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Using an Innovative Model to Automate an Efficient Taxi Dispatching System in Mauritius

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ABSTRACT

The world is rapidly changing with the introduction of innovative technologies to meet the ever-changing demands of consumers. This research focuses mainly on the study of the actual taxi system in Mauritius to manage their everyday activities in an efficient way to earn a good and a decent earning. With over 6000 drivers in Mauritius, this has caused a major issue in the transportation sector. According to the survey conducted in Shanghai, China, the percentage of empty miles ((total miles-service miles)/total miles) for taxi is 32%, while the waiting time for passenger may extend more than 1 hour in the rush hours at the worst. The taxi employed under this actual system is rarely capable of reaching the customers in the shortest possible time. This is an exigent problem actually confronting current taxi systems. Thus, an alternative Interactive Taxi dispatching system is proposed, whereby the system will be fast and cost effective to transfer the customer's request from the operator to the most suitable vehicle. This dispatch ensures that customers are served within the shortest time, resulting in satisfying customer's demands. Since existing taxi system are working manually, there is a need to have automatic taxi trip system which would be easy and efficient. [14] Therefore, the aim of this paper is to research the pertinence of the use of an Interactive Taxi Dispatching System as an alternative mode for taxi drivers to easily be connected with their riders.

Keywords--- Taxi Drivers, Taxi Dispatching System, Taxi Booking, Quick Transport, Cost Effective Taxi

I. INTRODUCTION

Taxis have an imperative role in contributing constructive services within Mauritius transportation sector. In the midst of the growing prominence for providing satisfaction to customers, it is fundamental for taxi drivers to continuously improve their current systems and facilities to guarantee quality and superior service. Our everyday life has changed rapidly and is connected always with devices around us. We can have anything we need at any time and people simply expect to be able to connect wherever they are. Thus, this interactive taxi dispatching system helps riders to quickly find the most suitable taxi for their transportation and allow drivers to simply connect to passengers through a fair reward system. In the end, what we want is to have a smarter, faster, and more effective transportation platform for all people to use daily.

Nowadays, taxis are available everywhere in Mauritius to provide services to serve their customers in each region. However, many taxis roaming on the streets counter to request passengers on their way, and take passengers to their specific and desired destinations. As a result, existing taxi networks are dependent on drivers to drive around in the region randomly to pick up passengers on the roads. This service model has successfully served up to 25% public passengers in metropolitan such as San Francisco and New York [1], [2].

In TAS (Taxi Automation System), online dispatching of available taxis to meet the current customer bookings are done normally with the help of a satellite-based taxi automation system to meet the current customer bookings; that is the system uses a Global Positioning System (GPS) to repeatedly locate taxis location in factual time. [3]. The current method consists of assigning the nearest taxi in first come first serve queue basis without taking into consideration the passengers who are in the request queue. To improve performance of taxi fleet service, preferably, the assignment taxis should be done concomitantly and optimally in order to service all customer bookings within the time frame. [4]

By means of comparing to the existing dispatch system, all the existing direct distances of the taxi to the current customer locations are generally calculated. However, this process needs pretty little space for storage and computation time. Conversely, for the anticipated dispatch system, the calculation of the shortest possible path for every available taxi required a significant larger room for memory and calculation time. [5] In regards to the speed and memory restrictions of computers, it was not a practical alternative to establish and calculate the shortest paths for all the available taxis.

The existing taxi operation approach features elevated number of empty taxies wandering around the streets, whilst plenty of potential riders are irritated with the fact of not finding a taxi when needed. [6] The key reason for this inadequacy is that the current taxi dispatch system is unable to exchange appropriate information in a real-time manner between taxi drivers, riders and the dispatching system.

The inefficiency in dispatching system not only makes a major impact on passenger waiting time and passenger satisfaction, but also increases the taxi driver idling time. Though, drivers said that though they do not mind waiting for hours, but still they find waiting at the terminal enormously time-consuming and tiring. [7] The drivers are likely to wander near residential areas during morning peak and wait until they get a passenger. The incompetency of the system arises; even when the market is correctly synchronized and harmonized, due to the deficiency of the perfect widely spread information sharing between taxi drivers and passengers. [8]

To improve taxi fleet service performance, ideally, we should concurrently and optimally assign taxis to service all customer bookings that are made within the time window. This is an exigent problem confronting current taxi dispatch systems. [12]

II. PROBLEM STATEMENT

The inefficiency in the current approach of booking a taxi is that it is incapable of reaching the rider in the shortest time and determining the actual rider's real-time location. As a result, many people are deprived from using taxi service. it is difficult to gain the distribution of passengers since passengers can appear at any place and any time in the city. [15]

III. OBJECTIVES

The objective of this Interactive Taxi Dispatching system is to provide riders with taxi services effectively and safely, based on the location of the taxi driver and rider. In other word, match the rider and available taxi properly in term of distance and availability of the nearest taxi first.

IV. HYPOTHESIS

An Android app for both drivers and riders along with the implementation of an online booking website and the online operator dispatch system will ease the task for the booking process.

V. RESEARCH QUESTIONS

1) What are the actual procedures for searching for a taxi in Mauritius?
2) What are the problems faced by Mauritians when searching for a taxi?

VI. LITERATURE REVIEW

A. Procedures for seraching for a Taxi

In this random searching mode, passenger is waiting for a taxi on street and empty taxi is moving around looking for a passenger, both passenger and taxi do not know each other's location. Passengers and taxis are randomly searching for each other as shown in the figure below.

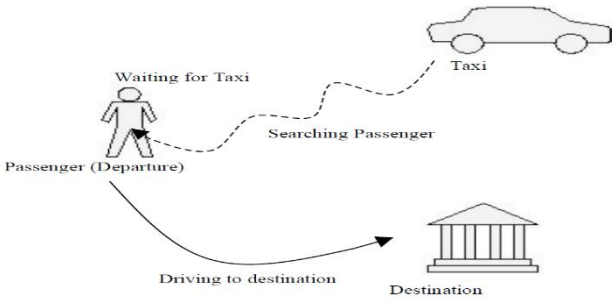


Figure 1.0: Procedures for searching a taxi randomly

In this mode, when a passenger needs a taxi, the only thing he or she can do is standing on street and waiting for a vacant taxi passes by. The waiting time of the passenger depends on the probability that a vacant taxi passes by during his/her waiting. [9]

Another mode is when a taxi is waiting for a passenger at a heavy traffic center or stop point. The location for taxi is known but the arriving passenger is unknown as shown in the figure below.

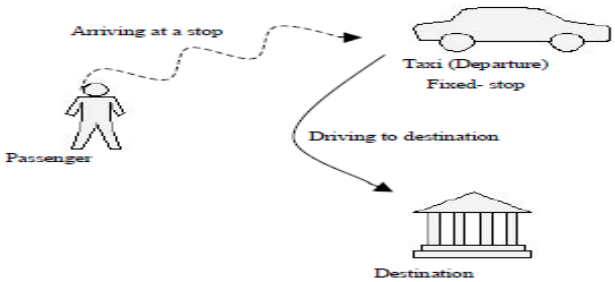


Fig 1.1: Taxi waiting for a passenger

For a vacant taxi, it reduces empty driving searching for passengers but the waiting time could be very long. After several interviews with taxi drivers, we find that the average day waiting time of taxi at Pudong International Airport in Shanghai to get a passenger is 15 minutes. [10]

B. Problems faced when searching for a taxi

More cars may pass on a busy street, and during rush hours, thus there may be few vacant taxis passing by. An unlucky passenger may wait long time without meeting any available bypass taxi. For the driver of a vacant taxi, he/she has to keep moving the taxi and hopes to find a passenger waiting on the bypassing street. Since the location of potential passenger is unknown, the taxi driver has to decide which street to roam through in order to increase the probability to meet a passenger. The unproductive idle driving and waiting time is caused by

lack of taxi and passenger location information. In a big city, usually there are so many idle taxis roaming around causing traffic jam and air pollution. This may also cause accidents when a taxi driver is looking for a passenger without paying enough attention on driving. [11]

From a taxi driver's point of view, an efficient taxi system is one in which his or her taxi is never empty. By contrast, a customer's idea of an efficient taxi system is one that delivers an empty taxi to his or her location at the instant one is desired. Obviously, these goals are in conflict. [13]

VII. METHODOLOGY

In order to develop a suitable system, requirement determination process was taken into consideration. Software tools used are HTML/HTML5, CSS3, Javascript/Bootstrap/AngularJS, JQuery/Jquery Mobile, PHP 5.0, Wamp Server, Android Studio 5.0 ADT for executing the application, MySQL for storing the database of users and Ionic framework/ Cordova environment for coding the program for the application. Moreover, Agile approach was used for the software development process. Additionally, to contrast between the current booking system and the Dispatching system, a table is provided below:

Table 1.0: Contrast between current system and Dispatching Centre

	Current system	Dispatching Centre
Reservation	You wander around the street to find a taxi or phone a taxi driver to come and pick you up.	You connect to Fast Taxi app on your Smartphone.
The Ride	The driver is barely polite and he doesn't care because he may never see you again. The car is not always clean.	The driver is nice and polite and the car is tidy. The drivers know that they will be evaluated after the ride
Paying	The price is determined by the driver himself and sometimes these prices may exaggerate.	Fast Taxi calculates the tariff based on the distance travelled.
Emergency	Wait until someone comes for help.	Press the alarm button and the operator will take immediate actions
Afterwards	That's it! It's over!	Rate the driver to improve our reputation for future customers

VIII. PROPOSED SYSTEM

The ideal solution is to develop an interactive dispatching system which will be android-based and web–based applications and which can be accessible on mobile devices such as smart phones and tablets. Several APIs will be integrated in the system. The content can also be customized to be used on any devices, including PDAs, mobile phones, etc., that are connected to the internet depending on the users' device. Furthermore, extending the user's ability to receive and interact with the information.

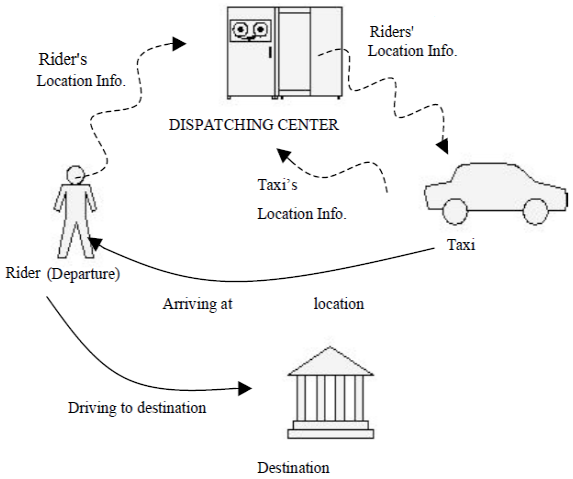


Fig 1.2: The Proposed System

Initially, there are three modes for a booking a taxi.

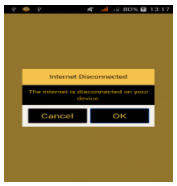
1) Instant Booking using the app
2) Advanced booking using the website
3) Direct call to the DISPATCHIG CENTER

By knowing both rider's and taxis' locations, the DISPATCHING CENTER can determine which taxis are available nearby to serve the rider. Explicitly, this system will work as follows. Preliminary, when a rider needs a taxi, he can simply send a booking request for a taxi through a wired phone, a mobile phone or Internet. DISPATCHING CENTER will take the rider's request and automatically attain the current location of both the rider and taxis. After both of their locations are known, DISPATCHING CENTER searches the nearest taxis. Then if there are some taxis available, the DISPATCHING CENTER will choose the nearest taxi to the waiting rider, and order the taxi to pick up the rider. Then, DISPATCHING CENTER will send the taxi details and the expected arrival time of the driver back to rider. When the driver arrives at the rider's location, he notifies the rider. Once the ride is completed, the rider will receive another notification for the completion of the ride and the rider can rate his/her booking. If there is no available taxi, the DISPATCHING CENTER will notify the rider the sad news and wait for 15 minutes until a taxi is available. Both the rider and the driver can cancel a booking at any time due to some reason. But, if a rider cancels a ride more than 3 times, he/she will be block automatically and has to contact the site admin to reuse the system. Furthermore, the rider can call the driver and the DISPATCHING

CENTER in case some problems arise. Both the rider and the driver can make use of the panic button to alert the DISPATCHING CENTER in case of emergencies.

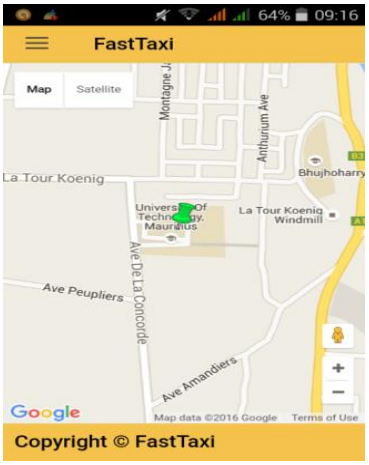
IX. RESULT

The splash screen of the Fast Taxi app will appear, and will check if the phone's WI-FI is on and if it's not it asks users to turn it on.

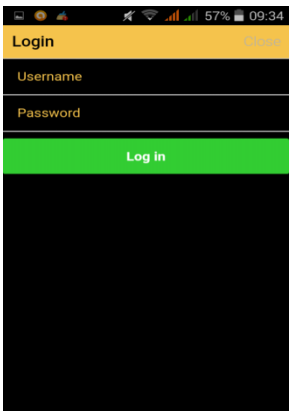


The booking process takes place as follows:

1) Once both the drivers and riders open their app, their current location is displayed.

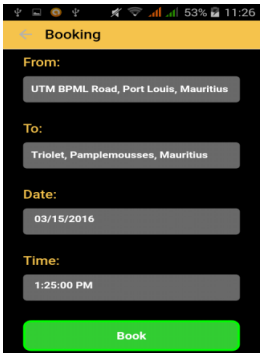


2) Both drivers and riders must login to use their app.

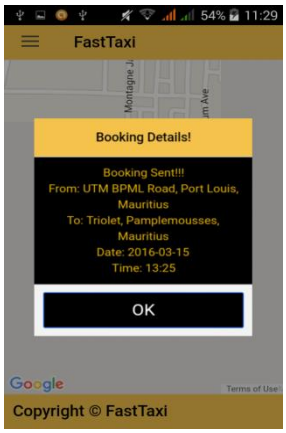


3) Rider can make an instant booking using the app as shown below.

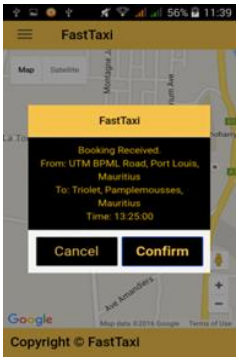
Assume that the booking is being done from UTM BPML Road, Port Louis, Mauritius and its destination to Triolet, Pamplemousses, Mauritius



4) Once the rider will click on the book button, the following notification will appear on his screen.



5) The rider receives a confirmation about his/her particular booking and will receive another notification to confirm the booking.



6) At the same time, the driver who can satisfy the criteria mentioned by the rider and having the shortest distance path will be alerted.

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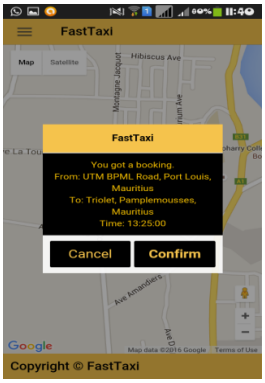
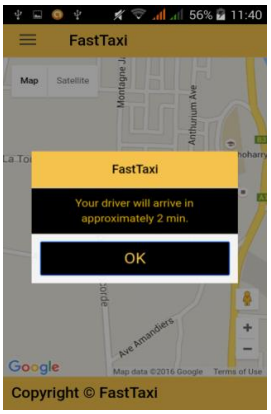
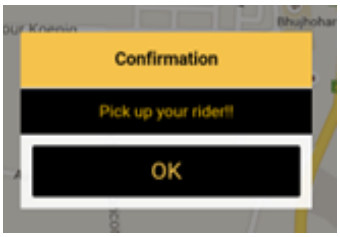


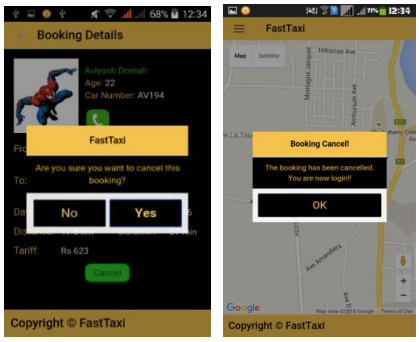
7) Once the driver confirms the ride, the rider will be alerted on his app.

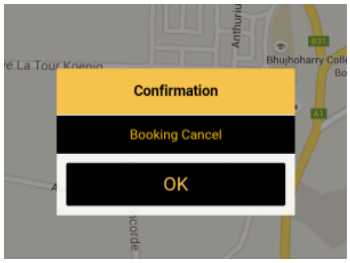


8) Simultaneously, the driver will receive a notification to pick up his rider.

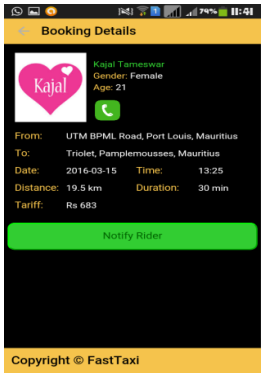


9) A rider can also cancel a booking. However, the rider cannot cancel a ride more than 3 times in a month or else he will be blocked. The driver will receive a notification that the booking has been cancelled.

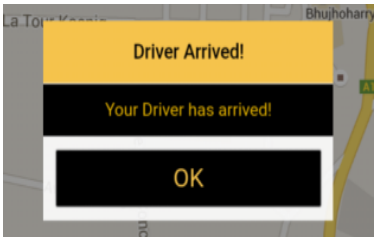




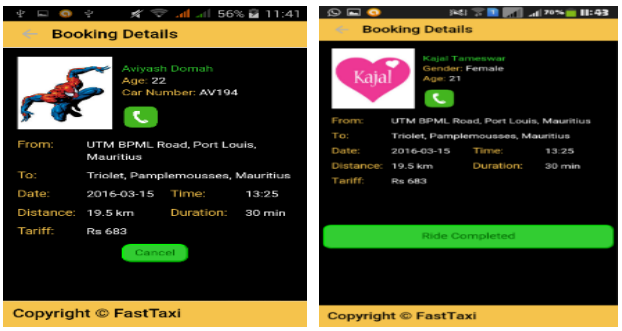
10) Upon arrival, the driver will notify the rider by clicking on the notify button



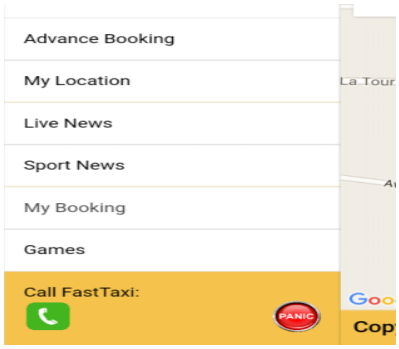
11) Concurrently, rider will receive the notification that the driver has arrived and the driver will receive a confirmation message that he has notified the rider.



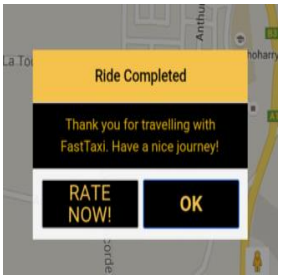
12) During the ride, both the rider and the driver can view the booking details on their app.

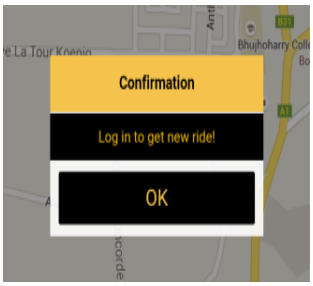


13) Use the panic button in case of an emergency or even make a call to Fast Taxi.

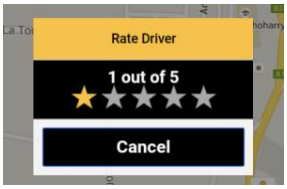


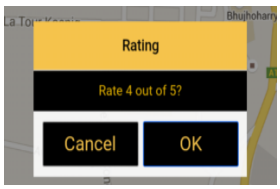
14) On completion of ride, the driver will click on the ride completed button and the rider will receive the following message. At the same time, the driver will also be notified to login for a new ride.





15) When rider will click on Rate button, the following will appear to rate the booking.





16) Both the rider and the driver can view live news, sport news, and play games.

X. CONCLUSION

This Interactive Taxi Dispatching system is an innovative approach to the Mauritian people. As a whole, this proposed system will allow the Dispatching center to lessen the time to pick up the rider, consequently improving the accuracy and efficiency of their dispatch systems accordingly, and thus delivering a superior level of guaranteed service to the riders. With the diminution in waiting times, more riders would agree to take on taxis through bookings, rather than using other means of hiring them when needed. This would let the taxi operators to better manage and optimize the taxi fleets in an efficient way, as a much better match of demand and supply of taxis could be met to satisfy customer's needs.

In the near future, to further improve the performance of this proposed system and at the same time to use the system to its full potential, advanced research can be carried out to gain and ascertain new methods or ways to obtain accurate estimations of the signal delays on the road, so that they can be incorporated into the estimated travel times to give the rider much more accurate information about the drivers' arrivals. This will help during the decision-making moment of dispatch to give a better estimate of the arrival time of a taxi. This needs a function that will predict the delays caused by signals that normally an individual vehicle experiences at intersections, would enhance the accurateness of the proposed system.

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