**Smart Public Transport with Optimized Resource Utilization**

**V 1.0**

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# Introduction

Our solution proposes to optimize the size and eventually the frequency of public vehicles plying through a set of predefined stops on a particular route.

**Phase I – Fixed Vehicle Schedules**

* Passenger registers pickup date, time, stop and destination stop
* The system registers the request and assigns the request to the closest match (i.e. the vehicle which is most likely to meet the requirement)
* Passenger can book – tentatively (without blocking money and availability) or confirm by blocking money and availability
* System sends a Q R Code with yellow (for tentative bookings) or green (for confirmed bookings) status
* Passengers with tentative booking has to arrive at the pickup stop and scan the Q R Code to confirm the travel – this blocks money and availability and updates the availability of space on the vehicle, the new Q R Code with a green status is sent to the passenger – this is done on a first-come-first-served basis
* Entry into the vehicle is restricted to green Q R Code holders
* At the destination stop the Q R Code has to be scanned again to confirm end of journey, deduction of money for the journey made and refund of the remaining blocked amount

**Phase II – On-Demand Vehicle Schedules**

* System calculates the optimum departure time and size of the vehicles based on bookings made and broadcasts the same to all stoppages on the route

# Phase I – Fixed Vehicle Schedules

## Smart Route Selection by Passenger

1. To avail this facility a passenger needs to install the android App in his or her smartphone.
2. Upon launching this App a local map shows up with the highlighted Smart Stops\*.
3. Then the passenger needs to choose a pickup stop and a destination stop from the available Smart Stops alone with pickup date and a preferred time.
4. Now the passenger submits the inputs to see the vehicle schedules available for the selected route on the specified date with the departure times closest to the specified pickup time.
5. The passenger will get a filtered and effective list of vehicle schedules on the basis of specified input.
6. In case there is no direct route between pickup stop and destination stop, system will show the transit routes if available.
7. The list view of the schedules will display following count information for each schedule entry:-
   1. Confirm booking count
   2. Tentative booking count
   3. Available seat count\* (??)
8. Passenger can select a suitable schedule from the list and proceed to booking. There are two types of booking that a passenger can avail. One is ‘Tentative Booking’ and the other is ‘Confirmed Booking’.

## Tentative Booking by Passenger

1. After a successful route selection a passenger can perform a Tentative booking by choosing ‘Tentative Booking’ in the mobile App.
2. This booking option does not block any cost from the passenger and does not guarantee any seat availability in the vehicle but an entry of ‘Tentative Booking’ will be saved in the system.
3. Upon successful ‘Tentative Booking’ the passenger receives a QR code, let us term it as ‘Tentative QR’.
4. Passenger needs to do a confirmation scan of this ‘Tentative QR’ at the designated pickup stop on pickup date before boarding the vehicle.
5. Upon successful confirmation scan the passenger will receive another QR code as confirmation of booking. This QR code can be termed as ‘Confirmed QR’.
6. Note: A passenger with a ‘Tentative QR’ is not allowed to board the vehicle.

## Confirmed Booking by Passenger

1. Once a passenger selects a suitable schedule from the list, he/she can choose ‘Confirmed Booking’ option to block a seat in the vehicle.
2. This booking option actually reserves selected seats in the vehicle and blocks the incurred cost of the entire route from the passenger.
3. The extra cost will be credited back to passenger’s account during off boarding.
4. System updates the booking record at backend and generates a ‘Confirmed QR’ against the booking made for the passenger.
5. The passenger can board the vehicle at the pickup stop on scheduled date and time with the ‘Confirmed QR’. No need to do a scan at pickup stop.

## Vehicle Onboarding Process

1. Once the vehicle arrives the pickup stop passengers with ‘Confirmed QR’ only can board the vehicle.
2. There is a scanner at vehicle entry which validates passenger’s ‘Confirmed QR’ and allows him/her to enter the vehicle only if the QR is valid.
3. Upon a successful onboarding, system updates the backend data.

## Vehicle off boarding Process

1. Once the vehicle arrive a passenger’s destination stop, he/she can exit the vehicle after performing an ‘Off boarding scan’ of the ‘Confirmed QR’ at vehicle’s exit scanner.
2. The off boarding data of the passenger is saved at system’s back end.
3. A passenger is not allowed in the vehicle beyond his/her booked destination stop.
4. List of passengers’ names whose destination is the next upcoming Stop, will be displayed in a screen inside the vehicle.
5. Once the destination Stop is reached, passengers who selected this destination have to off board the vehicle. An alarm will sound till all the excepted passengers off board the vehicle after performing an exit scan.
6. The passengers off boarding before the terminal stop need to do an ‘End trip’ scan of the ‘Confirmed QR’ at destination Stop in order to get a refund of his extra cost blocked during Confirmed booking.
7. The ‘End trip scan’ needs to be done within a specified time period after the end of journey. Beyond the time limit the refundable cost will be forfeited.

## Backend Processes for Resource Optimization

1. System will freeze farther booking for particular Schedule prior to a certain cut-off time period before the journey begins.
2. Once the booking period is over the system calculates the booking counts, both Confirmed and Tentative bookings are calculated and the vehicle capacity requirement as per the demand is finalized.
3. Now the system matches the vehicle capacity requirement against the available vehicles in the system’s vehicle repository.
4. Then system retrieves a suitable match or the closest matching vehicle for that particular Scheduled trip.
5. The most suitable vehicle will be auto-assigned by the system to execute the Scheduled trip.
6. System will be notified by the vehicle at the beginning and at the end of a Scheduled trip.
7. In case of booking of transit routes system will update booking information of multiple Scheduled trips involved at one go.

# Phase II – On Demand Vehicle Schedules

## Backend Processes to achieve Optimum Resource Optimization through Optimum Vehicle Schedules

1. System will analyze previous booking records, specially the departure times specified by the passengers to determine the pick hours of every route.
2. Depending on the results of analysis system will update the schedule timings of the routes or create new Schedules.

# Technology Overview

## Used Technology Stack

Following framework and technologies were used to develop the proof-of-concept:

* **Programming language**
  + Java 7 or higher
* **IDE**
  + Eclipse Juno or higher
  + Android studio 1.5 and above
* **Build Tool**
  + Apache Maven 3.0.4
* **Database**
  + Oracle 10g or higher
* **Messaging middleware**
  + PubNub Data Stream Network (<https://www.pubnub.com/>)
* **API/SDk** 
  + Android PubNub sdk
  + PubNub java sdk
  + Google maps api