CS 8803 – AIAD Project Report.

Instant Car-Pooling on the Android Platform

Vinaya Shenoy

Parikshit Sudumbrekar

Madhura Tipnis

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Introduction:

With increasing convergence between different technologies like the cellular world, internet (IP) world, different applications have become popular and many more are under development. One of the prominent services popular amongst the users is the "Location Based Services" and "presence". The current location-based services out there in the market use the policy of 'broadcasting locations' while enabling any activity between the various users. This may lead to unintended recipients being the beneficiary of certain events. With this in mind, we aim to develop an application/service that would enable selective delivery of events/messages to the intended recipients based on their location. This would help in avoiding thousands of messages being sent to unintended recipients. Thus, not only the location of the intended recipient is taken into consideration; but the context of the location is also taken into consideration. In this project, we define the context of the recipient as its distance from the initiator of the event.

Objectives:

The objectives of the ‘Instant Car Pooling Application’ can be stated as follows:

1. Enable users to create events that would specify the following information-
   - The total vacancy in the car.
   - The time at which the event is going to take place.
   - The Final destination.
2. Development of the logic that would enable-
   - Poll in the location information of all the intended recipients.
   - Take decision based on the context on the location.
   - Send ‘sms’ to all the selected recipients and handle the accepted or rejected messages received from the recipients.
3. Generate a Google Map that shows the initiator the map between his location, all the recipients that agreed to his car pooling event and the final destination.

We aim to demonstrate all these scenarios on the ‘Android Emulator’.

Motivation:

The application under consideration, the ‘Instant Car Pooling’ application, is a novel idea which has never been implemented before. This became our source of motivation for going ahead with this project. All the current car pooling methods are

1. Time consuming.
2. Require a lot of before-hand planning.
3. Require several rounds of communications in the form of series of e-mails or a series of telephonic conversations.

Also, there seems to be an absence of a ‘Car Pooling’ application on the mobile phones. This motivated us to develop our application on the ‘Android Platform’, one of the upcoming and latest mobile platforms launched by Google.

A different source of motivation behind the development of this application is that of the ‘Georgia Tech India Club’. All the members of this club complained about receiving thousands of mails which either requested for a Car Pool or which offered a Car Pool. Thus, uninterested students used to receive such mails. We thought; why not develop a ‘mobile-based instant Car Pooling application’ as our gift to the student community of Georgia Tech? This really gave us the passion to go after the completion of this project. The initiator of the event could select intended recipients from the contact list. The application then checks for the relative context of the location of all the selected recipients and forwards the event to only those recipients that satisfy the context.

Technology Overview:

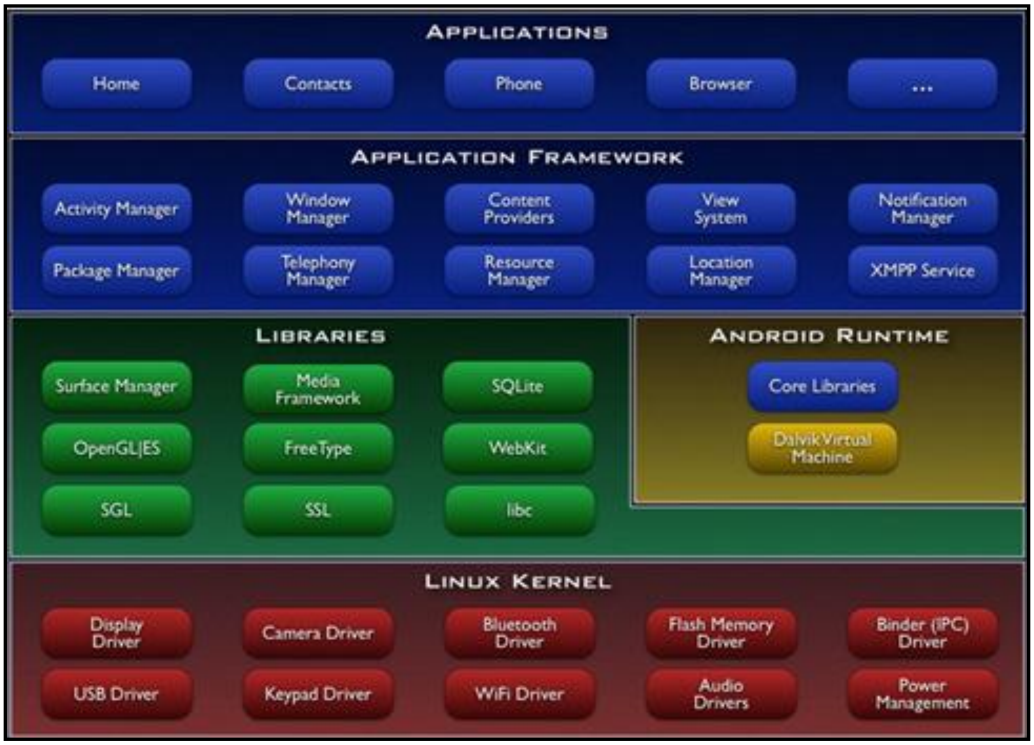


Figure 1: Android Technological Overview

Android is a new operating system for the G1 phone that has been released by Google in 2008. The main difference that sets the Google G1 phone apart from other operating systems is that the Android is based on an open source platform. This implies that anyone can view and even modify the source code. This results in constant evolution of the software. In case a developer senses that there is a certain feature that is currently not included then he or she can incorporate it in the phone and the software would develop. Since it is a fairly new platform, it is not as developed as other mobile operating systems. But considering the open source nature and other features, it can go a long way beyond other mobile operating systems.

The hardware associated with the phone is provided by various companies. As and when the hardware becomes more advanced, the Android OS will be able to support more features functions.

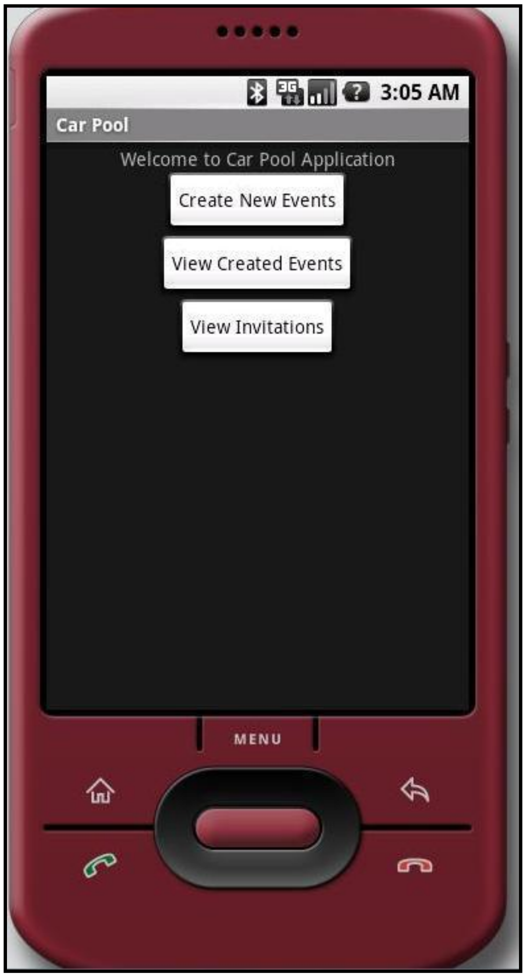
Related Work:

1. Location tracking is the most essential thing and a definite pre requisite for any mobility related application. This can be done in different ways.
2. A social tool has been developed which helps the user connect with people around him. This tool has been developed on the Symbian Operating System. The location of the user is detected in the cell phone by getting information from the cell tower. This application doesn’t need GPS. Each user can keep up with what is happening with people in the friend’s list. Broadcasting of messages is the approach followed in this tool. It also provides other features like connecting people with similar interests. It helps the user explore various places in and around the location detected.
3. There is a mobile social networking service called Loopt which broadcasts the location of the user even when the phone is closed. It also allows sending of messages or sharing of photos between contacts. This Loopt is currently limited to the Sprint network.

Architecture:

The users that have this application installed on their cell phones can use this application as either initiators of car pooling event or as invitees for a car pooling event. When the user launches this application, the user is given three options to choose from. The user can create a new car pool event, view the events that he has created earlier or view invitations for car pool event from other users. When the user chooses to create a new event, he is given a form which has fields such as subject of the car pool, time of the car pool, vacancies in the car, destination address of the car pool, and a button to choose from the list of his contacts. The user enters the values in the fields and then clicks on the contact list. The contact list is displayed from which the user selects the contacts he wants to send the invitation of the car pool to. All the invitees will be sent an SMS with the details of the carpool event. When the invitee accepts an invitation, the carpool application on his phone will respond back to the initiator with the current GPS location of the invitee. When the initiator gets back the positive reply from an invitee, he will retrieve the location co-ordinates from the sms and using reverse geocoding functionality of the Geocoder utility will calculate the street address of the contact. Now when the initiator views the event generated, he can see all those who all have responded to the event. A Google map is created with the locations of all those who have responded to the event. It gives the order of pick up as per the order in which the invitees have responded. We have used the Google Map API here for generation of the route map based on the location as detected by the geo coder. Once the vacancies are full, the other invitees who try to accept the invite later are displayed a message which says that the car is full.

Project Screenshots:

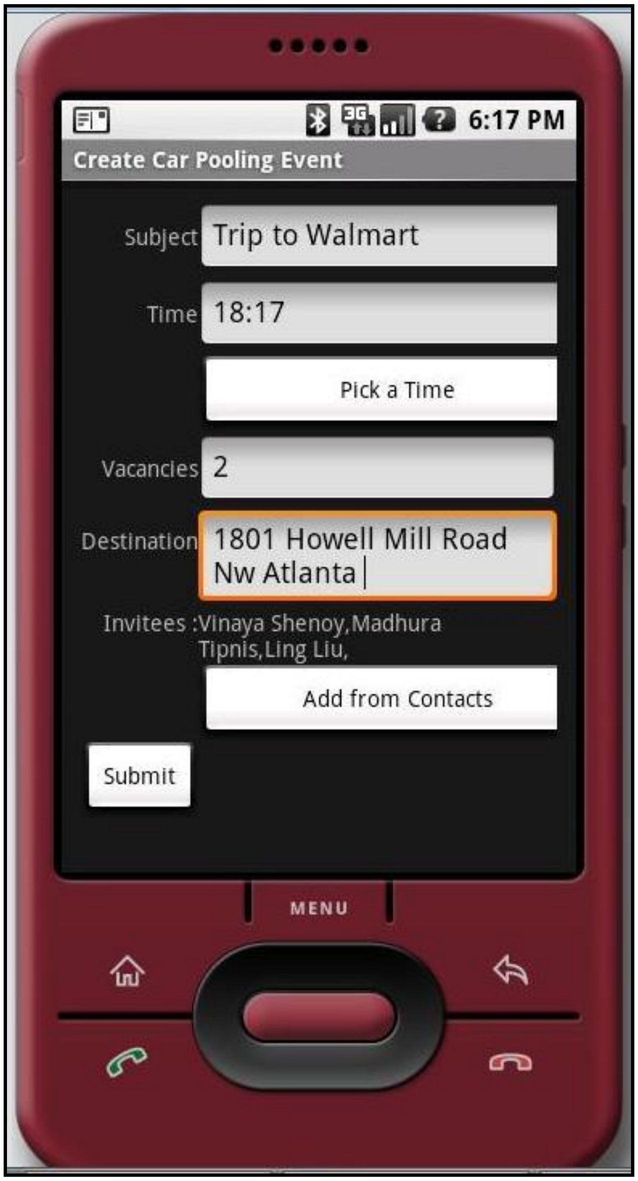


Welcome to Car Pool Application

Figure 2: Carpool Application - Starting Window

This is the first screen that appears on the cell phone display when the user starts the application. There are three options that are provided. They are

- Create an event - This allows the user to start a new car pool.
- View created events - This allows the user to go back and view the car pool events that have been created earlier by him.
- View Invitations - This option lets the user view invitations for other car pooling events from his friends.



Create Car Pooling Event

Subject Trip to Walmart

Time 18:17

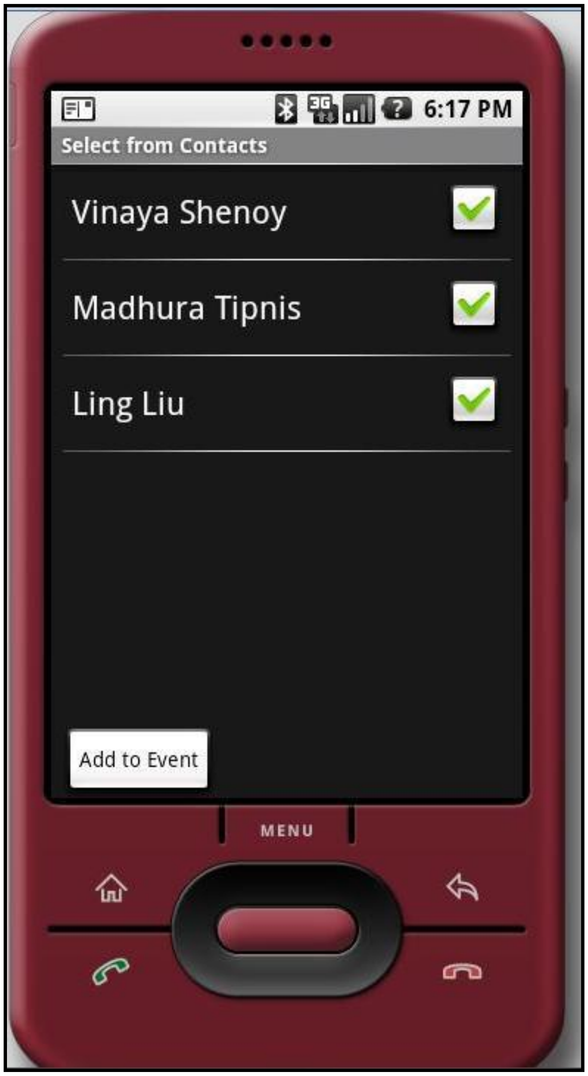
Vacancies 2

Destination 1801 Howell Mill Road Nw Atlanta

Invitees :Vinaya Shenoy,Madhura Tipnis,Ling Liu,

Figure 3: Carpool Application - Create a new Event

This screen appears on the cell phone display when the user chooses to create a new car pooling event. In the subject box, the user can type out a short description of the purpose of the car pool. Since it is an instant car pooling application, the day is set to the current day as recorded in the cell phone. The user is given a list of times to select from when he clicks on the "pick a time" option. Also the user is allowed to specify the number of vacancies in his car to go to a particular destination. The user enters his destination address in the destination box. Then the user can select contacts from his contact list to whom all the event will be sent to.



Select from Contacts

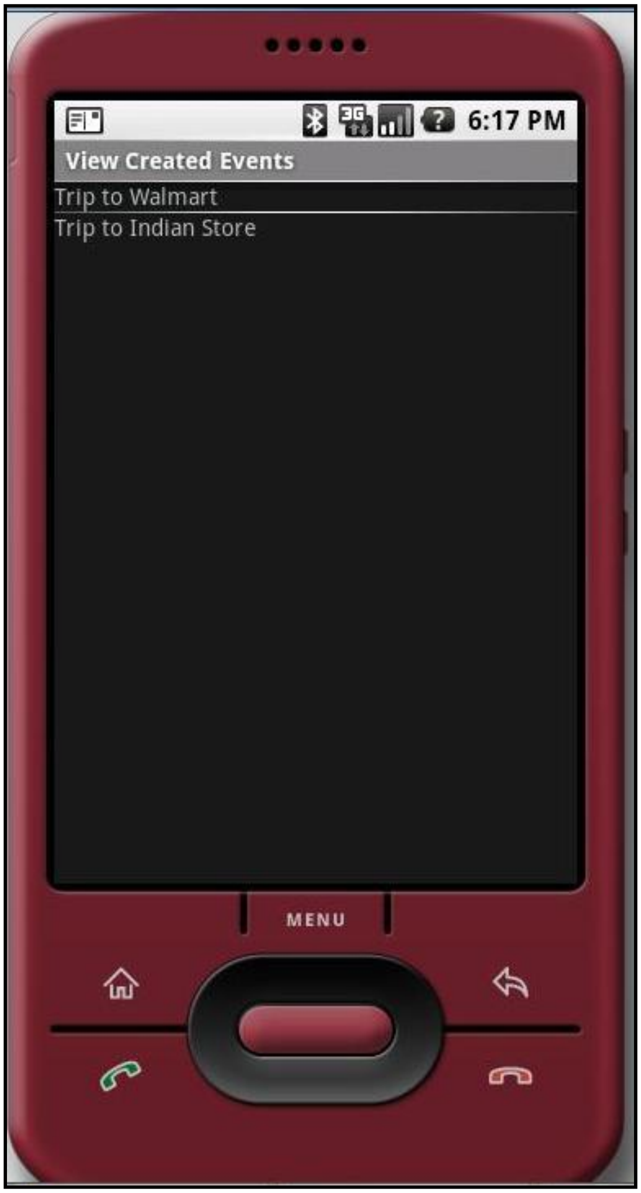
Vinaya Shenoy ☑

Madhura Tipnis ☑

Ling Liu ☑

Figure 4: Carpool Application - Contact List

This screen is the contact list. The user can select the contacts he wishes to send the car pool event invite to, with the help of check boxes provided next to the names of the contacts. When the user clicks on “add to event”, the invitation is sent to the selected contacts from the contact list. This event is sent in the form of a ‘sms’.



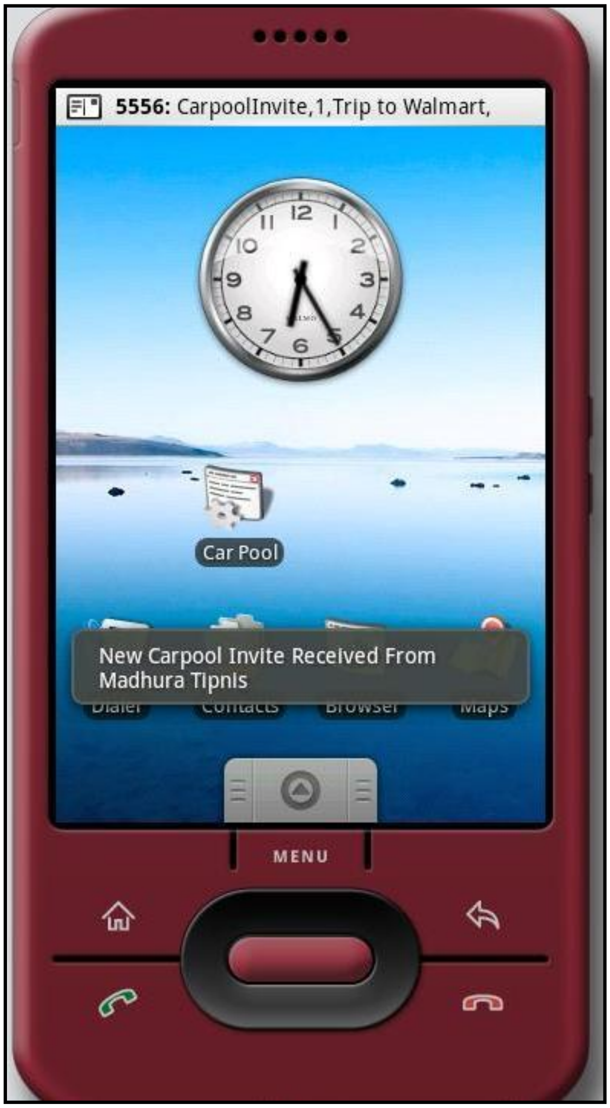
View Created Events

Trip to Walmart

Trip to Indian Store

Figure 5: Carpool Application - Events Created history

This screen is displayed on the cell phone display when the user chooses to view the car pool events created by him. The user can click on the individual events to view the details of each event. This list contains all the past events as well as the pending events.

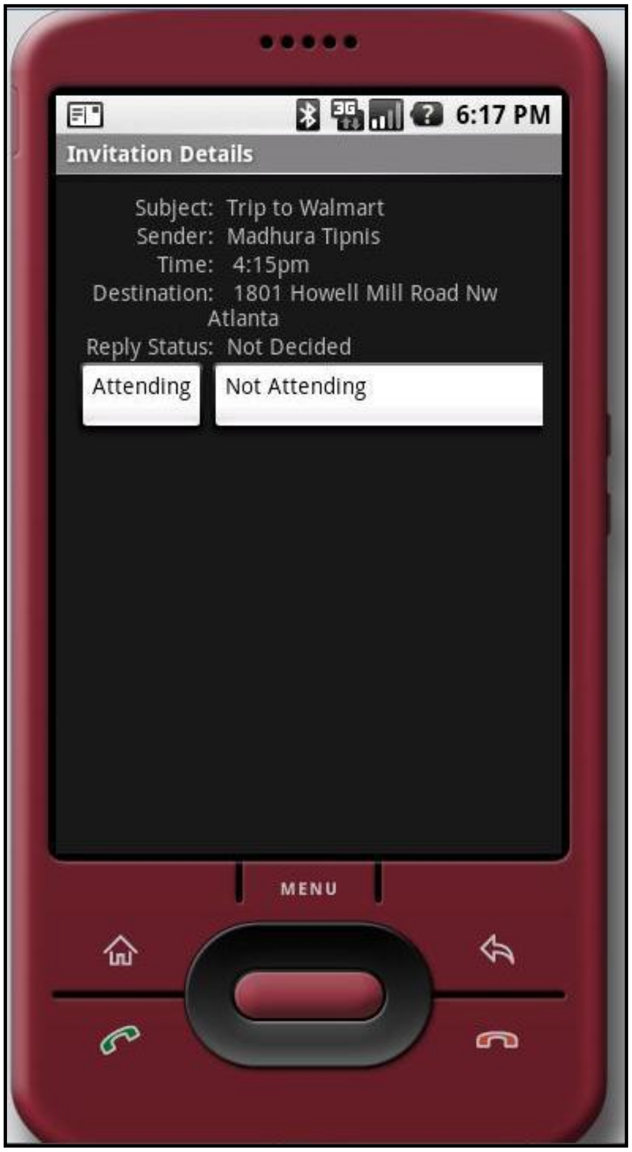


5556: CarpoolInvite,1,Trip to Walmart,

New Carpool Invite Received From Madhura Tipnis

Figure 6: Carpool Application - SMS for carpool invitation received

When the message is sent to the contacts, the message as shown above appears on the display of the contacts to which the message is sent. The name of the car pool event generator also appears in the message pop up.

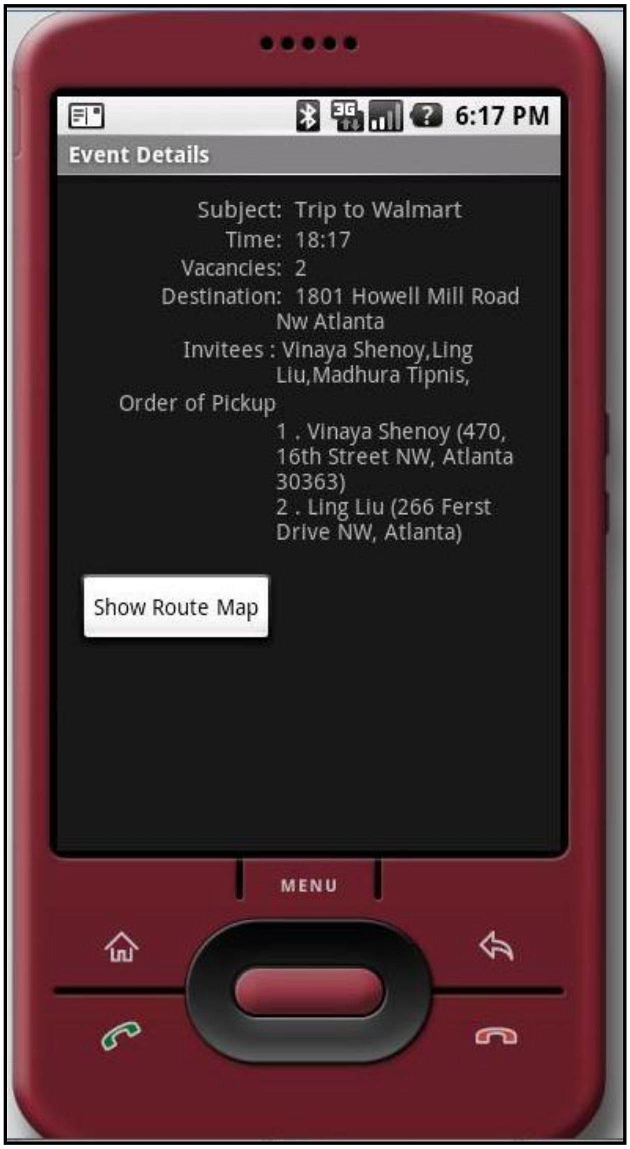


Invitation Details

Subject: Trip to Walmart
Sender: Madhura Tipnis
Time: 4:15pm
Destination: 1801 Howell Mill Road Nw Atlanta
Reply Status: Not Decided

Figure 7: Carpool Application - Car Pool invitation details

When the user clicks on “view invitation” option on the main page, the user is displayed the screen above. The invitation gives details of the car pool which includes the subject of the car pool, the name of the initiator of the event, the time at which the car pool is scheduled to take place, the destination of the car pool and the status of the reply. The user is given to options to respond to the message of either attending or not attending. The user can click on either one depending on his choice. Once the user responds to a message he won’t be given an option to change his decision.



Event Details

Subject: Trip to Walmart
Time: 18:17
Vacancies: 2
Destination: 1801 Howell Mill Road Nw Atlanta
Invitees : Vinaya Shenoy,Ling Liu,Madhura Tipnis,
Order of Pickup
1 . Vinaya Shenoy (470, 16th Street NW, Atlanta 30363)
2 . Ling Liu (266 Ferst Drive NW, Atlanta)

Show Route Map

Figure 8: Carpool Application - Details for the event creator

This page will be displayed to the user who created the events. It will give him a summary of the event with details such as the subject, the time of the event, vacancies in the car, destination of the car pool, invitees to the event, and the order of pickup of the invitees who responded. The order of pickup is decided on first come first serve basis currently. Also the user is given an option to check the map of the route now by clicking on “show route map”.

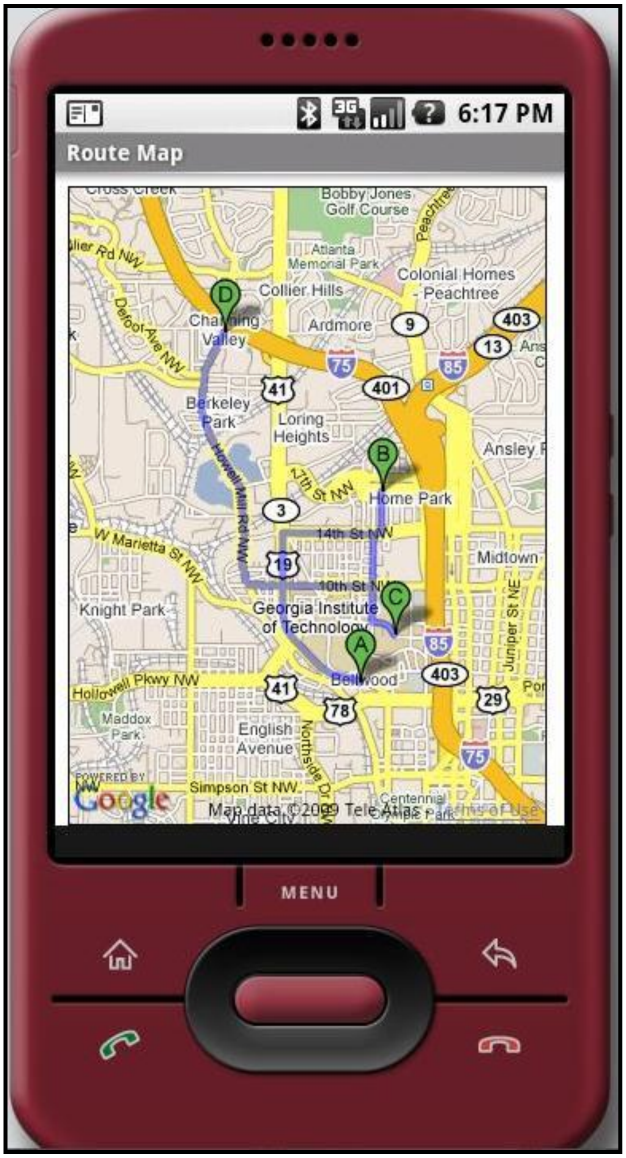


Figure 9: Carpool Application - Map showing pick-up points

The route map is displayed to the creator of the car pool event when he clicks on the "show route map" option. Along the route, the pick-ups in the order of first come first serve are plotted. The interesting thing about this application is that in the beginning when no recipient has accepted the invitation, the initiator of the event can view a map of source (his location) and the final destination. As and when recipients accept the car pooling invitation, the map is updated and it shows all the intermediate pick-up points (the locations of the recipients who have accepted the car pooling invitation). Thus, the initiator of the event now has the entire map, wherein he has all the information about the route to follow.

Evaluation/Testing:

We tested our application by running four instances of the emulator on the same machine. In each emulator we stored three contacts with their numbers being the port numbers on which the other three emulators were running. We then tested the following scenario:

1. When a user creates a new event, the event is created properly ensuring that all the parameters are valid. For eg, the user can’t put a time in the future or put a negative vacancy, give no invitees. Also, we verify the destination address provided by the user to ensure that the address is correct and exists on the map.
2. Once the event is created, we verified that all the invitees got an sms message with the proper details and the invitation is displayed in their invitation list.
3. When an invitee accepts an invitation a reply sms with his GPS coordinates is sent back to the initiator.
4. When the initiator gets a accept response, the event is updated and the initiator can see the pickup location of the invitee on the map.
5. When the carpool for an invite becomes full, all invitees who respond after that get a carpool full response sms.

Future Work:

This project provides a proof of concept of the ‘Car Pooling’ application. It is a stripped down version of our dream ‘Car Pool’ application. There are a lot of improvements that can be incorporated into this project that makes it more complete and feature rich. The future work with regards to this project can be summarized as follows:

1. Currently, the initiator sends car pooling invitation to his friends from his contact list. Their location is forwarded back to him when they accept the invitation. This helps in the creation of the Google Map for the event initiator. In the future, we could have a web service that handles all this location information. This would also solve some privacy related issues like the publishing of recipient location etc.
2. At the moment, the routes are decided on the ‘First Come First Serve’ basis. This means, the route is decided on the order in which the recipients accept the car pooling invitation. But the path obtained from this may not always be the shortest path. Thus we could have algorithms like the ‘Dijkstra’s’ algorithm or Algorithmic concepts like ‘Dynamic Programming’ to calculate the shortest path between source, destination and all the recipients. Thus, optimization on this front can be obtained.
3. The web service can be programmed to handle the context of the location. The context of the location can be determined by its proximity to the location of the event creator. Thus, the web service can determine a radius and determine the recipients which fall within the

radius as the ones who would receive the car pooling event message; while those which lie outside the radius would be ignored. Thus, broadcasting of the event can be avoided.

4. Other features can include displaying only the events that are pending when the user clicks on the ‘View Created Events’ button. All the past and completed events could be stored in a separate ‘history log’.
5. Currently, the final destination needs the complete address of the location. In the future, the final destination address could be populated by extracting information from the ‘subject’ of the event and using Google Maps functionalities. For example, if the user types in ‘Trip to Wal-Mart’ as the subject, then the final destination address could be filled automatically by the closest Wal-Mart store located near him.

Project Experience:

Working on the project was a learning process with a lot of interesting discoveries. The Android platform being comparatively new was a challenge to work on, since very less documentation was available as well as little support was available through the online communities. During the initial phase of the project, all the various APIs that were supported were studied to determine their use and feasibility towards the project. During this initial feasibility study, we realized that certain API support have been removed from the latest version of Android. This included the crucial one of Google Maps, which our project was dependent on. Thus, began another study to determine the use of actual Google Map APIs through the Android code.

Also the basic idea of the project made us realize that how convenient car pooling can be made with this application. The project exposed us to the latest technology in the area of mobile platform development.

In class the various issues in mobile computing were covered. Also there was an extensive explanation of mobile computing in general. This discussion helped us a lot in the project.

We realized that issues such as less power on the device, etc. can be a problem if there are huge amounts of computations to be done. Thus, we made a point to keep the client as this as possible and with this aim in mind, we also aim to develop a web service in the future that would completely take care of all the computation and make the clients really ‘thin’. Location based services were extensively covered in the class. This motivated us to incorporate them into our project. We have extensively used locations in our project, in fact we have the plotted the Google Map by making use of them.

Due to such background developed in class, we thought of experimenting on the Android platform. It gave us a boost to explore the yet not totally discovered areas in Android API usage.

Initially we wanted to test the project by executing instances of the Android emulator on different machines. These emulators would then communicate between each-other through means of messages. But, we were not able to demonstrate in this fashion due to certain technological challenges. In the end, we demonstrated the application by executing different instances of the Android emulator on the same machine. We further aim to test the performance of our application by adding a number of recipients and measuring the time taken for the Google Map to build. This would help us in determining whether the time remains for large number of recipients, finding the bottle-necks if any and moving towards a cut-off for the number of recipients for which the application shows normal execution time.

Conclusion:

Thus, this project successfully demonstrated a mobile based ‘Car Pooling’ application. This application would help in the process of creation of ‘instant car pool’ events. Thus, we successfully reduced the long conversations needed for normal car pool events. In future, more functionality can be added to make this application more robust and more feature rich. With the advent of smart phones, this application, when developed to its fullest, would be able for all to use and make their journeys much more enjoyable and comfortable.

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