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Design of Taxi Routing & Fare Estimation Program with Security Tracking and Re-prediction for Smart Phones

[1]Anjali Saxena, [2]Ruchita Madhavi, [3]Shweta Mohite

[1,2,3]UG Student, B.E. Computer, SIGCOE, Maharashtra, India.

[1]anji.saxena12@gmail.com, [2]ruchitamadhavi46@gmail.com, [3]mohiteshweta09@gmail.com

Abstract: **Our design involves developing an app that will be used for taxi routing and fare estimation. It also includes security tracking with fare re-prediction. To improve the accuracy of the taxi fare estimation the estimated fare is re-predicted using adaptive calibration method which is based on average error in fare and timing delay. Our design also combines with short message service (SMS) to develop an application program on the smart phone with the following multifunction, real-time route planning, fare estimation and a security tracking system, also it provides various other services like share your ride, onetime payment to ensure customers satisfaction. It also involves feedback from the customers about the ride which can be used to evaluate the performance of the service provider**

Keywords — Adaptive calibration method, One time payment, Security tracking, Share your ride, Taxi fare estimation, Taxi routing.

I. INTRODUCTION

There are a great many programs for predicting a taxi fare[1] both on the Website and on the smart phone application market, and there has also been some research into the routing options of the electronic map. However, the results are not precise enough and are even limited to the user setting the fare rate[2] and other information, not to mention safety protection. To facilitate the user's choice of the best route and to predict the fare in order to save time and money by using electronic map real-time information, our design uses adaptive calibration method or machine learning method. For the calibration method we set up two calibration elements, which are the actual fare and the timing delay, both of which are then divided into several ranks. During simulation on the road the program records the fare and the timing delay and converts them into metadata. Based on those data and ranks the program re-predicts automatically when running the prediction program. We also use electronic maps and GPS[3] to create a mash up application which then combines both short message service (SMS) functions to share information between users, so that our program can conduct actual simulation, send the current location to friends and family to ensure safety[5] and concurrently store the coordinates of the driving route trace.

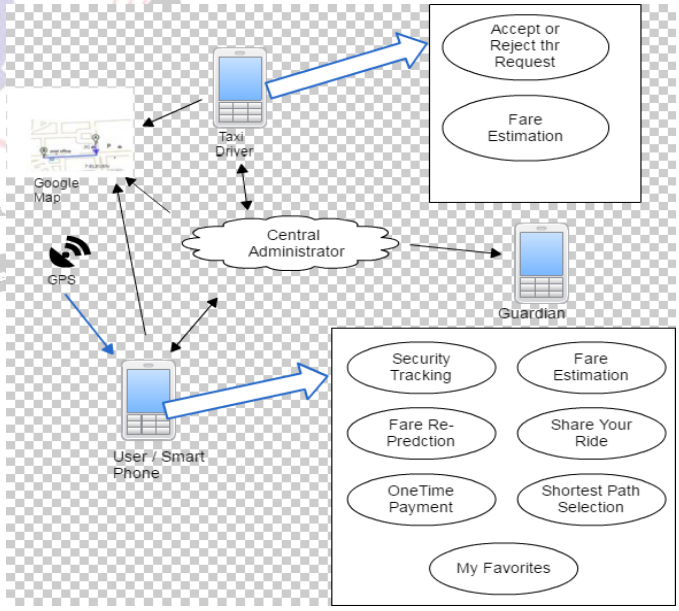

Fig 1 System Model

II. PROPOSED SYSTEM

To overcome some drawbacks of existing system we are going to develop a framework for android mobile application, Taxi Routing and Fare Estimation Program. In this project we are going to implement app that will be used when wants to

travel through taxi, for the implementation of this application user & taxi driver has to install our app.

Objective

1. To develop a centric framework for taxi fare estimation for citizens.
2. To ensure customers comfort for selection of taxi on the basis of :

- Type of taxi (AC/NON AC)
- Number of seats
- Drivers Ratings

3. To ensure tracking facility for customer if guardian phone number is entered.
4. To continuously inform the passenger regarding the current location of taxi.
5. To provide "Share Your Ride" service.
6. To provide fare estimation and Reprediction of fare for accuracy.
7. To provide "One Time Payment" service for faster transactions.
8. To enable shortest path selection if available.
9. To ensure that the customer feedback and ratings are beneficial to other passengers.
10. To allow the driver to accept/reject the request.
11. To ensure that the activities of both entities are tracked by the centralized administrator.

III. PROPOSED SYSTEM WORKFLOW

Following are the steps which describes the flow of system

Passenger

1. If any taxi passenger wants to access the services through framework, need to be register first.
2. Registration needs following details
    1. Full name.
    2. Residential address.
    3. Date of birth.
    4. Contact number.
3. Login form needs username which is provided by passenger at the time of registration.
4. After successfully login into system a Home page will appear with 3 options:
    1. Number of taxi's for a particular location towards destination.
    2. General estimation for that source to destination.
    3. Change Profile.
5. For acquiring service passenger had to select destination. System will suggest a nearest taxi service provider with the location on Google map. Select service provider and fill the necessary details and acquire service. Then the nearest taxi service provider has received the notification about enquiry.
6. Passenger can change their personal details within change profile area.

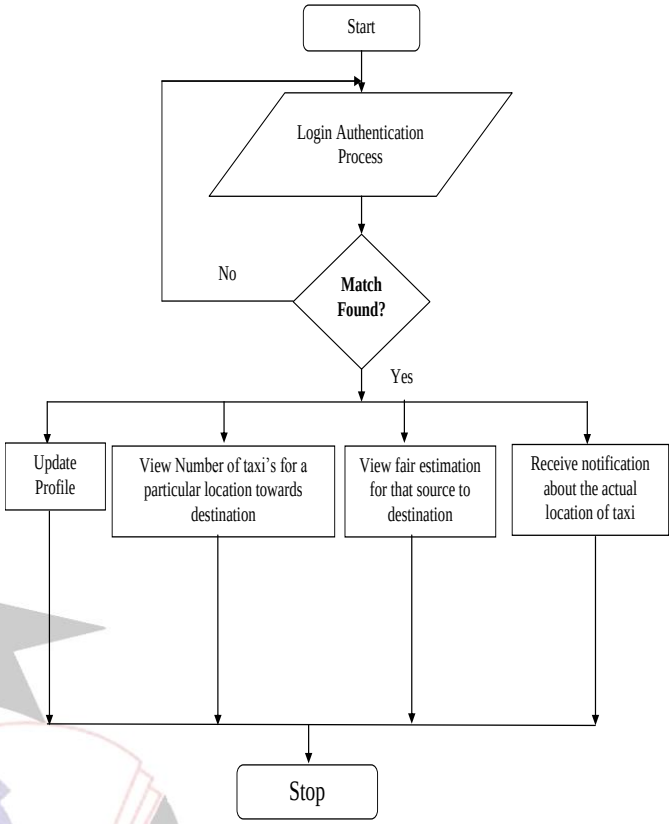

Fig 2 Flowchart for passenger

Taxi Service Provider

Service providers are registered with framework with basic details of service which they are going to provide passenger.

1. As soon as Service provider receives any notification it will send confirmation about journey.
2. Then that passenger will receive notification about the actual location about taxi driver with latitude – longitude & after every five minutes passenger will get updated location of taxi driver through GCM (Google Cloud Messages).

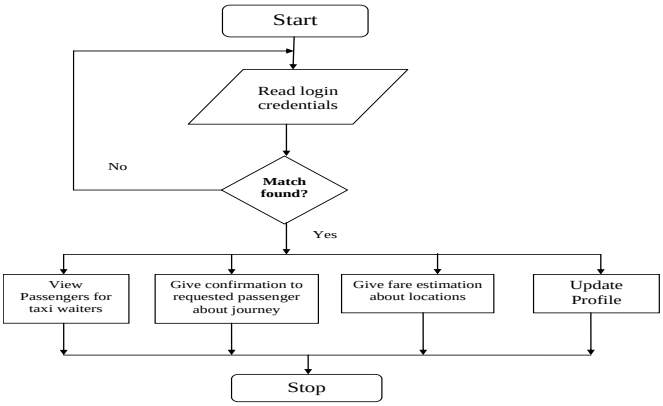

Fig 3 Flowchart for Taxi service provider

Administrator

To keep a track on the activities of both the passenger and driver a central administrator is required.
The administrator is responsible for keeping the track on the records of both taxi driver and passenger.
The administrator ensures that continuous service is provided to the passenger in case of any failure.

IV. ADAPTIVE CALIBRATION METHOD

The Adaptive Calibration method, one of the methods of machine learning, allows computers to evolve particular behavior types based on empirical data. This method is concerned with the development of algorithms which allow the machine to learn via inductive inference based on observed data .Our design sets up two calibration elements, the actual fare and the timing delay, and divide them into several ranks. The main task of our calibration method is to provide customized information to users. All ranks are classified based on the Individual timing and fare slots. We use a simple algorithm tore-predict the fare estimation. We use an adaptive machine learning method to increase the accuracy of the fare prediction which is calibrated automatically, and we divide the fare and the timing delay into several ranks which reiterate the calibration program inside the self-learning method.

V. FARE ESTIMATION AND REPREDICTION

The equation of the original fare prediction is as in (1). The timing delay is not programmed during the prediction period

$$F_o = F_i + \left((D_{map} - D_i)/D_c\right) \times F_c \qquad (1)$$

F_o : Original fare prediction

F_i : Initial fare; F_c ; Time required counting the fare

D_{map} : Distance from the electronic map

D_i : Initial distance

D_c : Time required determining the distance

For the calibration method the equation of the re-prediction of the average fare error rate is as in (2), and that of the re-prediction of the average timing delay is as in (3).

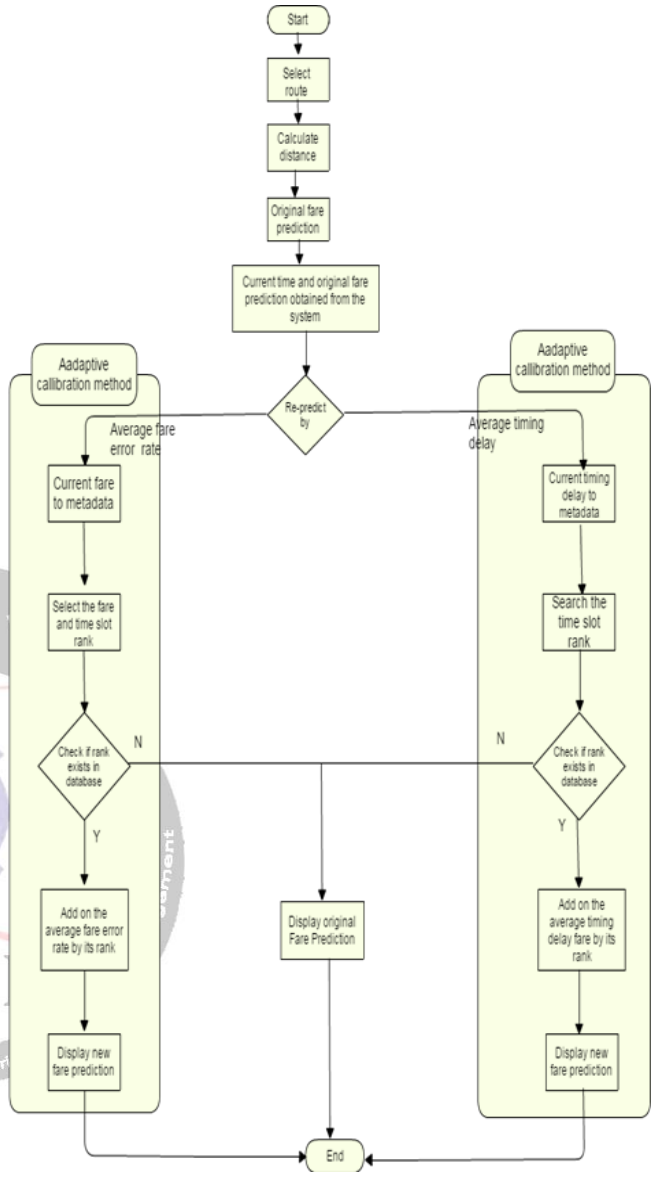

Fig 4 Adaptive calibration method

$$\gamma_{avg} = \left(\sum_{k=1}^{n} F_a / F_o\right) \Big/ n \qquad (2)$$

$$t_{avg} = \sum_{k=1}^{n} t_d \Big/ n \qquad (3)$$

γ_{avg} : Average error of the fare ; F_a : Actual fare

t_{avg} : Average of the timing delay

t_d : Timing delay, k : Constant, n : Number of times

The equation of the re-prediction fare that is calibrated by the average fare error is as shown in (4), and that calibrated by the average timing delay is as shown in (5)

$$F_{r-f} = F_o \times \gamma_{avg} \quad (4)$$

$$F_{r-t} = F_o + \left(t_{avg} / t_d\right) \times F_c \quad (5)$$

F_{r-f} : Re-prediction fare (calibrated by the average fare error).

F_{r-t} : Re-prediction fare (calibrated by the average timing delay).

VI. FARE ESTIMATION IN SHARING A RIDE

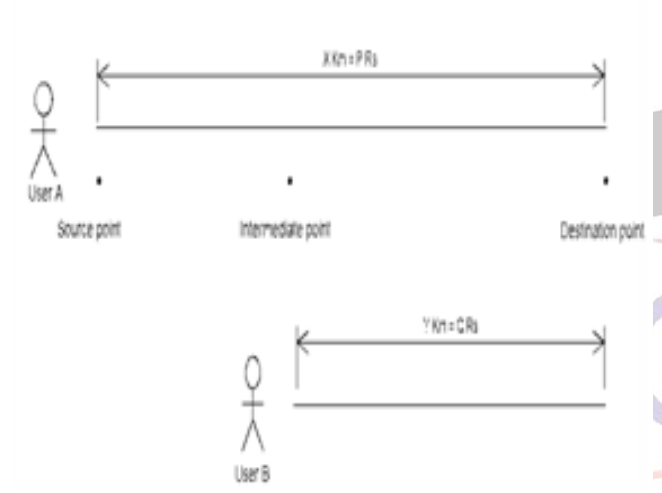

Fig 5 Share your ride

Suppose there is a User A that travels from particular source to destination, while travelling there is an intermediate point that the User A will travel while reaching the destination. User B wants to travel from that intermediate point to the destination. Since the destination of both user A and user B is same they can share their ride.

Distance from source to destination= 'x'km
Fare from source to destination= 'P' Rs
Let User A has to pay amount A

Distance from intermediate to destination= 'y'km
Fare from intermediate to destination= 'Q' Rs
Let User B has to pay amount B

Let us assume fare from source to intermediate point is 'R' Rs.

Fare for User A = R + (Q/2)

Similarly calculating fare for User B

Fare for User B = (Q/2)

VII. ONE TIME PAYMENT

The onetime payment option can be used to ensure faster transactions. Under this the customer creates and account with us and deposits a particular amount and each time he travels with us the predicted fare will get automatically deducted from the respective account.

VIII. COMPARISON WITH OTHER DESIGN

Parameter	Our Design	Other Design
After the acceptance of passengers request by the taxi driver continuously the taxis current location will be informed to the passenger	YES	NO
Taxi Drivers complete information along with photo	YES	NO
Fare Prediction	YES	NO
Fare Reprediction	YES	NO
Security tracking with current location being informed to the guardian via messages	YES	NO
One Time Payment option	YES	NO
Share your Ride service and computation of fare accordingly	YES	NO

IX. CONCLUSION

We have implemented an application program about taxi routing and fare estimation program with security tracking and re-prediction for smart phone. This application gives the exact location of taxi, proper route for journey, exact fare for the journey.

The main cause in estimation of the fare will be timing delay; hence we have use adaptive calibration method that makes use of GPS to trace the coordinates while travelling. This application not only can be used for taxi fare estimation but it can also be used to update current location or to send message when the user is travelling. This application also provides security protection system.

Not only can this application program be used in estimating a taxi fare, it can also be used to upload the current location to send it to an appointed smart phone or mobile phone number by SMS when the user is traveling.

In addition our design can serve as a personal security protection system. In our application program both a smart phone and a mobile phone must support a mobile network so that our program can send data to the social network and use SMS to send messages. Therefore, depending on the provider

used, their rates, and their areas served, the user will have additional costs for communication.

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