An Effective Taxi Recommender System

Siddhesh R. Bhagat[1] Sagar K. Golhar[2] Sahil S. Bagde[3] Rohit Gavade[4] Prof. Shubhada Mone[5]
[1,2,3,4,5]Department of Computer Engineering
[1,2,3,4,5]MMCOE Karvenagar, Pune University

Abstract— In this research, we are creating an android-web based taxi booking application. Our system is a real time android application which not only allows the passenger to book a taxi on demand, but its uniqueness lies in the point that it also helps the taxi driver to earn more profit by mining the historical GPS trajectories. Our system helps the taxi drivers in finding the next cruising location where they can find passengers yielding maximum profits. The different factors considered in the system are distance between the current location and the recommended location, waiting time to get the next passenger, expected fare for the trip and most importantly the historical data of a location for providing the recommendations. We are using the historical GPS data to analyze and retrieve the habitation of residents in area. Also we are using clustering analysis and spatial-temporal analysis to make groups of locations based on the mentioned factors. Temporal and spatial issues are important factors which the taxi drivers often consider in the real world for determining passenger distribution. A location-to-location graph model, referred to as pick-drop location and the next passenger pick-drop location is used in the system. This model is also used to calculate the trip fare from the current location and the destination location.

Key words: Recommendation System, Android application, GPS, Temporal, Spatial, K-means, Data Mining

I. INTRODUCTION

As our population is growing day by day, the present local transportation system is proving to be insufficient in meeting the demand for convenient and comfortable transportation of public. And in the private sector of transportation there is a hassle to wait for taxi on road and the bargain with the drivers. Also from the taxi drivers' perspective, they have to keep cruising on road to find the next passenger so as obtain maximum profit from their rides. In the attempt to find passengers, the drivers waste their time and money in cruising on the roads which eventually proves inconvenient.

But this fragmented approach of the conventional taxi-passenger system can be made highly efficient if we can bring the taxi drivers and passengers on a common platform and thus use the travel habits of the passengers and location specific data to provide a service which is convenient and beneficial to both – the passengers and the taxi drivers. Hence, the proposed system provides a platform to the taxi drivers and the passengers to communicate with the aim of enabling the taxi driver to earn more money and the passenger to get a taxi on demand.

The uniqueness and the main motto of the system is that it provides a profitable approach to the taxi drivers to go about their business. Most taxi drivers aren't fortunate enough to cruise to an area or location that always has passengers waiting for taxis cabs. For a taxi driver, the most concerned topic is likely to be how to maximize his profit. A taxi driver may cruise the road network searching for passengers for a while (which may include waiting at some taxi stands), and then pick up passengers and drive to the designated destination. As the passengers get off the taxi, the driver starts cruising the road network again. It is at this moment that a recommender system could be used to help the taxi driver know where to cruise such that his profit can be increased.

So, the purpose of this work is to recommend a good location for the taxi driver to cruise to such that he can earn more profit by mining the historical GPS trajectories than cruise based on his own experience. to minimize the drivers' cruising time and waiting time and thereby maximize the profits, We take the unorganised taxi-passenger relation and turn it into a system that is convenient to the passengers and highly profitable to the taxi-driver. Using this system the taxi driver doesn't have to cruise on the roads anymore to find his next passenger nor do the passenger have to search for a taxi. We do this by using data mining techniques like K-means and special-temporal analysis.

II. RELATED WORK

Most of the existing works on cruising location recommender system have only considered two of the four factors that we propose to consider through these works, customer demand can be understood. However their approach did not validate the demand of the location in different situation in practice and they did not evaluate by how much they can improve the revenue.

Our approach is different from the above mentioned methods in the following aspects. We provide a new approach to clustering which is more appropriate for our study. Since there are many fluctuating factor regarding the choices of the next position when taxi drivers are looking for a new passenger, we provide two new models which takes into consideration the importance of transition probability, and the revenue. Last we provide a taxi recommender system for taxi drivers and validate the increase in revenue when drivers adopt our system. We use historical GPS data to analyse and retrieve the habitation of residents in an area. Temporal and spatial issues are important factors which the taxi drivers may consider in determining passenger distribution. We emphasize on impacts on the movement of the taxi drivers after the passengers are dropped off by analysing the spatial and temporal factors. Simulation results indicate that although the statistics of historical data may be different from real time passenger requests, this proposed recommender system is still effective on recommending better profitable cursing location.

A. Drawbacks of Existing System:

The random cruise' strategies of the taxi driver for passenger finding have undesirable side effects like large wastes of fuel, an inefficient traffic handling, an increase of vehicles' wear and of the air pollution. Another important dimension of this problem relies on scenarios where two or

more companies struggle to serve an uneven passenger demand: the competition forces them to use inefficient strategies to pick up as many passengers as possible.

III. PROPOSED TAXI RECOMMENDATION SYSTEM

An effective taxi recommender system uses the android mobile phone one for passenger and one for the taxi driver. Passenger installs the android application of the system and register to create account at taxi recommender system so that he can use this account for sending request for cab.

Taxi driver also install taxi drivers android application in his mobile and register with his Name, Email-ID, Phone number, Taxi Number, taxi type, his driving license no and create account at taxi recommender system so that he can receive the passenger request through that application. This android application uses the GPS system to send the current location or at which location the passenger required the taxi for him so according to the location the system can send the request of passenger to the nearby taxi driver.

A. System Architecture:

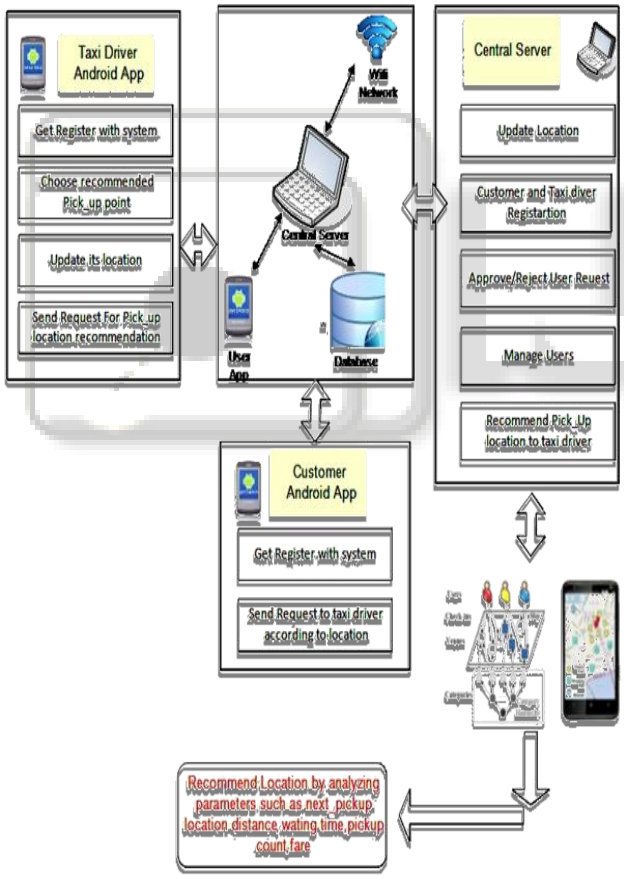

Fig. 1: System Architecture of the Taxi Recommender System

This system is used for finding next cruising location. Four factors have been considered, which are

1) Distance between the current location and the recommended location,
2) Waiting time for next passengers,
3) Expected fare for the trip and
4) Expected trips and revenue from the drop- off location.

experience which is the most likely location to pick up passengers given the current passenger drop off location

B. System Design:

Despite of wide use of Taxi in the main cities for traveling purpose, the taxi drivers do not know in which route they get more passengers and passengers also do not know when the taxi actually comes for pick–up.

So in our application we give separate to application for passenger and taxi driver in which taxi driver can easily get the passengers on which he selected route. And passengers also know when taxi comes for pick up.

1) Taxi Driver Application:

In this application taxi driver can be recommended with pick up location by admin according to his location Taxi Driver can see the analyzed data in which route he will got maximum passengers according to that he will decide go through that particular route or not.

2) Passenger Application:

In passenger application user can easily recommend for pick-up to the taxi driver. Using this application user known how many time required traveling, waiting time and rent for journey.

3) Admin Application:

In admin application admin perform following application

1) Manage users.
2) Approve/Reject Request.
3) Update Location.
4) Recommend pick-up location to taxi Driver.

C. System Specification:

The technologies which are used to implement the system are:

1) The operating system for the terminal is Android.
2) Java programming language and android SDK, JDK is used to develop the software.
3) JSP/SERVLET is used for Database Access..
4) MY SQL it is a light weight Database which is going to be used for database access from the server.

D. Algorithms:

1) Grid-Based Clustering Algorithm:

Grid based clustering analysis is an automatic process to find similar groups of objects from a database. Among the existing clustering algorithms, grid-based algorithm generally have a fast processing time, which first employ a uniform grid to collect the regional statistic data and then perform the clustering on the grid instead of the database directly.

An Adaptive Mesh Refinement technique is used in our application process were large amount of spatial data, structured meshes are often used to avoid directly operating on the data objects. A 2-dimentional AMR tree is developed with two levels of the refinement. The complexity of constructing an AMR tree is : O(dtn * 1-p^h/1-p+6^d m*1-q^h/1-q),assuming the refining factor is 2 and each cell must check its(3^d-1) neighbors for connected sub grid. If q=0.5,the complexity becomes O(2.6^d m).

2) Temporal and Spatial Analysis:

These are the formal techniques which study entities using their topological, geometric or geographical and timing properties. Uses the place and route algorithms and also

does the analysis of geographical data. In spatial analysis boundaries are made and considered for plotting the area as in location or city. The advantage is that spatial distribution is made for locations and for pick up points. In temporal the time parameters are considered as in at what particular time the passengers are in demand of a taxi in that particular location plotted by the spatial analysis. And thus this will help the taxi drivers to earn profit which one of the main priorities of the proposed system. An STP map is also developed by using these techniques.

1) Data clustering is done using grid clustering is on a set of GPS points on the historical GPS trajectories for dividing the map into fixed square areas.
2) Four main factors are calculated which are average waiting time (denoted by T) in each cluster, the distance between two clusters (denoted by D), the average revenue from each cluster (denoted by R), the transition probability which captures the relation of the passenger get-off location and the next passenger get-on location (denoted by P).These parameters are further used for finding best next pick up point.
3) Building of two location to location graph models on-off and off-on graph by observing the routes of taxi driver. These graph models are used to adopt relation between the passenger get_off location and the next passenger get_on location.
4) Finding score (Sk) of each cluster , Sk represents the scores of cluster k, which finally finds the best candidate location to seek for the next passenger.

IV. Conclusion

In this paper, we have implemented the effective taxi recommender system which features to give the maximum profit to taxi drivers and decrease the waiting time of passengers. By using this system it is possible for the passenger to book the taxi and reach the desired destination as soon as possible. In this application it is also possible for the driver to select the taxi stops where the passengers are in demand of taxi. Using grid clustering algorithm technique, the proposed system can plot the density of location where the passengers or customers are highly in demand of the taxi.

V. Acknowledgement

We are working on this project under the guidance of Prof. Shubhada Mone, Assistant Professor at MMCOE College of Engineering, Karvenagar PUNE.

References

[1] Yu-Ling Hsueh, Ren-Hung Hwang, and Yu-Ting Chen, "An Effective Taxi Recommender System Based on a Spatiotemporal Factor Analysis Model," in Proceedings of the International Conference on Computing, Networking and Communications, Mobile Computing & Vehicle Communications Symposium, 2014.
[2] J. W. Powell, Y. Huang, F. Bastani, and M. Ji, "Towards reducing taxicab cruising time using spatio-temporal profitability maps," in Proceedings of the 12th international conference on Advances in spatial and temporal databases, Berlin, Heidelberg, 2011.
[3] H.-W. Chang, Y. chin Tai, and J. Y. jen Hsu, "Context-aware taxi demand hotspots prediction," IJBIDM, vol. 5, no. 1, 2010.
[4] L. Moreira-Matias, R. Fernandes, J. Gama, M. Ferreira, J. o. Mendes-Moreira, and L. Damas, " An online recommendation system for the taxi stand choice problem (poster)". In vnc, 2012.
[5] J. Yuan, Y. Zheng, L. Zhang, X. Xie, and G. Sun, "Where to find my next passenger," in Proceedings of the 13th international conference on Ubiquitous computing, New York, NY, USA.
[6] T. Takayama, K. Matsumoto, A. Kumagai, N. Sato, and Y. Murata,"Waiting/cruising location recommendation based on mining on occupiedtaxi data," International Journal of Systems Applications, Engineering and Development, vol. 5, no. 2, 2011.
[7] J. Yuan, Y. Zheng, C. Zhang, W. Xie, X. Xie, G. Sun, and Y. Huang, "Tdrive: driving directions based on taxi trajectories," in Proceedings of the 18th SIGSPATIAL International Conference on Advances in Geographic Information Systems, New York, NY, USA, 2010.
[8] International Journal of Engineering Science and Technology Vol. 2(8), 2010, 3441-3446, "A Survey of Grid Based Clustering Algorithms"
[9] Wei-keng Liao, Ying Liu, Alok Choudhary, "A Grid-based Clustering Algorithm using Adaptive Mesh Refinement"

