Taxi Fare Estimation and Routing Using Re-prediction Method

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***Abstract*— In our daily life we travel through Taxies, and many times we face the problem of meter tampering or frauds in Taxi Fare, causing overcharging. For avoiding such problems we are making an application which can estimate nearest exact fare in addition to this it can also help us in routing through the route we are taking. For calculating fare we use two methods to improve the accuracy of the taxi fare estimation. To improve the accuracy of the taxi fare calculation an adaptive calibration is used; to reduce the error of cumulative distance improved distance accuracy is used. Multifunction in terms of real-time routing, fare estimation and security are provided by connection with services like SMS, social networking sites and cloud storage.**

***Keywords*— GPS, Calibration, Fare Calculation, Delay**

I. INTRODUCTION

There are a great many programs for predicting a taxi fare both on the Website and on the smart phone application market [1] and there has also been some research into the routing options of the electronic map [2]. However, the results are not precise enough and are even limited to the user setting the fare rate 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 two methods to improve the accuracy of the fare estimation. One is the adaptive calibration method or machine learning method [3], the other is reducing the error of the cumulative distance which is calculated by GPS signals [4]. 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. Since the roads are not flat, using the coordinates there will be a drift of the distance. To reduce the error of the cumulative distance we initially set this at 30m in our program and then narrow it down to 20m and 10m. After testing the error drift of the distance we find that it has greatly converged. We also use electronic maps [5] and GPS to create a mashup application which then combines both short message service (SMS) functions and social networks and uses the cloud [6] technology as the cloud storage to share information between users, so that our program can conduct actual simulation, send the current location to friends and family to ensure safety [7], and concurrently store the coordinates of the driving route trace [8].

II. MODULES

User:

The user will initially install the application and then will run the application and will set the initial or the least fare. And will enter the destination.

GPS:

Global Positioning Signal these signal will help us to track the user and will extract the current position of the user. And GPS will also provide the user the complete route taxi has travelled through.

Social Networking Websites:

We will send the update regarding the position of the user to a specified user id so that in case of any emergencies that person position can be traced .

SD Card/Cloud Storage:

In our application we will store the data about the routes and the locations of the user in a SD card or in cloud as a metadata.

XML:

XML is one of the most widely-used formats for sharing structured information between programs, between people and between computers and people, both locally and across networks.

III. METHODS AND SOFTWARE FLOW

Calibration

Our design uses an adaptive calibration method or machine learning methods to improve the accuracy of taxi estimated fare using the automatic calibration method to re-estimate. Fares and delay timing are the two elements which are divided into several ranks; we use the calibration method to compensate the estimated error, forecast accurate taxi fare when the actual simulation, the parameters like co-ordinates and intermediate fare will be recorded each time fare, and the lag time is considered. The adaptive correction method, converts the data to the metadata and as the next estimate of compensation. Program shortened to accumulate the accuracy of the actual distance to judge the distance can be increased. When using these two methods in the prediction and simulation to increase the accuracy of the program, you can improve the estimated accuracy of the taxi fare.

Fare Calculation:

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

$F_o=F_i+((D_{map}-D_i)/D_c)*F_c$ (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 Reprediction

For the calibration method the equation of the re-prediction of the average fare error rate is (2) and is followed by that of the reprediction of the average timing delay (3) .

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

$$t_{avg} = \left(\sum_{k-1}^{n} {}^{t_d}/_{n}\right) \quad (3)$$

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 tries

The fare error rates are caused by the distance and the timing delay so that there is a gap between the actual and the predicted fare. We therefore use the adaptive calibration method for the actual fare, with each 16 INR as a rank, and then narrow it down to 1 INR, whilst the calibration method for the average timing delay is divided into three ranks by time slots, peak hours, off peak hours and other hours, and then narrowed down again to 12 time slots. The equation of the re-prediction fare that is calibrated by the average fare error is as shown in, and that calibrated by the average timing delay is as shown below:

$$F_{r-f} = F_0 \times \gamma_{avg} \quad (4)$$

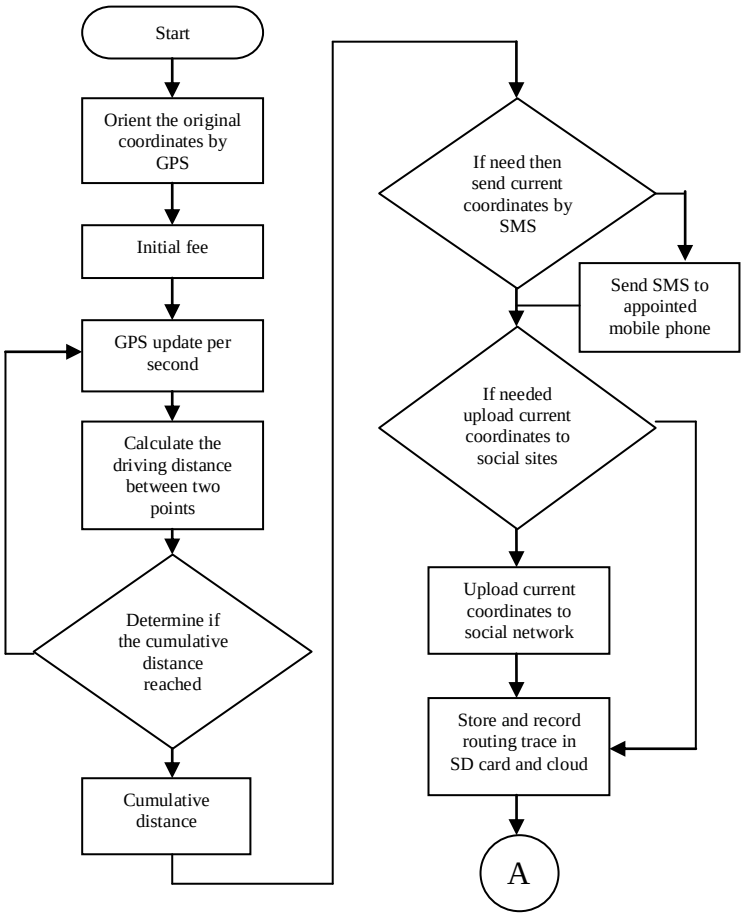
$$F_{r-t} = F_0 + \left(t_{avg}/t_d\right) \times F_c \quad (5)$$

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

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

GPS receiver orients the current location co-ordinates and updates it each second for the security tracking system, when starting this program the. It is user's choice whether or not to send an SMS to appointed mobile phone number and to upload the current location to a social network. The frequencies can be set by the user. Metadata is created on SD card of the phone as well as cloud which consist of all coordinates of that particular route.

Actual distance is cumulated by a random distance error which is reduced by our re-prediction method and for the same the coordinates are updated per second by GPS system in case of detour, waiting or stopping at traffic lights.



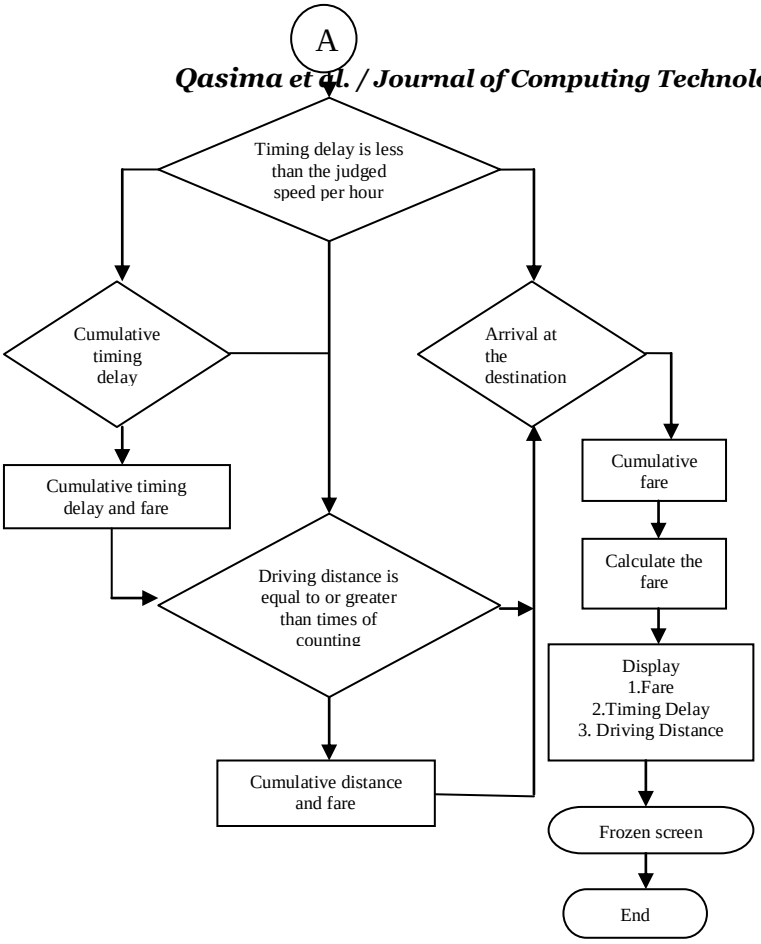


Fig. 1: Software flowchart fare calculation and security tracking system

IV. PROPOSED SYSTEM

Table I shows the comparison of three designs [1], [2]. It elaborates the improvements that will be done in our application which were not there in previously implemented designs

TABLE I. COMPARISON

Function	Design A	Design B	Our Design
Fare prediction	Yes	Yes	Yes
Fare re-prediction	No	No	Yes
Manual fare rate set	No	No	Yes
Routing and storing route	No	No	Yes
Sharing location for security	No	No	Yes

V. WORKING PRINCIPLE

After installing the application on mobile phone following steps need to be followed:

Software requiremnts:
Android SDK
Emulator to test the code
Java 1.6 or above
Front End: Android
Back End: SQLite

Hardware Requirements:
Processor: Pentium 4
RAM 512 MB
A mobile device: Android OS, having GPS and access to internet

VI. CONCLUSION

We aim to design the application program for fare estimation along with real-time function in taxi routing, and security. Not only can this application program be used in estimating a taxi fare, it can also be used to upload the current location to a social network or to send it to an appointed smart phone or mobile phone number by SMS when the user is travelling thereby providing security to user. Hence in addition our application can serve as a personal security protection system.

For 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.

ACKNOWLEDGMENT

At the outset, we would like to express our sincere gratitude to our guide **Prof. B.W. Balkhande**, it is due to his enduring efforts, patience and enthusiasm, which has given us sense, direction and purposefulness to this paper and ultimately made it a success. He has taken pain to go through the project and make necessary correction as and when needed.Our deep sense of gratitude to our respected Head of Department **Prof. Vidya Chitre** for the constant encouragement. We would like to tender our sincere thanks our respected principal **Dr. M. Z. Shaikh** for understanding and the support. We would also thank our Institution and our faculty members without whom this project would have been a distant reality. We also extend our heartfelt thanks to our well wishers.

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