Users search history

Now the collective search history is ranked according to the number of times the attribute is searched for, given in Table 2,3 and 4.

Attribute	Count
1RK	3
1BHK	2
2BHK	2

Table 2. Count of Property Type Search

Attribute	Count
1	2
2	1
3+	1

TABLE III. Count of No. of Bathrooms Search

Attribute	Count
No	2
Semi	2
Full	1

TABLE IV. Count of Furnish Type Search

Now when the user A Log-In into his account, room's having attributes Property Type - 1RK and No of Bathrooms – 1 and Furnish Type – No/Semi will be recommended to user A.

3) Daily Chores Services [15]

The user just needs to select the service type and list of the service provider is recommended to the user. The list which is recommended are searched and put together using Web Scraping.

4) Recommendation Through Notification

The user is recommended with more new profiles of roommates recommendations after a time period from the starting date of his/her profile freezing date. Also with notification the user is given an option to snooze the notification service for a particular time period. The recommendations are made through email notifications.

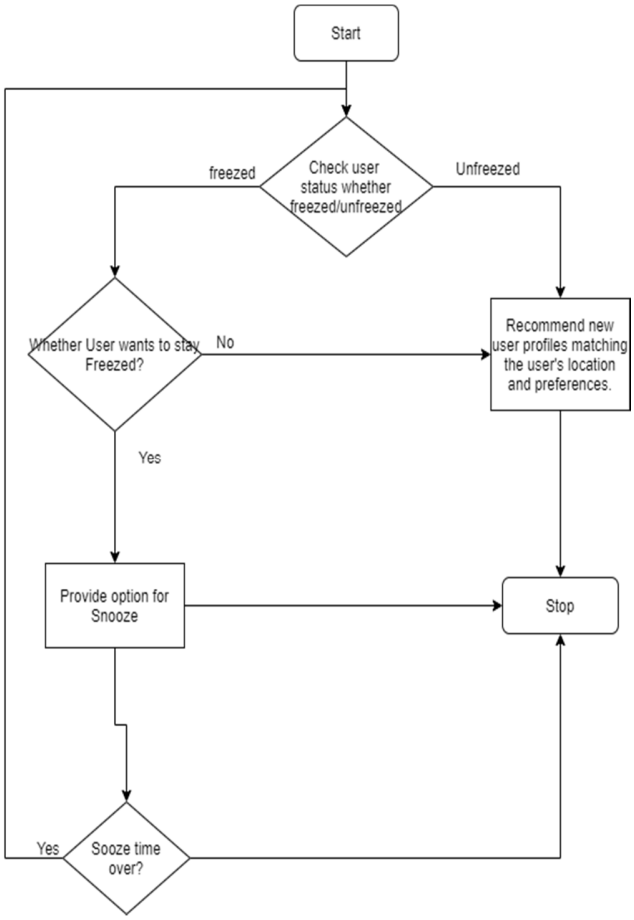

FIGURE III. Process Flow for Notifications

4. Results & Discussions

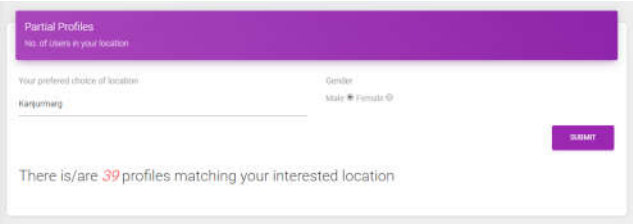

FIGURE IV. Partial Profiles

User needs to select location and gender from the dropdown list and the user's first name who is looking for roommates in the same location will be displayed.

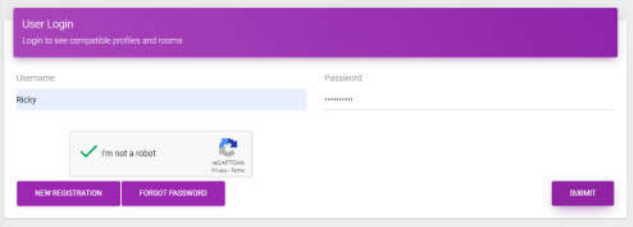

FIGURE V. Log-In

To see the complete profile user needs to Log-In

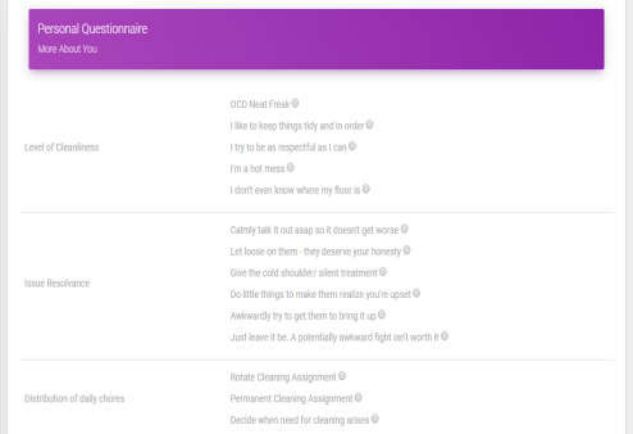

FIGURE VI. Questionnaire for Finding Compatibility

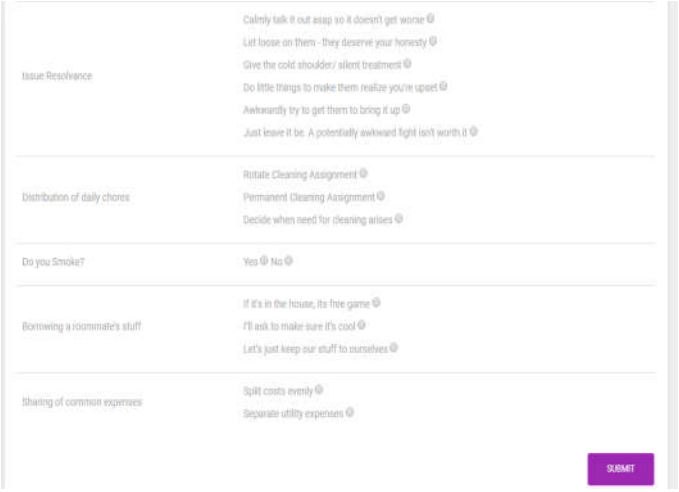

FIGURE VII. Questionnaire for Finding Compatibility

Based on the answers of the questionnaire given by the user during new registration, the compatibile users are ranked accordingly and are recommended to the user.

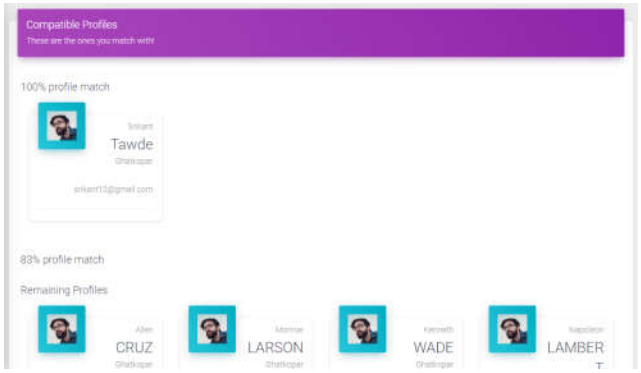

FIGURE VIII. Compatible Roommates Complete Profiles and Rooms Recommended

After the user login into his/her account a list of profiles according to the compatibility rank is displayed. Also a list of Rooms Profiles is recommended through Collaborative Filtering.

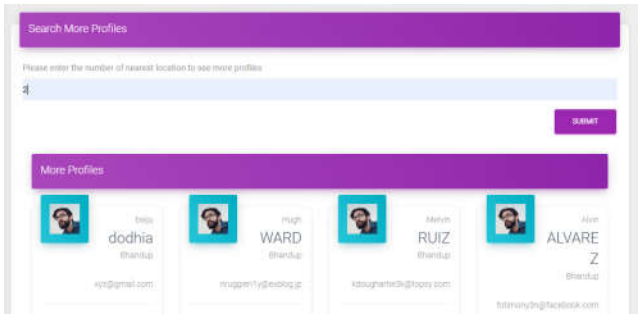

FIGURE IX. More Profiles

User just needs to add the number of nearest neighbours he/she is interested in to see more profiles who are looking for roommates in that neighbourhood.

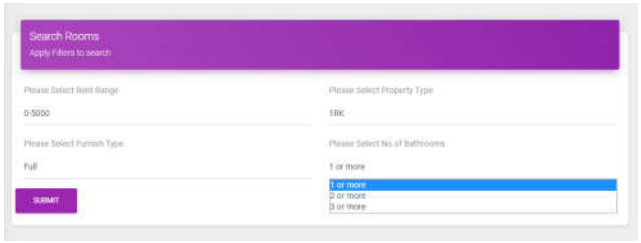

FIGURE X. Rooms Search

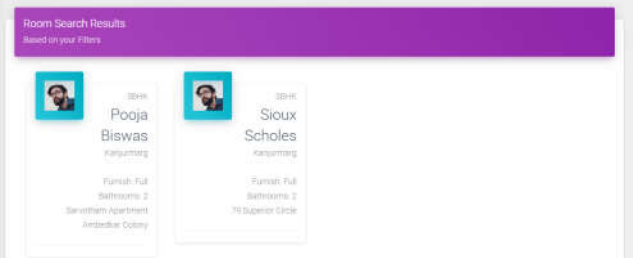

FIGURE XI. Rooms Results

FIGURE XII. Service Providers

User just needs to select the service type from the dropdown list.

5. Conclusion

The implemented system provides services like roommate recommendation, room recommendation, suggestions for nearby daily chores services like laundry, tiffin, maid etc. The already available systems in the market do not provide all of the aforementioned services. The system is the only of its kind. The platform successfully recommends compatible user profiles in the user's vicinity. With that it also provides the user the option of profile recommendations through email. The accommodation related problems are solved by successfully recommending rooms that match the interests of the compatible users. The user is also serviced with listings of the daily household service providers. Thus, the system is fully capable of solving all the problems related to accommodation.

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