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| Northern Arizona University |
| Requirements |
| CS 476 – Localization |

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| Blayne Kennedy, Kimi Oyama, Daren Rodhouse, Chihiro Sasaki |

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# Introduction

The localization features of MoneyClip Mobile (MCM) will provide customers with targeted advertisements and coupons that will be an additional feature to an existing web-based payments infrastructure. With request from Mr. Joshua Cross of Hermes Commerce, Inc., this project aims to provide the localization features and customer data analysis to aid in the further development of the existing MCM system. The Problem Statement, Functional and Non-Functional Requirements, Environmental Requirements, Potential Risks, and the Project Plan can be found in this document.

In the Problem Statement section, a detailed background on MoneyClip Mobile and its need for localization features is provided. The localization features will provide Mr. Cross with the necessary targeted advertisements and coupons. This additional functionality will make MCM different from its competitors.

In the Functional Requirements section, the essential requirements are listed for the iOS/Android applications and the webservice. Each of the requirements for different pieces of the system is further divided down into users and merchants, the two main stakeholders of the system.

Next, the Environments Requirements section outlines some of the constraints and environmental requirements to be considered in the system design. This includes limitations from the existing infrastructure, considerations about the content filtering system for advertisement creators, Google API limitations for using Google Maps, language considerations, and device operating system platform considerations.

The Non-Functional Requirements section introduces the major non-functional requirement considerations to the system. This includes accessibility, expandability, maintainability, and usability concerns that are important to the usefulness and further development of the MCM system. Each of the non-functional requirements is accompanied by a description, the condition in which they are valid, and a threshold of verifiability.

In the Potential Risks Section, the important risks pertaining to the localization aspect of MCM are covered. They include any potential risks that affect any of the stakeholders involved in a relevant manner, along with their corresponding impact and possible mitigations. The risks include security of localization integration, privacy protection interference to geolocation, the potential of merchants pushing too many advertisements and coupons to the point of annoyance, loss of cell service, inaccurate geolocation, failure of the MCM server, and the potential of user mobile devices recognizing more than one merchant in its proximity.

Finally, the Project Plan section outlines the project plans for this project, which includes a Gantt chart. At the end of this project, Mr. Cross will be presented with the localizations features implemented on the database, the web service, and on iOS/Android mobile applications, along with documentation regarding the data analysis of customer activity to improve targeted advertisements.

# Problem and Solution Statement

MoneyClip Mobile (MCM) is a web-based payments infrastructure providing fee-free transactions to customers and merchants through the use of mobile smartphones.  Mr. Joshua Cross of Hermes Commerce, Inc. is planning to make this mobile payment system more robust by providing targeted advertisements, coupons, and managing customer’s royalty programs.

This capstone project will develop the localization features for the MCM advertisement, coupons, and loyalty network.  The software will be developed for the existing MCM network and database to ease the transition of integrating this feature.  The team will be developing the same copy of the existing network and database on a local server to develop in and test the added feature.  The prototype of the localization features implemented on the database, web service, and iOS/Android applications will be presented to Mr. Cross at the end of this project.

Part 1: Problem Statement

This project is sponsored by Mr. Joshua Cross, CTO of Hermes Commerce Inc. in Flagstaff, Arizona. Hermes Commerce Inc. produces an application called MoneyClip Mobile (MCM) that allows users to transfer funds to and from other users, merchants or customers, without involving physical money or credit and debit cards. Mr. Cross is responsible for the development of MCM as well as for the business aspects of the product. MCM addresses the need of users to exchange funds regardless of distance.

The general problem facing MCM is competition with popular technologies such as Google Wallet and Square. Mr. Cross’ goal for overcoming this challenge is to combine all the functionalities of the competition into one application and find a niche for that application. In order to accomplish this, MCM application needs to be able to transfer funds between customers and merchants. In addition, the application needs to determine when a customer is making a purchase from a merchant in order for the merchant to push the charge to the customer’s MCM account. Also, MCM will give customers control over the frequency and types of advertisements or coupons they receive, and it will give merchants options for when to push advertisements or coupons depending on customer trends.

This project involves implementing a localization function that notifies merchants when MCM customers are in their vicinity, allowing the merchant to push a payment request to the customer’s MCM account if the customer makes a purchase. This functionality allows true moneyless transactions. The third and final chunk of functionality that we will be developing is the data analysis algorithms that will be used for effective direct advertising. We will be implementing trend finding algorithms that will be used for direct advertising. These algorithms will use past user transactions to find patterns and compute probabilities that will be available to merchants to aid their advertising decisions.

Part 2: Problem Solution

System Improvements

One piece of functionality we are adding is the ability to allow customers to select the amounts and sources of advertisements that are pushed to their account via the iPhone application, Android application, or website. They should be able to customize their settings to choose differing levels of participation from the advertisements. Merchant settings should also be available for change on the website or either mobile application.

The next function being added is the analysis of customer traffic to find patterns that merchants can use for direct advertising. The merchants will have the option to push an advertisement depending on the chance that a customer will respond. For instance, if a customer just ate at a restaurant downtown, there is 40% chance that they will get drinks when they are done. This information will be available to merchants so a bar can set their account to push an advertisement whenever a customer makes a purchase at a restaurant downtown. In this situation, there is a very low chance that the customer will eat again, so another restaurant will probably not push an advertisement to this customer. Related to this, advertisements must be pushed to customers with minimal time lag to make sure that they have not left the area before they receive the advertisement.

Of the data stored by MCM, we will use the customer transaction history to determine purchasing patterns. The algorithms we implement will produce statistics for merchants. The pattern recognition algorithms will analyze past customer transactions in order to predict future purchases. Merchants will be able to look at the probability of a certain customer making a purchase from them and determine whether or not they want to push an advertisement to that customer. The localization functionality requires additional user settings, such as types of advertisements or coupons they are accepting on their account.

System Impact

Our additions will make MCM a more comprehensive and robust commerce application. Therefore, our sponsor will have a better product to pitch, potentially making his job easier. The development team of MCM will be able to utilize localization activity code from the Android and iOS applications and use them to further their development of the applications.

By using MCM with localization features, there will be fewer steps in the money exchange, and thus transactions will be faster and lines will move faster. Theft may also decrease because there would be less cash to steal, making it not worth the effort and consequences.

With the added localization functionality, MCM becomes a comprehensive commerce application. Many other applications focus on certain aspects of commerce but none so far combine them. MCM will have the potential of removing the need for physical money entirely because you will be able to move money between customers, and between customers and merchants regardless of distance. Merchants will also be able to advertise more effectively, and customers will be able to tailor their account for advertisements and coupons that they are interested in.

# Functional Requirements

1. **iOS/Android Application**
   1. Users
      1. Create Account Page
         1. Users must be able to enter their name.
         2. Users must be able to enter their birthday.
         3. Users must be able to enter their gender.
         4. Users must be able to enter their groups.
      2. Login Page
         1. Users must be able to login using their username and password.
         2. Users must be able to navigate to ‘Create Account Page” (see 1.1.1) from this page.
         3. Must update user location upon login
      3. Home Page
         1. Users must be able to navigate to “Settings Page” (see 1.1.4) from here.
         2. Users must be able to navigate to “Merchant Map” page (see 1.1.5) from this page.
         3. Users must be able to navigate to “Search Page” (see 1.1.6) from this page.
         4. Users must be able to log out.
         5. Must be accessible from every page.
      4. Settings Page
         1. Users must be able to edit their localization options from here.
            1. Users must be able to turn off their localization option.
            2. Users must be able to turn on their localization option.
         2. Users must be able to opt in to various levels of participation for advertisements and coupons.
            1. Users must be able to opt out of all forms of advertisements.
            2. Users must be able to choose only to receive advertisements from certain merchants.
            3. Users must be able to choose to receive coupons from all merchants.
         3. Must have a link to the home page.
      5. Merchant Map
         1. Users must be able to see merchants on a map within a 5-mile radius.
         2. Clicking on the merchant coupon or advertisement must direct the user to the merchant map.
            1. The merchant map must show the direction from the current user location to the merchant.
            2. The merchant map must distinguish the selected merchant with a different pointer.
            3. The merchant map must show the current user location on the map.
         3. Must have a link to the home page.
      6. Search Page
         1. Users must be able to search for merchants.
            1. Users must be able to search by merchant name.
            2. Users must be able to search by merchant category.
            3. Users must be able to search by nearby location.
         2. Users must be able to search for coupons
            1. Users must be able to search by merchant name.
            2. Users must be able to search by coupon category.
            3. Users must be able to search by nearby location.
         3. Users must be able to search for advertisements
            1. Users must be able to search by merchant name.
            2. Users must be able to search by advertising category.
            3. Users must be able to search by nearby location.
         4. Must have a link to the home page.
   2. Merchants
      1. Create Account Page
         1. Users must be able to enter their business name.
         2. Users must be able to enter their business address.
         3. Users must be able to enter their business category.
      2. Login Page
         1. Merchants must be able to login using their username and password
         2. Merchants must be able to navigate to ‘Create Account Page”(see 1.2.1) from here
      3. Home Page
         1. Merchants must be able to navigate to “Account Settings” (see 1.2.4) from here
         2. Merchants must be able to navigate to “Advertisement Settings” (see 1.2.5) from here
         3. Merchants must be able to navigate to “Advertisement Creator ” (see 1.2.6) from here
         4. Merchants must be able to logout from here

Must be accessible from every page.

* + 1. Account Settings
       1. change product category
       2. add an address
       3. modify addresses
       4. change name
    2. Advertisement Settings
       1. Merchants must be able to see a list of their pre-approved advertisements and coupons.
       2. Merchants must be able to modify their existing coupons and advertisements and coupons.
          1. Modified advertisements and coupons must be approved again by MCM.
       3. Merchants must be able to edit their target audience for each advertisement.
       4. Merchants must be able to opt in to different levels of participation for advertisements and coupons.
          1. Merchants must be able to opt out of pushing any form of advertisement.
          2. Merchants must be able to choose different types of customers determined by various factors (such as frequent customers, new customers) for different advertisements.
          3. Merchants must be able to push advertisements and coupons to all targeted customers.
       5. Must have a link to the home page.
    3. Advertisement Creator
       1. Merchants must be able to create an advertisement.
       2. Merchants must be able to submit an advertisement to MCM for content approval.
       3. Merchants must be able to specify target audience for the advertisement.
          1. Merchants must be able to specify legal limitations of the advertisement

Alcohol advertisements require the age of 21 or over.

* + - 1. Must have a link to the home page.

1. **Website** 
   1. Users
      1. Create account
         1. In addition to the existing create account page, users must be able to perform the following actions.
            1. Users must be able to enter their birthday, including the year.
            2. Users must be able to enter whether or not they are a student.
            3. Users must be able to enter their gender.
      2. Login Page
         1. Users must be able to log in using their username and password.
      3. Home Page
         1. Users must be able to access the settings page.
         2. Users must be able to access the merchant map page.
         3. Users must be able to access the search page.
         4. Users must be able to access the recent activities page.
         5. Users must be able to manually input their current location, for the case when location privacy settings are enabled.
      4. Settings Page
         1. Users must be able to perform the same tasks that are available in the applications.
         2. Users must be able to edit their localization options from the website.
            1. Users must be able to turn off their localization option.
            2. Users must be able to turn on their localization option.
            3. Users must be able to opt in to various levels of participation for advertisements and coupons.
            4. Users must be able to opt out of all forms of advertisements.
            5. Users must be able to choose only to receive advertisements from certain merchants.
            6. Users must be able to choose to receive advertisements from all merchants.
         3. Merchant List and Map Page
            1. Users must be able to see a list of merchants and their coupons within a 5-mile radius.

Users must be able to see the relative merchant location distance.

* + - * 1. Clicking on the merchant coupon or advertisement must direct the user to the merchant location on the map.

The merchant map must show the directions from the current user location to the merchant’s location.

The merchant map must distinguish the selected merchant with a different pointer.

The merchant map must show the current user location on the map.

* + - * 1. Users must be able to search for merchants.

Users must be able to search by merchant name.

Users must be able to search by merchant category.

Users must be able to search by nearby location.

* + 1. Ad/Coupon Search Page
       1. Users must be able to search for advertisements/coupons by merchant name.
       2. Users must be able to search for advertisements/coupons by categories.
       3. Users must be able to search for advertisement/coupons by location.
    2. Recent Activities Page
       1. Users must be able to see a list of their recent localization activities.
       2. Users must be able to delete a list of their localization activities.
       3. Users must be able to sort through their list of localization activities.
  1. Merchants
     1. Create Account
        1. In addition to the existing create account page, merchants must be able to perform the following actions.
           1. Merchants must be able to input their product type.
           2. Merchants must be able to input their location by address.
        2. Merchant accounts must be approved by the MCM administrator for legitimate information.
     2. Login Page
        1. Merchants must be able to log in using their username and password.
        2. There must be a link to the “Create Account Page” (see 3.2.1).
     3. Home Page
        1. Merchants must be able to access the settings page.
        2. Merchants must be able to access the merchant map page.
        3. Merchants must be able to access the search page.
        4. Merchants must be able to access the recent activities page.
     4. Account Settings
        1. Merchants must be able to edit their product type.
        2. Merchants must be able to edit their location by address.
     5. Advertisement settings
        1. Merchants must be able to see a list of their pre-approved advertisements and coupons.
        2. Merchants must be able to modify their existing coupons and advertisements and coupons.
           1. Modified advertisements and coupons must be approved again by MCM.
        3. Merchants must be able to edit their target audience for each advertisement.
        4. Merchants must be able to opt in to different levels of participation for advertisements and coupons.
           1. Merchants must be able to opt out of pushing any form of advertisement.
           2. Merchants must be able to choose different types of customers determined by various factors (such as frequent customers, new customers) for different advertisements.
           3. Merchants must be able to push advertisements and coupons to all targeted customers.
     6. Advertisement Creator
        1. Merchants must be able to create an advertisement.
        2. Merchants must be able to submit an advertisement to MCM for content approval.
        3. Merchants must be able to specify target audience for the advertisement.
           1. Merchants must be able to specify legal limitations of the advertisement

Alcohol advertisements require the age of 21 or over.

* + 1. Advertisements (list of advertisements on account?)
       1. Merchants must be able to create new coupons and advertisements.
       2. Merchants must be able to modify existing coupons and advertisements.
       3. Merchants must be able to opt in to different levels of participation for advertisements.
  1. Administrator
     1. Administrator must be able to approve new advertisements/coupons.
     2. Administrator must be able to take off inappropriate advertisements/coupons.
     3. Administrator must be able to see a list of merchant activity.
        1. Admin must be able to see a list of approved advertisements/coupons.
     4. Administrator must be able to see a list of user activity.
     5. Administrator must be able to manage when merchant’s advertisements get pushed to a customer.

# Environmental Requirements

Existing Infrastructure

The team must use the existing MCM infrastructure, so the transition of adding the localization feature will be seamless.  Thus, a Mac computer will be required for iOS/iPhone programming.  iOS deployment on a physical device requires a subscription to the Apple Developer Network, which costs $99 annually.

Content Filter

Initially, merchants will be able to create any advertisements that they choose to. However, in the case that advertisement content is found to be inappropriate, the system will need to allow for a content filter to be easily added.

Google API Limitations

Geocoding is the process of converting addresses into geographic coordinates which you can use in Google Maps to place markers or position the map. Geocoding is a time and resource intensive task. Google recommends designing a cache for all systems that use geocoding to store addresses that have been pre-geocoded whenever possible. This is particularly crucial to implement because Google API has a query limit of 2,500 geolocation requests per day. If the limit is exceeded too often, Google will block access to the Geocoding API. Furthermore, our implementation of the system is limited to the inputs and outputs used by the Google API [1].

Java and XML

Android applications must be developed using the Java programming language along with XML. Our client has asked us to create an android application that showcases our localization capabilities, therefore, Java and XML must be used in the implementation of our project.

Android devices

There are several differing Android devices currently on the market. The most crucial difference to understand while implementing our project is the difference in screen size and screen density between the devices. Due to this, we must implement our Android application so that our interface is displayed relative to each device screen rather than one particular screen size.

Android OS

There are several different Operating Systems that are being used on Android devices. Our application will have to be implemented so that it can be accessed on as many different OS versions as possible. The application should also be developed using an API high enough to fully and correctly implement the system, but the API should be as low as possible so that more devices can be compatible with the application.

xCode

iPhone applications must be developed using xCode. Our client has asked us to create an iPhone application that showcases our localization capabilities. Therefore, xCode must be used in the implementation of our project.

# Non-Functional Requirements

Below in Table 1 is the list of non-functional requirements for the MCM localization project.

*Table 1: Table of non-functional requirements for the MCM localization project*

| **Non-Functional Requirements** | | | |
| --- | --- | --- | --- |
| **Requirements** | **Description** | **Condition** | **Threshold of Verifiability** |
| Accessibility | The ability to of the users to access the MCM system at all times | Wi-Fi or cell data connection and GPS is needed at the user’s location | Users are able to access their accounts from their devices or web site at any time of the day |
| Efficiency | The amount of hardware required to perform the desired function is minimal | Wi-Fi or cell data connection and GPS is equipped on most cell phones as well as other app devices | The localization feature only requires users to have access to data and GPS |
| Expandability | The ease in which the system evolves to include additional locations | Locations have to have merchants using MCM | All functions specified are able to be implemented on 100 locations |
| The ease in which the system evolves to include additional users | Additional users use the application | The Google maps API limits the max number of queries to 2,500 a day |
| The ease in which the system evolves to include additional merchants | Additional merchants use MCM service | All functions specified are able to be implemented on 100 locations |
| Integrity | The amount of safety measures against unauthorized hacking into user accounts | All conditions | Security systems for user login are encoded |
| Maintainability  Maintainability | The extent to which the system is written in a uniform style | The functionality of the environment in which the system is maintained is similar to that of the development environment | The same notation and techniques are used throughout the program |
| The extent to which the system is understandable | Pieces of code are explained through comments, with descriptions for each new definition  Documentation is provided for all code |
| Performance | The extent to which the system meets the real needs of the stakeholder | Both cell data and GPS is available from the phone | All the functional requirements are met (See Functional Requirements section) |
| The extent to which the system locates the user | GPS data is needed and cell data for sending the request | The system can locate the user within 15 seconds |
| Reliability | The ability of the system to operate continuously | The server side of the system operates while users are accessing the resources | The system must operate continuously, 24 hours a day |
| Reparability | The extent to which the system is able to recover from an error | The server side of the system operates while users are accessing the resources or sending data | The system recovers from the error within an hour |
| Reusability | The extent to which each function of the program is independent of the system itself | No conditions | The code meets the threshold of maintainability and sections of code abide by the black box principle |
| Robustness | The degree in which the system is stable | The test simulations reflect real situations | The system does not crash for any specific functionality |
| Size  Size | The size of the database | All conditions | The system will be less than a GB with the beta user data |
| The size of the phone applications | The phone applications will be less than 20 MB |
| Understandability | The extent to which the system functions are self-evident to the user and the stakeholder | All conditions including all user experiences with the phone application as well as the computer interface | Manuals and help toolbars are provided as part of the system |
| Usability | The extent to which the system does not require extensive knowledge on how to use the system | All conditions | The steps involved in users completing tasks are less than 7 steps, taking as little time as possible |

# Potential Risks

This section outlines the potential risks that are the most relevant to this project. It analyzes the impact of the risk and also steps to mitigate the risk if possible.

Security of Localization Integration

**Risk:**

The localization feature of the system compromises the security of the existing payments infrastructure of MCM.  The integration of the localization feature of the system to the existing MCM infrastructure may create security loopholes in the system.

**Impact:** The impacts of this risk would be very high, since user payment information is at risk.  Thus, utmost care must be put into the integration of the system to avoid security loopholes.

Privacy Protection Makes Geolocation Impossible

**Risk:**

Users have a privacy protection on their geolocation, so targeted advertisements based on location becomes unfeasible.

**Impact:**

The localization feature heavily relies on the user’s specific location, and thus targeted advertisements and coupons become impossible.  The user would need to manually input their current location to the system, which becomes an inconvenience to the user.  Merchants would also be unable to push advertisements and coupons, potentially losing customers.

Merchants Push Too Many Advertisements and Coupons

**Risk:**

Merchants push too many advertisements to their users using the new feature in localization.

**Impact:**

This risk would degrade the reputation of MCM, making it seem like a spammer application.  Users may disable, remove, or block the application from pushing advertisements, in which case useful features of localization become unavailable.

No Cell Service

**Risk:** No cell service at the user location.

**Impact:** Users would not be able to receive real-time updates of nearby merchant information, advertisements, and coupons.  Users may thus not be able to receive relevant coupons, losing money.  Merchants may also lose potential customers.  Mitigation strategies for this risk would be to provide offline functionality for users.

Inaccurate Geolocation

**Risk:**

Location information obtained from mobile devices are inaccurate.  Location readings from mobile devices can be inaccurate for several reasons.  A combination of GPS, Cell-ID, and Wi-Fi information are used to provide the user’s location.  These services provide different levels of accuracy, and it may result in inaccurate user location.  Also, customers using their mobile devices are often moving from location to location, and the user location system may not provide accurate data at one point in time.

**Impact:**

Users may receive irrelevant advertisements and coupons from merchants.  Also, inaccurate user location may confuse the user and prevent them from using the application in the future.  This results in a loss of customers for MCM and their affiliated merchants.

MCM Server Failure

**Risk:**

The MCM server may go down.

**Impact:** Customers would not be able to receive real-time updates of nearby merchants and their advertisements and coupons, thus potentially losing money.  Also, merchants would also be losing potential customers during server down-time.  One of the mitigations for this risk is to save offline information for the applications to be useful while the server is down.

More than One Merchant in User Proximity

**Risk:**

User is in proximity of more than one merchant.

**Impact:**

Users may receive data from more than one merchant.  Users may be confused by having the application notifying them about multiple merchants’ information.  Merchant transaction may then become inaccurate, where users are paying to the wrong merchant.

# Project Plan

The following are the major milestones for the MCM localization project. The dates associated with these milestones are shown in the Gantt chart in Figure 2.

1. **Complete the Database**

The database will have the following tables:

1. Advertisements
2. Coupons
3. Customers
4. Merchants
5. merchantLocations
6. merchantProductType
7. subscribeForAds
8. subscribeForCoupons
9. customerTransactions
10. **Complete Website**

The login, create account, and modify account pages will be functional. On the user side, the merchant map and the advertisement settings pages will also be complete. On the merchant side, the create advertisement, create coupon, and view advertisements and coupons pages will also be functional.

1. **Complete Android App**

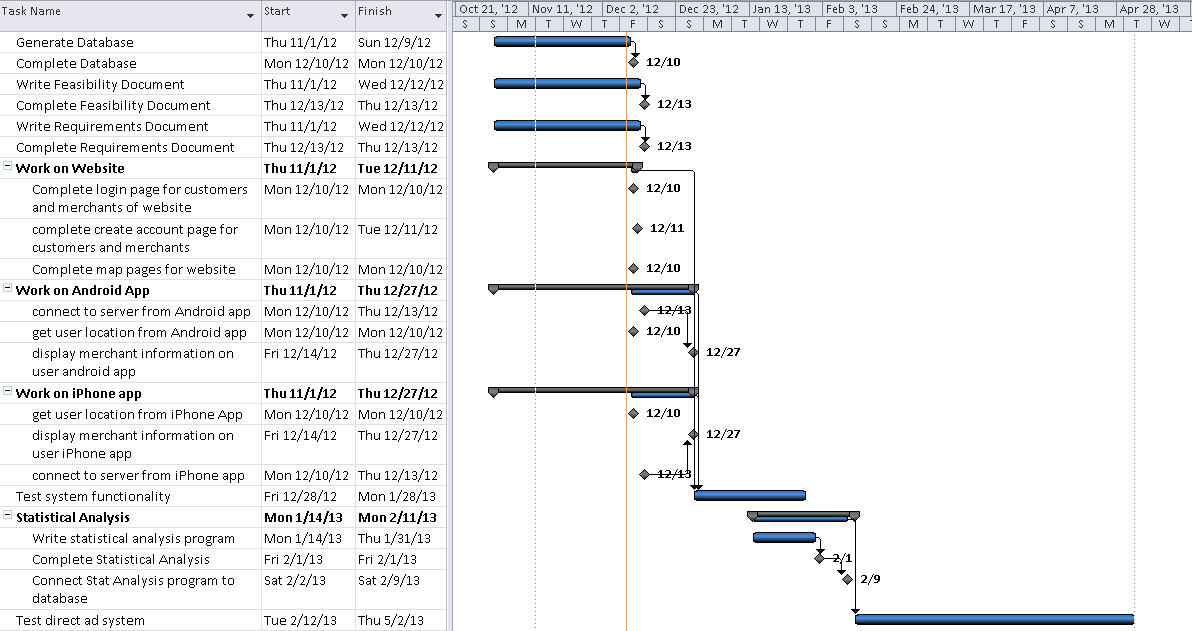
The application will be fully functional and connect with our server.

1. **Complete iPhone App**

The application will be fully functional and connect with our server.

1. **Complete Statistical Analysis Program**

The program will report the correct statistics based on user transaction histories and locations in a timely manner.



*Figure 2: Gantt chart of major milestones for the MCM project.*

# **Sources**

1. 2012. The Google geocoding API. https://developers.google.com/maps/documentation/ geocoding/#Limits