

**Penn State World Campus – MGIS Program  
GEOG 596B  
Capstone Project**

**MapMyTrip App for Android Smart Phone  
Final Report**

By Thu Nguyen

Advisor: Dr. Krzysztof Janowicz

Winter 2011 - Summer 2012

## ACKNOWLEDGMENTS

First of all, I would like to express my thanks to Dr. Krzysztof Janowicz, who has been my advisor on this Capstone project for over a year. His broad knowledge in mobile application development, his critical thinking, thoughtful guidance, constructive criticism, and encouragements have excelled my research skill and my critical thinking to the next level. I would like to thank Beth King for actively coordinating and updating my graduation status. Thanks to Doug Miller for his advice and encouragement to keep me on track with my Capstone project. I would like to thank all professors from all courses in this MGIS program. The invaluable knowledge that I learned from these courses has built a solid foundation for my long-term career as a GIS Application Engineer. It enhances my knowledge in supporting large-scale enterprise GIS systems at Virginia Department of Transportation. I would like to thank my organization's management and Learning Partnership for their trust in my ability and their approval of the educational fund to cover most of my tuition for the MGIS program. Last but not least, I would like to thank my family members and my co-workers for their support and encouragement. I would not be able to complete the MGIS program successfully without them.

Thank you all.

## 1. INTRODUCTION AND MOTIVATION

Our classical methods of tracking a journey while on vacation usually consist of a digital camera, camcorder, hard-print, and/or scrapbook, all of which cost so much time and money. For several years, my family has gathered a considerably massive amount of pictures from our vacation trips. These pictures and video clips have piled up on my home computer's hard drive and on the camera's SD cards. They've become unmanageable over the time, because these are just raw images and unlinked to each other. I have always wanted to make scrapbook for the family's memories, but hand-scrapbooking is very time-consuming. It took me forever to finish even one. I could not record and share our adventure instantly at real time and end up miss out a lot of interesting movements. Our traditional way of planning a trip costs too much time searching for places of interests and things-todo. Then after the trip, all these hard-copies become trash and I still need to spend tremendous amount of time organize pictures and notes to create a scrapbook. On top of that, there is the cost of printer cartridge to print the trip's information, pile them up and carry on the trip. From the conversations with several friends, co-workers, folks in the community, as well as, online research, I have found that majority of travelers share the same problem with me. Usually after each vacation, most of us have to get back to our daily busy schedules, and we never have time to organize our collection of memorable trips into a scrapbook to share with friends and family. This problem inspired me to search for the current innovative technology, which can help myself and other travelers like me around the world be able to retain our valuable memories journal in the least amount of time after each trip. This also adds convenience to trip planning and traveling by utilizing current innovative technology.

The small, portable smart phone technology has created a new revolution in application development [2]. Smartphone is the highly active, always-attached personal item. Its unique GPS, camera, social network and computing capabilities introduce a convenient and cost-effective method to collect simple positions' coordinate data and create maps that can become the basis for photo album, video

clips for a trip. The multi-purpose functionality on smart phone inspire me to develop a real-time trip mapping of digital photo album.

The purpose of MapMyTrip app is to save a tremendous amount of time for travelers by providing a fun and convenient tool that the travelers can use to create their trip journal while on-the-go. This app will utilize the all-in-one capability of smart phone technology to instantly track the coordinates of destinations, create the map of these coordinates with link to photos / video clips taken in real-time, and share on Social Network media. while on-the-go.

## **2. FUNCTIONALITY**

This app utilizes the smartphone's GPS technology to capture real-time coordinates for creating map of destinations, capturing and connecting to photo, video clip and notes while on the go. The app can be displayed well in both portrait and landscape views as well as on multiple resolutions and densities. 3G/4G data plan or Wi-Fi high speed internet connection is required when tracking coordinates or synchronizing to Cloud. This app consists of front-end and back-end functionality. Front-end functionality includes capturing and displaying information via multiple User Interface screens. The back-end functionality includes the ability to save to local database and synchronize to the Cloud's storage.

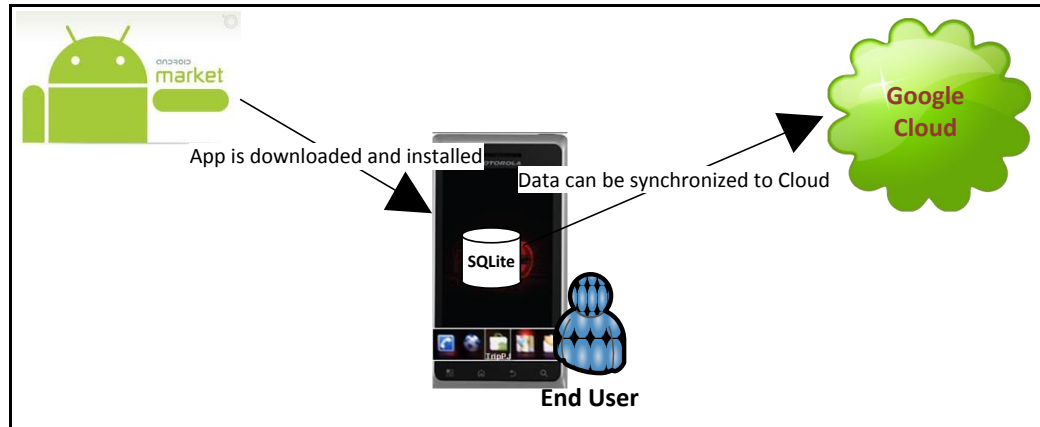
The front-end application will provide the ability to create a new trip with basic information such as trip name, departure date, and auto-captured geo-location using device's GPS. Once the trip is created and is saved to database, the user can zoom to the map marked current position, as recognized by the device's GPS, and start capturing picture, video clip, or notes. Behind the scene, the device also has a background service to verify status of internet connection, in order for GPS to function correctly. In case the device may lose internet connection, the application will display a message and the app will be disabled. The second front-end functionality is to list all trips available in the local database. The user can tap on a

particular trip to open its photo album map. The third functionality is the ability to display the photo album map, which is the map of all destinations represented as the markers connecting to photo, video, notes of the trip. From this map, the user has the option to synchronize data to Cloud. Then email the URL of the map on Cloud to their friends, or post the URL to Facebook.

The back-end functionality includes the ability to save to local database and synchronize to Cloud for secured backup, high performance, and scalability. Before data is submitted to local database, there will be a background verification, to make sure that database and tables existing locally on the phone; otherwise, the new database and tables will be created for the first time usage. User will have option to synch data to Cloud, given that the user should have a gmail login account, so they can save data to their private session. There is a background check to ensure that internet connection is on, in order to successfully synch to the Cloud.

### 3. **METHODOLOGY**

The application is developed for Android smart phone, since Android platform is open source and open platform. The Android OS for mobile offers developers the opportunity to create innovative experiences via features such as multitasking, mobile mash-up, and access to hardware and system-level functions [1]. Also, according to Garner Report on November 2011, the Android Market Share keeps ramping up rapidly [7]. This will promise the higher probability of usage of this app among Android OS phone users. The application User Interface is developed to be compatible across all mobile platforms with the focus on user-friendly Interface design for the smart phone's screen real state, auto-adjusting to the phone's screen size, unique touch functionality, and keyboard limitation. The approach for Database design is to keep it simple so that the query response time can be optimized. All application and database field names are self-descriptive. The application will be tested on Android touch-screen smart phones. Figure 1 below shows the Architecture diagram of the app.



**Figure 1:** MapMyTrip Architecture Diagram.

## 4. IMPLEMENTATION

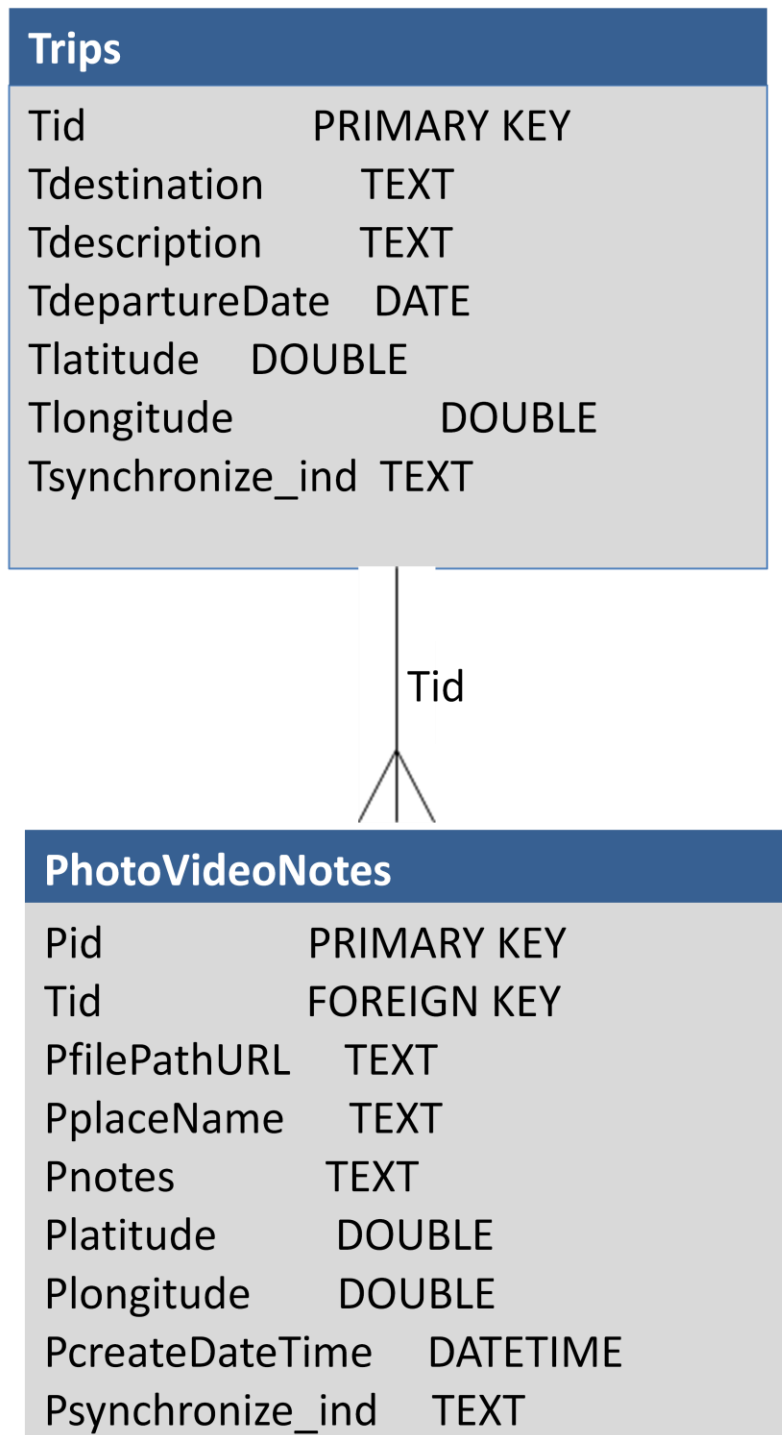
### 4.1. Programming Languages and Toolkits Installed

The application is programmed using HTML5, CSS3, JavaScript, JQuery, JQuery Mobile, PhoneGap API, Google Map API. Data can be stored locally in the SQLite database or synchronized to Google AppEngine Cloud Storage via a Google email account. The following softwares are installed for the development and test environments:

- Android SDK Toolkit
- Android Development Tool (ADT)
- JDK 6
- Eclipse IDE 3.4 or greater
- Eclipse JDT Plugin
- AppEngine Java SDK

### 4.2. Database Implementation

The database is designed to be light-weight and consists of two tables: Trips and PhotoVideoNotes as shown in Figure 2 below. The parent table, Trips, stores trip related information such as trip name, description, departure date, latitude, longitude, as well as a synchronization indicator to indicate whether a particular row has been synchronized to the cloud yet. The child table, PhotoVideoNotes, stores



**Figure 2:** MapMyTrip Database Design.

the metadata of images, video clips, and notes, such as place name, geolocation, created date and time, and the physical path or URL linked to image / video, all of which are stored in a file-based format. The column Pid is the primary key of the table, and Tid is the foreign key which is used in the joint query between the Trips table and the PhotoVideoNotes table for data retrieval. All column names are self-descriptive and the first uppercase letter of column name is the table name's initials, which will improve the readability in the programming codes.

### **4.3. User Interface Implementation**

The User Interface is designed and programmed to utilize JQuery Mobile API to enhance the aesthetics and feel of a smart phone app as well as minimize the hassle of typing. For example, the Date input field is programmed to use a scrolling Date picker API. The application consists of four main screens:

- Trip Listing Screen
- Create New Trip Screen
- Capture at My Position Screen
- Trip Map Screen

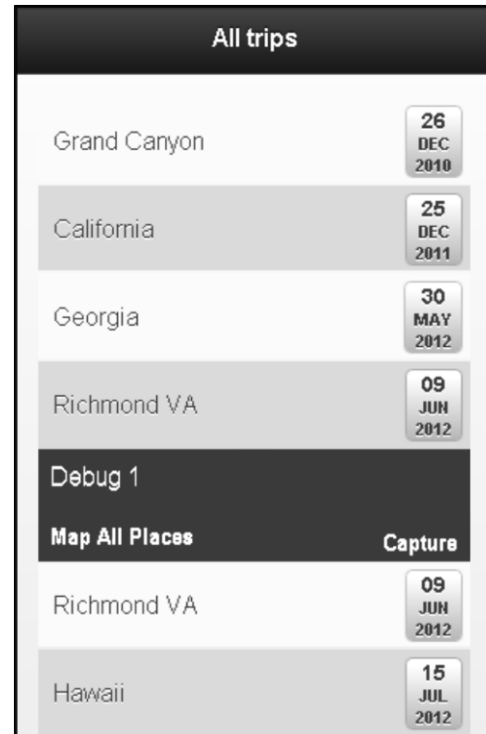
#### **4.3.1. Trip Listing Screen**

This screen list all the trip names with Departure Date displayed to the right as shown in Figure 3 below. The New Trip button, located in the footer section, will create a new trip record. The Synchronize button will synchronize data to the Cloud. Upon tabbing on a particular trip, this trip will expand down to display Description, the Capture hot link, and Trip Map hot link as shown in Figure 4 above. The Capture hot link will open a map marking the current position for capturing picture, video clip, notes as shown in Figure 5. The Map All Places hyper link will open the Trip Map screen, which displays all markers of destinations.





**Figure 3:** List of all Trips. The New Trip button allows one to create a new trip record. The Synchronize button will synchronize data to Cloud.



**Figure 4:** Tab on a trip to expand the Description, Capture hot link and Map of All Places hot link. The Capture hot link will open the map of current position as shown in Figure 6.

#### 4.3.2. Create New Trip Screen

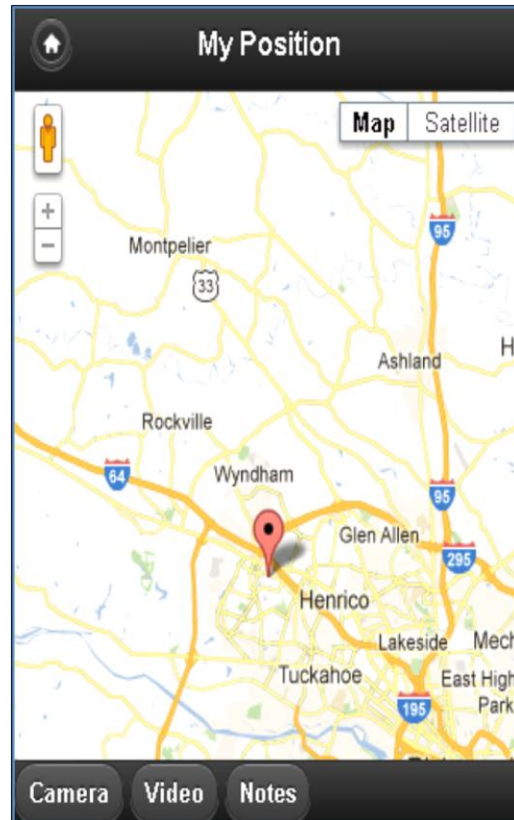
The New Trip screen in Figure 5 allows one to create a new trip record. All column names are self-descriptive. The geolocation fields are auto-captured by the device and are editable, in case the trip is created ahead of time. The Date field incorporates JQuery Mobile Mobiscroll Date Picker API for touch screen device (Figure 6). If the device is a non-touch screen, the date picker will fault back to text input.

**Figure 5:** Create a New Trip screen.

**Figure 6:** Mobiscroll Date Picker

### 5.3.3 Capture at My Position Screen

Figure 7 shows the map with the marker at current geolocation. This map uses Google Map API and can be switched between Map and Satellite. The latitude and longitude are auto-captured by the device and stored in parameters to save to the database later on. Three buttons in the footer section of the screen allows one to take pictures and video clips and record notes and associated metadata, such as place name.



**Figure 7:** Map of current position for taking picture, video clip, notes. Geolocation is automatically captured by the device at this step.

Figure 8 below shows an example of how tapping on Camera button will enable the camera mode for picture taking. (The Videos and Notes buttons will operate in the similar manner). Once the picture is taken, the user has the option to Save or Cancel.

The Save button (the left image) will handle three tasks

- Save the image to the phone's default camera storage path.
- Capture the image's path into a parameter for save to the table PhotoVideoNotes in field PfilePathURL later on.
- Open the metadata screen for entering information to be associated with the image.

The Save button on Write Notes screen (the right image) will save the new record of image's path and its metadata, plus the associated geolocation, timestamp and trip id to the table PhotoVideoNotes.



**Figure 8:** Once you tap on the image's Save button, the image is to be save to the phone's default camera storage folder and the "Write Notes" screen will pop-up for entering associated metadata. The Save button on Write Notes will save the new record of image's file path and metadata to the PhotoVideoNotes table.

#### 4.4. Trip Map Screen

The Trip Map screen is shown in Figure 9 below. This screen displays the joint query results from both tables Trips and PhotoVideoNotes, via trip id. Upon tapping on each marker, an associated picture, notes, or playing video will pop-up. From this map, the user has the option to synchronize to data to Cloud and email the url of the map on cloud or post the url to Facebook.



**Figure 9:** Map of all destinations. This photo is downloaded from Photo: [http://pwi.googlecode.com/svn/tags/REL\\_2\\_0\\_0/demo2.html](http://pwi.googlecode.com/svn/tags/REL_2_0_0/demo2.html) and resize for used as example.

## 5. CONCLUSION

When looking at other similar mobile applications in the market, most of the software offers one or some functions, but don't offer all functionality that I am looking for. For example, Hotels Near Me only searches on nearby hotels, Triplt keeps track of itineraries and update your trip status. Trip Journal tracks the itinerary in real-time, let you add markers, short notes, and upload photo to social network media, but it forgets to address the ability to backup your valuable data while on-the-go. Considering the size of the pictures and video clips, the phone can run short on storage space quickly.

The MapMyTrip app is to be developed and released to the Android market in two phases. Phase 1 includes all functions described in the Functionality section above, including the important function of synchronizing data to Cloud for secured backup and more storage. The future phase 2 will include the trip planner, a search option for near-by places of interests, and the ability to create journals of historical data. MapMyTrip will save the travelers time and money when tracking and creating maps of memorable adventures. This will be a fun and convenient way to retain their valuable memories in the least amount of time.

## 7. REFERENCES

- [1] Android Developers. <http://developer.android.com/guide/basics/what-is-android.html>
- [2] Murat Ali Bayir. Enabling Location Aware Smartphone Application via Mobility Profiling; University at Buffalo;  
<http://www.cse.buffalo.edu/~mbayir/papers/PhDThesis.pdf>
- [3] Damon Oehlman and Sébastien Blanc. Pro Android Web Apps: Develop for Android using HTML5, CSS3 & JavaScript (Paperback - Feb 22, 2011)
- [4] Brad Broulik. Pro jQuery Mobile (Paperback - Dec 7, 2011)
- [5] Andrew Lunny. PhoneGap Beginner's Guide (Paperback - Sep 23, 2011)
- [6] Yihong Yuan & Martin Raubal. On Correlation between Mobile Phone Usage and Travel Behavior – A Case Study; [http://www.giscience2010.org/pdfs/paper\\_139.pdf](http://www.giscience2010.org/pdfs/paper_139.pdf)
- [7] George Panagiotopoulos. Garner Report: Android Market Share Keeps Ramping Up. <http://technorati.com/technology/android/article/gartner-report-android-market-share-keeps/>