ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

Smart Taxi Business Application Using Spacio-Temporal Model

Nikhil G. Aurangpure[1], Shoaib A. Hannure[2], Nikhil C. Jadhav[3], Rohan S. Patil[4] , Prof. Shivani Sthapak[5]

Students, Department of Information Technology, Dhole Patil College of Engineering, Pune, Maharashtra, India [1,2,3,4]

Professor, Department of Information Technology, Dhole Patil College of Engineering, Pune, Maharashtra, India[5]

ABSTRACT:For the effective Taxi business we developed the fleet management system based on GPS which is important tool, as well as its useful to provide information to taxi driver for earning profit by mining the historical GPS path of the projectiles. In the literature, distance between current place and recommended place, time for next passengers and exact fare of trip these three factors provide the similar objective have been considered in different work. In this paper, in addition to this factor we added one more factor that is based on driver's experience which is most likely locations to pick up the passenger given the current passenger drop off location .the one location and another location graph model referred to as OFF-ON model is worked for define the relation between the get off location and next passengers get on location. To estimate the expected fare for a trip started at a recommended location we adopted an ON-OFF model. A real world dataset from CRAWDAD is used to evaluate the proposed system. A simulator has been developed for the simulate journey behavior of taxies in database. Our proposed system still effective on recommending better profitable cruising location.

KEYWORDS: Taxi, Mobile Application, GPS, locations.

I. INTRODUCTION

THIS The fleet management system is very popular for taxi companies due to cost down of GPS (Global Positioning system).By using this system can able to track time stamped GPS trajectories of its taxi cab. In addition status of taxi, off shift, waiting at stand cruising, occupied can also track. The GPS fleet system not only using for management and security but also used for provide useful information to driver to earn more profit by mining the historical GPS trajectories and status of taxies. As a consequence, lots of researchers devoted to the research on efficient taxi business, especially the recommender system for taxi drivers under different conditions and objectives. The most important thing for taxi drivers gain maximum his profit. In daily routine taxi driver may include occupied time and exact journey time and drive to the designated estimation (occupied time). As the passenger get OFF the taxi he again start find out road network. At this moment recommender system could be used to help the taxi driver know where to cruise such that his profit can be increased. 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 than cruise based on his own experience. Several factors shall be considered for guiding a taxi driver cruising to a more profitable location. Firstly, the distance between current location and recommended location should be the less to save time and energy. Secondly, the waiting time for the passengers should be the less when taxi is in recommended location [2]. Thirdly, the fare for the trip preferred to be more if the taxi driver is able to pick up passengers at the recommended location [1]. In these studies to utilize the historical data, most of the work considered three factor with different approaches. In this paper, we consider all of these factors. In addition, we also consider a fourth factor by mining the relation between the passenger get-off and get-on locations. A location-to-location graph, called OFF-ON model is proposed to capture the relation between the passenger's get-off location and the next passenger get-on location. With this model which is calculated based on the historical data, our recommender system is able to know which locations are with high probability to pick up passengers when the taxi driver drop off passengers at a location. Thus, the contribution of this paper is to explore all of these four factors such that the proposed recommender system is effective. In additional, we also analyze, among these four factors, which one are more important than others. A simulator is developed which simulates cruising behavior of taxies in the data set and one virtual taxi which cruises based on our recommender system. Our simulation results indicate that the revenue earned by the virtual taxi is within the top 1% during the weekdays and top 4% during the weekends when the

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ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

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Vol. 4, Issue 5, May 2016

historical data is used for simulation. The results also show that the revenue earned by the virtual taxi is within the top 6% during the weekdays and top 18% during the weekends when a new data set is used for simulation. The problem is formulated in Section III and our proposed solution is presented in Section IV. Next, Sections V shows the experiment results. Finally, Section VI gives concluding remarks and future directions.

II. LITERATURE SURVEY

If Most of existing works on cruising location recommender system have only considered two of the four factors aforementioned [1]–[3], [5]. Through these processes, customer demand can be understood. However, their approach did not validate the demand of the location in different situations in practice. Their results showed that the waiting time to pick-up a passenger could be reduced by 5%. In [1] proposed Spatio-Temporal Profitability (STP) map for guiding taxicabs to cruise to more profitable locations. They mainly focused on modeling the profitability of locations. In [5] recommended next waiting/cruising location using paper media which provides taxi drivers with picking-up numbers ranking and/or fee achievement per location only. In [4], presented a recommender system for both taxi drivers and passengers. For taxi drivers, the system recommends a good parking place with a short waiting time and a long distance for the next trip. Their precision and recall results showed that the method could effectively provide taxi drivers with high revenue positions. Their study suggested that travel distance and destination affect the travel behavior of people. However, their data set is small and only covers the Sunday slots. In [8] regarded places as Hubs and the travel experience of users as Authority, stemming from the web-based model named HITS. A good hub represents a page that points to many other pages, and a good authority represents a page that is linked by many different hubs. Therefore, the ranks of interesting places and influential users are obtained after the simulation processes.In this paper, our approach is different from the abovementioned methods in the following aspects. First, we provide a new approach to clustering which is more appropriate for our study. Second, because there are many fluctuating factors regarding the choices of next position when taxi drivers are looking for a new passenger, we provide two new models which take into consideration the importance of these factors, such as the waiting time of the place, the average revenue of the place, the 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 also compare our model with the modified HITS model. The average revenue and clusters are regarded as Authority and Hubs, respectively. The rank of locations is provided to the taxi drivers for recommendation in our experiments.

For taxi drivers, reducing the cruising time on the road and finding the next passenger effectively is the most important task during their operating hours. Taxi drivers tend to wait for passengers in popular positions to reduce their waiting time. Considering the balance of supply and demand, it is not a desirable situation that all taxi drivers go to the same place at the same time. Based on the current time and the current position, our system assists taxi drivers in finding a good potential candidate position by analyzing historical taxi trajectories, thus maximizing their revenue. Many factors affect the choice of the next position after taxi driver's drop off a passenger. These factors that fluctuate with the direction of the taxi drivers include the current time, the distance between the current position and other positions, the probability of passengers waiting at a certain position, and the waiting time of the position. We have designed a model to discuss the relationship of these factors and calculate the scores based on these factors to represent the probability of potential passengers at the positions. Taxi drivers who take the advice of our recommender system can gain higher revenue in a working day. We use the data set from CRAWDAD which contains mobility traces of taxicabs in San Francisco, USA. We have built the recommender system based on analysis of the historical taxi trajectories. There are four dimensions in the data set: latitude, longitude, time stamps, and the status of the taxi cab. Before conducting any further analysis on the subject of location-based services, clustering the GPS coordinates into location is an important step. We select the positions where the passengers get in and out of the vehicles, because we want to understand the movement patterns in the taxi trajectories. After filtering the pickup /drop off positions, we group similar positions together by the process of clustering.

III. PROPOSED SYSTEM

Use To analyze and retrieve habitations of residents in an area we used historical GPS data. Limited time issue are important factor which taxi drivers may consider in determining distribution of passengers. We emphasize on impacts on the movement of the taxi drivers after the passengers are dropped off by analyzing the spatial and temporal factors.

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Temporal Analysis

From our analysis, the daily total revenue on weekdays and weekends are significantly different. Thus, we divide our GPS data into two categories (i.e., weekdays and weekends) so that the properties of taxi demand can be reasonably observed. For instance, requests for taxies are high around office buildings on weekdays. On the other hand, demand for taxies is high around the entertainment centers on weekends. Furthermore, there is great demand for taxies around department stores or business zones during the daytime and around bars at night. As a result, the number of passengers who request taxi services varies with the time and the categories of place. In our experiments, we conclude that a higher number of divisions (for example, hourly time slots rather than morning, noon, or afternoon sections) will achieve better performance. Furthermore, we analyze the average waiting time in every place recorded in the historical GPS data. The average waiting time of a place is obtained by dividing the total waiting time by the number of times that passengers get on a taxi in that place. The average waiting time is an important factor that impacts the decision of going to the next pick-up location for taxi drivers.

Spatial Analysis

The first step of the spatial analysis is to conduct the data clustering process on a set of GPS points on the historical GPS trajectories. After completing the clustering of the GPS data, the distance between two clusters can be obtained. The impact of the distance factor is profound, since fuel costs are directly proportional to the distance driven. We observe that the patterns of the taxi service demand from our historical GPS data can be discovered. There are several potential improvements for this method. First, we did not focus on the temporal aspect beyond shifting the DEW at a delayed time and adjusting the size. Patterns in time may affect results by allowing it to include data from two distinct periods in relation to the traffic pattern; for example, rush hour traffic data included with non-rush hour data. To a lesser extent, the cell sizes and region M may need to adjust with time as well; for example, late at night, there may be a need to increase the cell size due to lower probability of live trips and an increase in M to include more potential locations. For validation purposes, M was large enough to ensure that all cruising trips considered ended within the area with our profitability scores; otherwise, the score would be zero when in reality it should be positive or negative. The goal would be to develop a dynamic STP mapping system that adjusts each of these components given current conditions and time.

IV. EXPERIMENTAL RESULTS

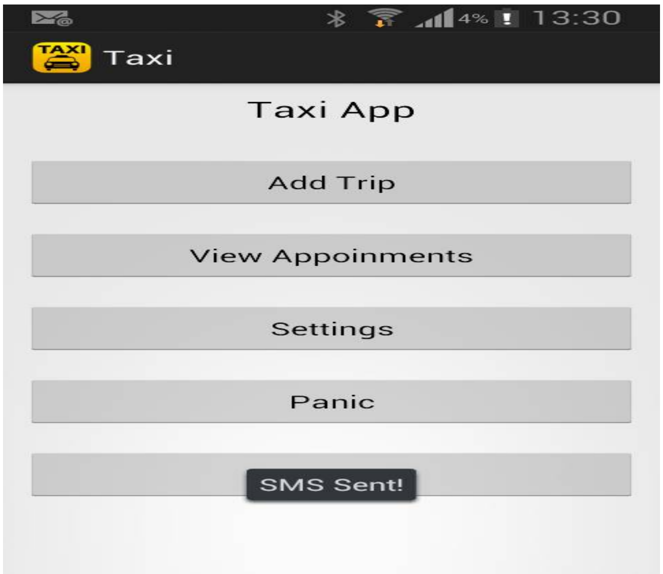

Fig 1. Add Trip

Passenger can add trip with this application and give the details of pick up location.

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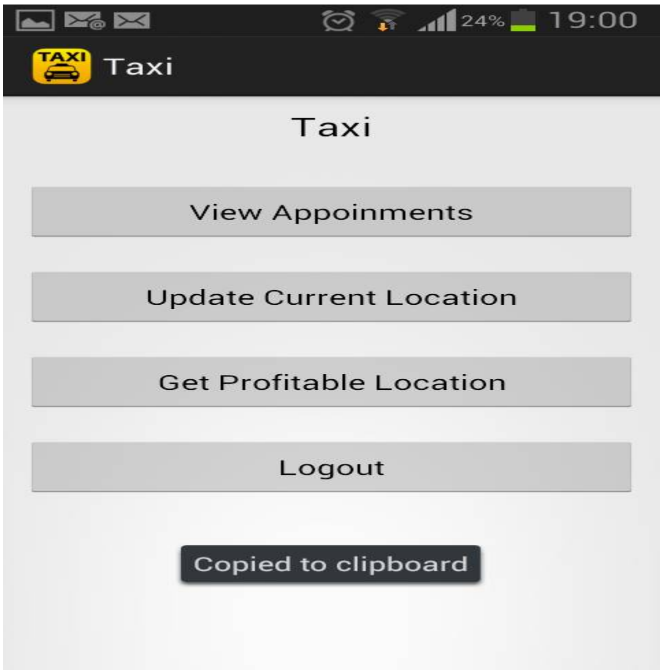

Fig 2. View current location

Taxi Drivers will be view appointment time and update his own location.

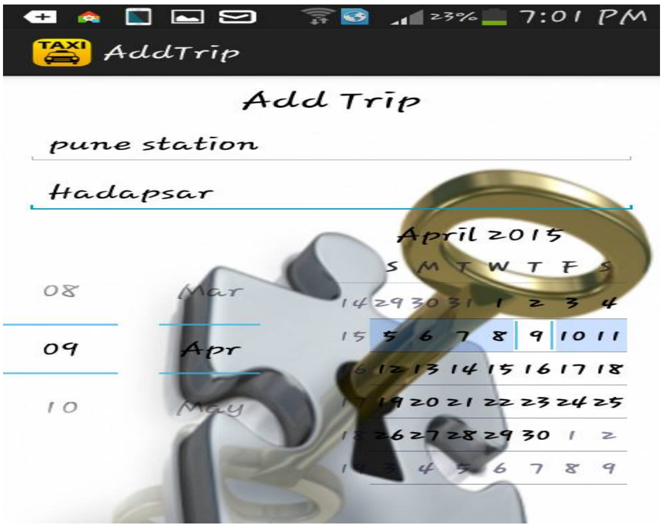

Fig 3. Add Trip

Add the Trip Details as Location pick up location and destination location.

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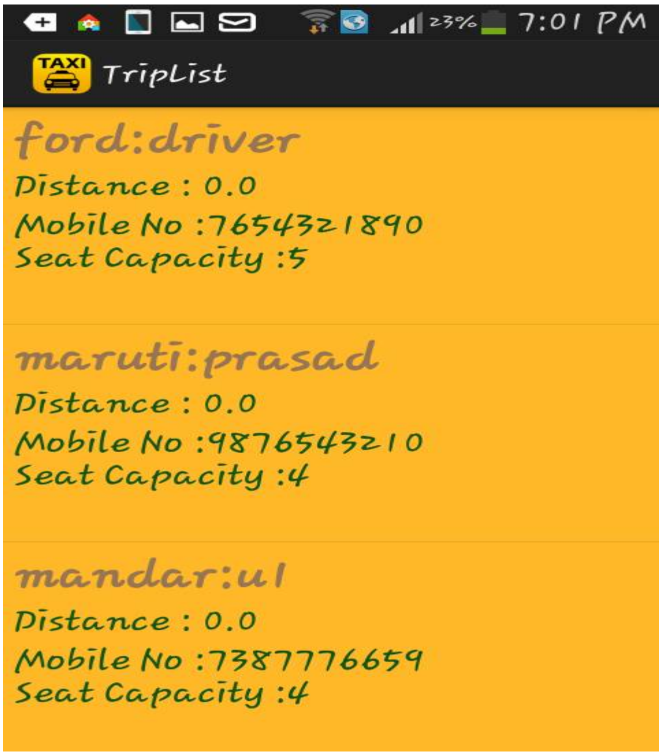

Fig 4. Display Trip list

Display all available Trip List with the driver's details like name and contact number.

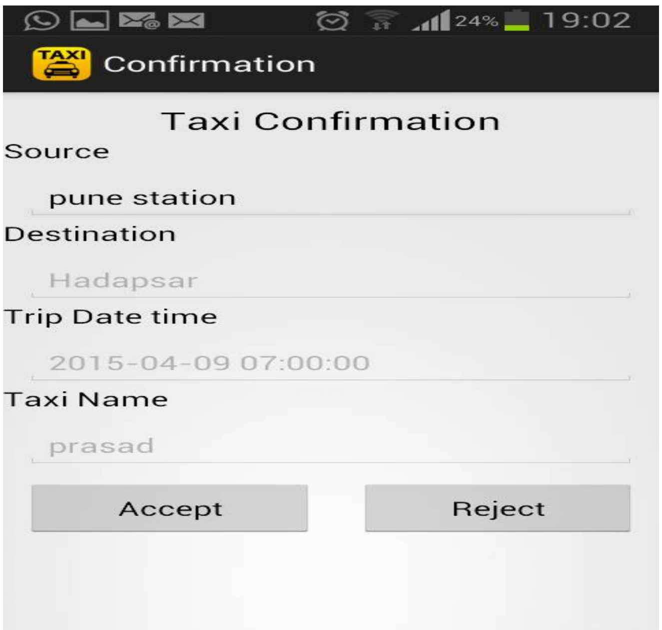

Fig 5. Taxi Confirmation

With available details book the taxi and accept the confirmation

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V. CONCLUSION

In our paper, we investigate four factors on recommending taxi drivers the next cruising location. The four factors are obtained by analysing the historical data trajectories according to spatio-temporal relation and location-to-location graph models. We evaluated the stability and reliability of our recommender system using real world data sets. Our simulation results show that our recommender system is effective in helping taxi drivers earn more profits even the historical data set may differ from the testing data set. Among these fore factors, we have observed that distance to the next cruising location and waiting time are more important than expected fare of a occupied trip starting at a location and the drivers' experience of picking up passengers from next cruising location based on current location.

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BIOGRAPHY

Mr. Nikhil G. Aurangpure pursuing his Degree Course in Bachelor of Engineering from Dhole Patil College of Engineering, Pune, Maharashtra, India

Mr. Shoaib A. Hannure pursuing his Degree Course in Bachelor of Engineering from Dhole Patil College of Engineering, Pune, Maharashtra, India

Mr.Nikhil C. Jadhav pursuing his Degree Course in Bachelor of Engineering from Dhole Patil College of Engineering, Pune, Maharashtra, India

Mr. Rohan S. Patil pursuing his Degree Course in Bachelor of Engineering from Dhole Patil College of Engineering, Pune, Maharashtra, India

Prof. Shivani Sthapak is a Professor in Department of Information Technology in Dhole Patil College of Engineering, Pune, Maharashtra, India.