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SMART TRANSPORT RECOMMENDER SYSTEM USING HYBRID APPROACH

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Abstract—***Numerous recommendation techniques have been already proposed and encapsulated into several e-business applications, aiming to perform a more accurate evaluation of the existing information and accordingly augment the assistance provided to the users involved. Intelligent Transportation Systems are changing the way people plan a journey and travel around the world (or even in a city). Also mobile devices are becoming an inseparable part of our lives and personalized location-based mobile services are gaining more and more popularity. So we are mixing the technology of a Mobile Phone and the smartness of Intelligent Transportation Systems to create a SMART TRANSPORT RECOMMENDER SYSTEM (Travel Bania) for people. The scope of this paper is to illustrate the design choices and the implementation of a personalized Smart Transport Recommender System, built for the citizens for regular use. Using this system the user can obtain the most appropriate mode of transport to travel between two arbitrary points in the city according to his/her priority (Cost, Comfort and Time).***

Keywords— Intelligent Transportation Systems, Recommender System, Mobile Devices, Smart Transport, location-based services

I. INTRODUCTION

Initial steps for travelling from one location to another location involves diverse decision making issues, which are basically related to the appropriate route and mode of transport selection. Such issues mainly rise due to the variety of the traveller's preferences (e.g. duration of journey, cost involved and the comfort level). In some cases where many alternatives exist, there is a need for providing recommendations. The customer should be assisted in order to properly evaluate the proposed alternatives and make his/her decision final. Obtaining recommendations from trusted sources is a critical component of the natural process of human decision making. Our aim is to find the best mode of transport which satisfies the user's preferences of comfort level, expense and duration of journey. Using this system the user can obtain recommendations for modes of transport between two arbitrary points in the city directly on his mobile phone. Recommendation systems have been described as systems that produce individualized recommendations or have the effect of guiding the user in a personalized way. The myriad approaches to Recommender Systems can be broadly categorized as:

- *Collaborative Filtering (CF)*: CF uses all users' past ratings to recommend items [7]
- *Content-based recommending*: It recommends items that are similar in content to items the user has liked in the past, or matched to attributes of the user. [7]

- *Knowledge-based recommending*: These are a specific type of recommender system that is based on explicit knowledge about the item assortment, user preferences, and recommendation criteria.[10]

- *Hybrid approaches*: These methods combine the Collaborative, Content based and Knowledge based approaches. [7]

In our proposed system we are going to use hybrid approach i.e. combining the features of all above mentioned approaches. Since first requirement is to collect data, so we are going to use knowledge based approach and will start maintaining user profiles. After getting enough data i.e. approx. 1000 profiles, we will move towards content based approach and finally when users of similar choices/preferences will be there, we will use collaborative approach. In this way a hybrid approach will be suitable for our application.

II. RELATED WORK

One of the popular application that everyone has in their mobile phone is Google maps (maps.google.co.in). It provides real-time GPS navigation, traffic, transit, and details about millions of places, such as reviews. Another popular application is Citymapper (citymapper.com). It is a trip planner application that combines all transportation modes to find the best routes like walking, subway, bus, train, rail, ferry, Uber, taxi & cab and bike share all in real-time, including bus and train schedules and disruptions. Another popular application Transit Direction by Moovit (moovitapp.com) , it constantly updates as transit operators change schedules or alter service, so that the user don't end up at a station that is closed, or waiting for a bus that isn't coming. What all these application do in common is that they find the best routes from Point A to Point B for most modes of transport. They provide real time navigation details and real time updates of transits. The biggest problem with the existing system is that, although it furnishes routing data but that data may not be completely customized, personalized, and suitable for the customer. Also every time the user might not be interested in the shortest possible route, what if the transit on that route is the most expensive?

Personalized Mobile City Transport Advisory System [1], a system that helps users to find a personalized path connecting two arbitrary points of a city using the city transport means and walking. The paths are illustrated by listing the various connections that the user must take to reach the destination using public transport means and walking. The recommendations are selected in a personalized way, using a knowledge-based recommendation technology, and for each user the suggestions are computed according to their travel-related preferences. The limitations of this system are that it is not having an interactive interface. Also it is taking a lot of input from the user (i.e. not suitable for the user having time limitations or is in hurry)

Another project *Recommendation for Local Transportation System using Ambient Intelligence* [5] proposes design of a context-based recommendation system for local transportation system in order to provide an accurate ETA (Estimated Time of Arrival) and ETD (Estimated Time of Departure). It generates recommendations for an alternative path to traveller's destination to save time in case of adverse situation of traffic on a particular route. Provide the required recommendation alternate means of transportation. But it is completely dependent on another system i.e. Intelligent Transport System (ITS). Also it doesn't consider all modes of transport. And most importantly no option for user to enter his/her preferences.

An Integrated Transport Advisory System for Commuters, Operators and City Control Centres [4] is a proposed system that not only has the user interface window but also the transit operator window and a control centre window. In the user window each individual is presented the personalized information on their mobile device at the time of offering a travel plan as well as the dynamic updates in transit.

The driver view updates interactively under the instruction from the control centre. In case of an on-road event being reported by a driver or by other public service sources, an alert is instantly triggered on the control centre dashboard that offers micro level view to monitor the incidents and allows a human expert to take actions enabled within the software application. The control centre views provide instant updates on ground incidents. It is possible to drill down to micro information of routes, zones, vehicles, passengers and incidents. The control centre can connect with and assist the drivers on move to help address traffic incidents. A substantial amount of intermodal non-personalized information is provided on the electronic displays on the hubs. The limitation of the system is that it only focuses on public transport and don't consider options like car pooling and or personal mode of transports.

III. PROBLEM FORMULATION

The biggest problem with the existing systems is that, although they are providing optimised path but that path may not be completely customized, personalized, and suitable for the customer i.e. not taking the user preferences. The nature of the data is more generic in nature. User can't tell the application that in which parameter he is focusing on like he is having time constraint or money issue.
Therefore, in this perspective some of the essential issues that have been observed from the existing literatures are as follows:

- In real life situations users are not always interested in the quickest way to travel from point to point and other aspects could be more important when deciding on a specific trip in a city
- Information is based on general need not as per individual user requirement.
- Systems assume single class of travelling for the user.
- Providing information based on crowd centred policy.
- Offering of unnecessary information consuming m more processing time, memory and bandwidth. [5]
- It won't tell the OPTIMIZED mode of transport based on user preferences of Cost, Time and Comfort.

Hence, after briefly reviewing the existing studies, the problem statement can be derived in the form of a statement "It is a challenging task to design and develop a SMART TRANSPORT RECOMMENDER SYSTEM that can furnish every aspect of requirement relevant to user in local transportation system."

IV. PROPOSED SYSTEM

The system evaluates context of users in the transportation system and based on the situation it provides unique recommendations to the traveller's discretely.

The prime objectives of the proposed system are:

- Design a recommendation system that suggests the best mode of transport after taking all the user preferences.
- Generate recommendations for an alternative path to traveller's destination to save time in case of adverse situation of traffic on a particular route.
- Provide the required recommendation of alternate means of transport.
- Makes use of user context and user profile.
- After the user will enter its preference for cost, comfort and time, the program will use its algorithm to find the best mode of transport. It'll also apply the concepts of recommender systems to give the best recommendation. Not only the best but also the second best and so on.

Basic approach used:

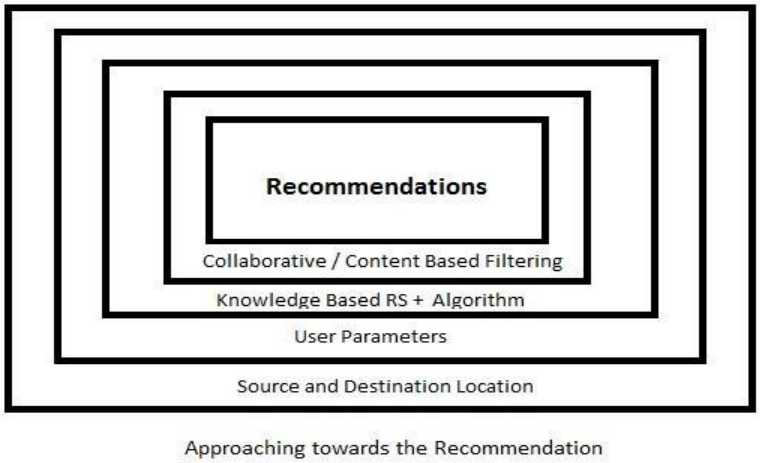

Fig 1. Basic approach

It basically is using a hybrid approach to suggest a mode of transport within a particular city. Basic steps represented by above model are:

- Initially user profile is created.

- Then take location from the user.

- Then parameters like cost, time and comfort is entered by the user.

- Using the algorithm from the knowledge base and extracting required data, proposed system will try to collect the whole information of that particular user.

- After that if necessary collaborative or content based filtering is used and modes of transport are suggested according to calculative priority of the user.

- User feedback is also collected in the efficient manner for further use.

- We propose to use "Regularized SVD" [12] as Collaborative and "Probabilistic Methods and Naïve Bayes"[11] as Content Based Filtering method to recommend the mode of transport

Pseudo code

This pseudo code is designed for a city. Here corresponding to every mode of transport is an element in every array with the same index. For example if Time[i] represents time of bus then Cost[i],Comfort[i],etc also related to bus.

- Input the parameters in cost , comfort and time from the user
- Create 3 arrays Cost[ ] , Time[ ] and Comfort[ ]
- For Time

1) Find the minimum value from Time [ ] and save in t_min
2) Divide every element of Time [ ] by t_min and save in time_div[ ]
3) Subtract 1 from every element of time_div[ ] and save in time_sub[ ] //to convert it into range of 0 to 1
4) Subtract every element of time_sub[ ] from 10 and save in time_rating[ ]//to get rating out of 10
5) Multiply every element of time_rating[ ] by the time and save in time_final[ ]

- For Cost

1) Find the minimum value from Cost[ ] and save in c_min
2) Divide every element of Cost[ ] by c_min and save in cost_div[ ]
3) Subtract 1 from every element of cost_div[ ] and save in cost_sub[ ]
4) Subtract every element of cost_sub[ ] from 10 and save in cost_rating[ ]
5) Multiply every element of cost_rating[ ] by the cost and save in cost_final[ ]

- For Comfort

1) Multiply every element of Comfort[ ] by the comfort and save in comfort_final[ ]
2) Add the elements of time_final[ ] with cost_final[ ] with comfort_final[ ] and save it in final[ ]
3) Sort the array final[ ] and suggest the mode with the highest value.

Mode with the highest value is most suitable for the user according to his/her preferences.

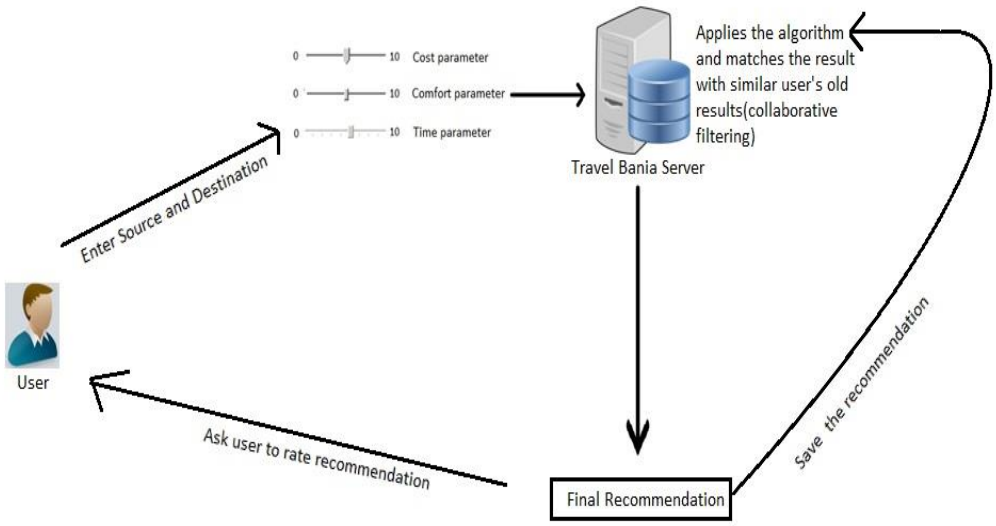

Fig 2. System architecture

V. CONCLUSION

A modern man spends considerable time in travel – either for business or for leisure purpose [3]. The person will have to choose between various modes of transports as he steps out. The best assistant a traveller possesses is the mobile device, he/she carries. Our Smart Transport Recommender System is targeted to users of mobile devices and provides a location-based service that recommends the optimal mode of transport between two arbitrary points, based on the specific user preferences of cost, time and comfort. It not only recommends the best mode of transport but also the second best, third best and so on. Our project uses a hybrid recommendation module that combines different recommendation techniques in order to provide the user with more accurate and efficient suggestions. We are going to make our proposed system to be flexible for additional changes in the future. Further we plan to conduct a user study, to test the effectiveness of the proposed system with a real set of people and visitors of Kurukshetra.

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