ABSTRACT

We present a smart phone application for Android phones for use by international students. The application is designed to help international students at TAMUCC with providing some useful information. Its main features are: bus schedule, local events, campus calendar, professors' information, international coordinators' information, student organization's information, campus map, and points of interest. We present the requirements, design, description of the implementation and a user study on the application effectiveness.
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1. BACKGROUND AND RATIONALE

International students not only deal with a new city, they also need to deal with a new culture and a second language. Since many people own a smart phone, we built this application to help international students. The purpose of this project is to produce a smart phone application that can be used by a TAMUCC international student to help them adjust to their new environment.

From figure 1.1 we can notice that from 2009 to 2010, the whole market is almost triple time grown.

![Global Mobile Applications Store Revenue in Millions of US Dollars](source/IMS_Screen_Digest)

Figure 1.1 Global mobile applications store revenue[6]

1.1 Android – Mobile OS
Android is an operating system for mobile devices such as smartphones and tablet computers. It is developed by the Open Handset Alliance led by Google.

Google purchased the initial developer of the software, Android Inc., in 2005. The unveiling of the Android distribution on 5 November 2007 was announced with the founding of the Open Handset Alliance, a consortium of 80 hardware, software, and telecommunication companies devoted to advancing open standards for mobile devices. Google released most of the Android code under the Apache License, a free software license. The Android Open Source Project (AOSP) is tasked with the maintenance and further development of Android.

Android consists of a kernel based on the Linux kernel, with middleware, libraries and APIs written in C and application software running on an application framework which includes Java-compatible libraries based on Apache Harmony. Android uses the Dalvik virtual machine with just-in-time compilation to run compiled Java code. Android has a large community of developers writing applications ("apps") that extend the functionality of the devices. Developers write primarily in a customized version of Java. There are currently more than 250,000 apps available for Android. Android Market is the online app store run by Google, though apps can also be downloaded from third-party sites.

1.2 Why Android
1.2.1 Android is a robust OS[3][7][9]

Android is a robust OS. It has the following features.

- Handset layouts - The platform is adjustable to any smaller or larger smartphone layout. It supports 2D graphic and also 3D graphic accelerated openGL. That means
android can provide very high quality graphic for the screen, for game, and finally to the end users. High resolution screen is one of the most important features of a smartphone, because sometime users think better screen means better quality of a phone.

- **Storage** - As for storing the data, android includes a full powered lightweight relational database which is SQLite. SQLite has most of the SQL standard. In addition, the syntax of SQLite is very similar to the normal SQL, but does not assure the domain integrity. Comparing to other database, assessing the database is not separate, but part of it. SQLite is getting more and more popular, and probably the most widely used database engine.

- **Connectivity** - There are a wide range of connectivity method in android, including GSM/EDGE, IDEN, CDMA, EV-DO, UMTS, Bluetooth, WiFi, LTE, NFC, and also WiMAX.

- **Messaging** - Android uses SMS and MMS technology as the messaging method. It supports threaded text messaging as well. Furthermore, cloud computing technology is introduced to messaging on android push messaging service.

- **Multiple language support** - In order to conquer the global market, android supports multiple language. The language package in android has almost all the popular languages used throughout the world.
• Web browser - As a part of Smartphone, a web browser is a must now. A open source WebKit layout engine based web browser is available in android. This web browser is coupled with Chrome's V8 JavaScript engine.

• Java support - As we know, most android applications are written in java. But there is no java virtual machine in android, so the java byte code cannot be executed. Instead, code are compiled into Dalvik executables and run on Dalvik. Dalvik is a specialized virtual machine which is just designed for android such battery powered and limited memory and CPU devices.

• Media support - Android supports the following audio/video/still media formats: WebM, H.263, H.264 (in 3GP or MP4 container), MPEG-4 SP, AMR, AMR-WB (in 3GP container), AAC, HE-AAC (in MP4 or 3GP container), MP3, MIDI, Ogg Vorbis, FLAC, WAV, JPEG, PNG, GIF, BMP.

• Streaming media support - It has RTP/RTSP streaming (3GPP PSS, ISMA), HTML progressive download (HTML5 <video> tag). Adobe Flash Streaming (RTMP) and HTTP Dynamic streaming are supported by the Flash plugin. Apple HTTP Live Streaming is supported by RealPlayer for Mobile, and by the operating system in Android 3.0 (Honeycomb).

• Additional hardware support - Android can use video/still cameras, touchscreens, GPS, accelerometers, gyroscopes, magnetometers, dedicated gaming controls,
proximity and pressure sensors, thermometers, accelerated 2D bit blits (with hardware orientation, scaling, pixel format conversion) and accelerated 3D graphics.

- Multi-touch - Android has native support for multi-touch which was initially made available in handsets such as the HTC Hero. The feature was originally disabled at the kernel level (possibly to avoid infringing Apple's patents on touch-screen technology at the time). Google has since released an update for the Nexus One and the Motorola Droid which enables multi-touch natively.

- Bluetooth - It supports A2DP, AVRCP, sending files (OPP), accessing the phone book (PBAP), voice dialing and sending contacts between phones. Keyboard, mouse and joystick (HID) support is available in Android 3.1+, and in earlier versions through manufacturer customizations and third-party applications.

- Video calling - Android does not support native video calling, but some handsets have a customized version of the operating system that supports it, either via the UMTS network (like the Samsung Galaxy S) or over IP. Video calling through Google Talk is available in Android 2.3.4 and later. Gingerbread allows Nexus S to place Internet calls with a SIP account. This allows for enhanced VoIP dialing to other SIP accounts and even phone numbers. Skype 2.1 offers video calling in Android 2.3, including front camera support.

- Multitasking - Multitasking of applications is available.
- Voice based features - Voice based controlling is available on android devices, including google search, calling, texting, navigation and so on.

- Tethering - Tethering is available on android device. Before android 2.2, tethering was from third party application or hand set maker. But after 2.2, tethering is form android itself.

- Screen capture - Screen shot is also possible on android. Before android 4.0, this feature is only available by third party application or manufacturer.

### 1.2.2 Android is leading the market[7][11]

In January 2011, Google Android accounted for 31.2% of the U.S. smartphone market, capturing the #1 spot in the rankings for the first time as the platform climbed from just 7.1% share a year ago. RIM followed with 30.4% to secure the #2 position, while Apple took the #3 spot with 24.7% share.

![Smart phone sharing chart](image.png)

Figure 1.2 Smart phone sharing chart[4]
According to new data released by Nielsen, Android’s market share has hit a plateau in the United States. Android remains the most popular operating system — ahead of iOS and BlackBerry OS, and Windows Mobile — with a 36% share of the market. However, that figure is on a par with the 37% share it had in Nielsen’s last report, released in April, when the operating system made a 22% leap over the study released in June 2010. Nielsen also found that 26% of U.S. mobile users own an iPhone, 23% carry a BlackBerry, 9% use Windows Mobile, 2% carry HP webOS devices, 2% have a Symbian-powered phone, and just 1% have a Windows Phone 7 device. Android users devour the most data, too, downloading an average of 582MB of data each month,
compared to the 492MB of data that iOS users download and the 448MB of data HP webOS users consume.
2. NARRATIVE

This mobile application has mainly four parts.

2.1 Web browser based modules

2.2 Web parsing based modules

2.3 Contact information based modules

2.4 Google map based modules

2.1 Web browser based modules

There are two features in this mobile application that are based on the web browser. Because there are some resources online and they are already ready to use and these websites are controlled by a third party, so for these features I just redirect them to another web link. These features are local events, and bus schedule.

This function could be finished by the following codes:

Local events:

```java
if (choice.equals("Local Event"))
{
    Uri uri = Uri.parse(hp.getLocalEvent());
    Intent intent = new Intent(Intent.ACTION_VIEW, uri);
    user.this.startActivity(intent);
}
```

Figure 2.1 Sample code of local event

Bus schedule:
```java
if (choice.equals("Bus Schedule"))
{
    Uri uri = Uri.parse(hp.getBusSchedule());
    Intent intent = new Intent(Intent.ACTION_VIEW, uri);
    user.this.startActivity(intent);
}
```

Figure 2.2 Sample code of bus schedule

### 2.2 Web scraping based modules

I used web scraping technique to finish the campus calendar feature. The reason why I do it this way is that there is a lot of information on the campus calendar web page and if I squeeze them on to the small screen, the size of the words will be very small. It is not convenient for users to view this page. So the solution is parsing the information the users need indeed, and output them to the text view on the cell phone.

For scraping the information I needed, I used jsoup, a third party library, which is java external library used to parse html file. Jsoup can parse a URL address, HTML text content. It provides a series of APIs, using DOM, CSS or something like jQuery to extract and manipulate data. Jsoup has mainly three functions. The first one is of course parsing HTML from URL, file or string. The second one is to search and extract data by using DOM or CSS selector. The third one is to manipulate the elements, attribute or text of HTML.

#### a. Calendar activity

This activity provides the user interface for users to select which calendar year they need.
The main screen has three buttons, which are for year 2011-2012 calendar year, 2012-2013 calendar year, 2013-2014 calendar year and 2014 - 2015 calendar year. In addition, these three buttons are set to clickable which is for listening the click action from the user. After click on any button, the screen will go to the corresponding year of calendar.

b. Year2011 year2012 year 2013 year2014 activities

These four activities and their xml have the user interface of the campus calendar. The contents of the screen have the simplified information for users. Why I did not use web browser to open the web link directly? It because again, the web page contains a lot of information. Putting all of the information to a hand set screen is a horrible thing for users. Users cannot see any information clearly and they have to zoom the screen in to make the view bigger, then they can get their information. By doing all of these, costs more time from users and it is hard to control from the user side. So put the most important information on the screen only is a good solution to any small screen. All the information that users seeing is not hard coded, but parsed from the web site and represented to the screen.

2.3 Contact information based modules

This part of the application is to provide users the contact information of whom they interested, such as professors, international coordinators, and some international groups. The information is available online but it is too small and not appropriate for the browser on mobile phones. So I designed this part in a simple and concise way. What the users need are mostly the name of the professors, their office hour, the email address and their
phone number.

a. **Department activity**

This activity and its layout are used for creating the user interface for the faculty in computing science department. It lists all the faculties’ picture, name, office hour email address and phone number. In addition, in this activity the events of the buttons are specified, such as calling or sending email.

b. **Email activity**

In this activity provides the UI of editing email. Users can edit the subject and the content of an email. After clicking send the user can choose either gmail or other email provider as the email service provider.

c. **Call activity**

The users can make a call from this activity.

d. **Intl activity**

This is the activity for users to view the contact information about the international coordinator.

e. **Stuorg activity**

The users can view the list of contact information of some international student groups from this activity.
2.4 Google map based modules

This module is to provide users some map and location based features. Users can check the university map, where to watch movie, where to eat and where Asian market is.

a. Cammap activity

This activity is to provide users the map view of university map. In this activity, the geo coordinate of TAMUCC is set as the center of screen. The map is set to be able to zoom. And initially the zoom level is set to 17. So the users can have a better view of the map.

b. Movie and MovieOverlay activity

These two activities are designed to show the cinemas in Corpus Christi. On the view of the map, some bubbles are shown to indicate the location of the interests. After user clicking on the bubble, the interests’ spot information is shown.

c. Restaurant and RestaurantOverlay activity

Similar like movie activity, some restaurants in Corpus Christi are shown to user.

d. Asian and AsianOverlay activity

The location of Asian market is shown to user.

f. Computer activity

The location where can provide computer sale or computer service is shown to user.
g. **Shoes activity**

The location where can find shoes selling is shown to user.
3. REQUIREMENTS

3.1 Users can log in to system

a) Users can type their username in the username box

b) Users can type their password in the password box

c) Users can click on “OK” button and go to their pages

3.2 Users can view pages

a) Users can go to local event page after select from the spinner

   There will be a calendar view showing the local events.

b) Users can go to campus calendar page after select from the spinner

   After selecting from the spinner, user can view the campus calendar from web browser.

c) Users can go to bus schedule page after select from the spinner.

3.3 Users can view contact information

a) Users can go to professor’s information page after select from the spinner.

b) Users can go to international coordinator’s information page after select from the spinner.

c) Users can go to international student group’s page after select from the spinner.

d) Users can make a call after clicking on the call button.

e) Users can send an email after clicking on email button.

f) Users can edit the subject and content part in the email.

3.4 Users can view maps
a) Users can view the university map.

b) Users can view the map for the interests spot.

c) Users can view the spot information after clicking on the spot pin.
4. DESIGN

4.1 Use case diagram

As we can see from figure 4.1, this application is implemented with a very simple system. There is only one actor which is the main user. And then the activities the user can perform: view local event, view campus calendar, view where to, view professors' information, view bus schedule, view international coordinator page and view student organization page.
4.2 Class diagram

Figure 4.2 Class diagram

The class diagram is not complicated as well. In android, it is very normal that almost each class has an activity. An activity is a single, focused thing that the user can do. Most of the activities have interactions with the user. And also the activity handles the creation of a window where the user interface placed. The activity can find its XML which is its view by setContentView(View) method. In the XML file, there are two view to represent it. One is the normal xml language, while the other one is a graphical layout which provides a possibility that the developer can do drag and drop to design the user interface. The most wonderful thing for developer is that there are a lot of widgets (such as button, text view, progress bar, rating bar...), text field, layout, time and date view and so on. All of these things are already available to developers.

4.3 Class/activity explanation

Login controls the login process. After users logged in, users can do different associated with different activities.
Department, studentOrg, intlCoord class/activities and their xml files provide the interface and operations. They list the people/organizations information: pictures, name, office number, office hour, telephone number and email address with image view, text view, and button view. At the same time, the telephone number and email address are clickable button. When user click on these buttons, the system can either make a call or send a email (email activity) to the people. In order to use the email function, the access internet permission needs to be set in manifest.xml file.

Campus calendar, year2011, year2012, year2013, year2014 class/activities and their xml files provide the interface and their operations. The campus calendar activity and its xml provides the user interface for users to choose which calendar year they interested in. There are four clickable buttons on this page. After users selected and clicked on a button, the activity will jump to the corresponding activity of calendar year. Year2011, year2012, year2013, year2014 activities have the user interface with providing the information of campus calendar. All the information shown on screen is extracted from the web site by using web parsing technology with jsoup, a third party java library. The user interface is customized, optimized for the size of a mobile phone screen. In addition, different type of information is set with different color for a easy read reason: semester information is set to be red, date information is set to be green and description information is set to be white.

LocalEvent and busSchedule class/activity is used to pop up a web browser and redirect the user to the web page. These two web page are controlled by the third party and they
are relatively easy to read on a mobile phone. That why I did not implemented them locally.

WhereTo class/activity and its xml provide the user interface for users to choose different location of interests. There are six clickable buttons which are representing where to eat, where to watch movie, where to buy shoes, where is asian market, where to buy computer and where find groceries. After selection, the map view will appear with some spot pins, indicating the location of that interests. And the pins are clickable to show some more detail information.

UniversityMap class/activity is similar to whereTo activity. It shows the map of TAMUCC. Users can move the view of the map and zoom in or out.
5. USER STUDY

A user study was performed to get the feedback from users about the user interface and the design of this application. User study is also called usability testing, which is a technique used in user-centered interaction design to assess a product. It is different from usability inspection. Instead of testing without users, the whole process involved users experiencing a lot. In another word, the user study depends on how users feel about the product. Usability testing is a black-box testing technique. The goal is to get the feedback from users, such as errors, bugs, and any possibility of improvement.

5.1 User interface study

This application was used by some users. There are two groups of users. The first group is the object users, which are the international students in the computing science department. The second group is also very important; the committee members. They gave me some feedbacks, some of them were very constructive, which can make this application has a better user interface, more functionality, and much more easier to use.

Initially, the design of contact information was to redirect the user to the web browser. But the user’s feedback indicates that the words in the browser are too small and they have to adjust the view bigger which was not convenient. In addition, the web browser-based design cannot make a call. Hence, new design implemented call function. (As shown in figure 5.1)
Figure 5.1 Professor information design with web browser

Figure 5.2 New professor information design
From figure 5.2 we can notice that the user interface for professors information has changed a lot. Firstly, the information of this is not from the internet, meaning the information is not provided by internet through web browser. All the information are provided locally which means the pictures, the strings are stored locally. The advantage of doing it this way is that the user can get the information without having any network connection, such as WiFi, or 3G, 4G network. That is more convenient and meaningful to the users. Secondly, all the information provided are simplified when compared to the old version. On the old version, there are lots of not very useful but taking spaces messages. So as for the new design, only most useful information is represented to users. They are the pictures of professors, the professors' name, office number, office number. As well as professors' telephone number and email address. Meanwhile, the telephone number and email address are two buttons. They are clickable. When users click on the button, it will be triggered to make a call or send a email to the particular professor.

Another case of user interface improvement is the campus calendar part. I initially designed this part by using a web browser as well just like the professor information part. After got the feedback both from the end users and my project committee members, All the feedbacks show that open the campus calendar in the web browser on cell phone is not convenient and hard to see. It is true that users can change the view larger, but the bigger the view is, the harder to control. As a consequence, the users prefer to have a simple, ease and clear view to get the information they interested in the most. In figure 5.3 shows the old design of campus calendar.
Figure 5.3 Old design of campus calendar

Figure 5.4 Campus calendar using parsing
As a response to the users' feedback, the feature of campus calendar part changed to use parse technique. By using parsing, the most useful and meaningful information are scraped from the website html file and then represented to the android view. (Figure 5.4).

Then the application was given to the user again for a new feedback. Users think it is a good improvement. It is easier for them to get the most useful information with a clean view. However, because there are a huge number of words with white color on the small screen, sometimes it is a little hard to find the right position for a single piece of information.

![Figure 5.5 Final design of campus calendar](image)

Figure 5.5 Final design of campus calendar
Hence, I changed the color if the view of different type of information. The semester information was set to red. The date information was set to green and the normal information was remained to white. The new look shown in figure 5.5. We can notice that the final design of campus calendar is very easy, clean and provides all the important information to the end users.

5.2 Functionality study
The feedback about the functionality side is that the "where to" part is not that useful. The users need to know more places to hang out, such as where to buy computer, where to buy shoes.
6. IMPLEMENTATION

6.1 Programming language used - Java

I used java as the programming language which is required by android platform. It is because java is a known language, developers know it and do not have to learn another programming language. It is harder to shoot yourself with java than with C or C++ since it has no pointer arithmetic. It runs in a virtual machine, so no need to recompile it for every phone out there and easy to secure. In addition, there are a large number of development tools for java. And several mobile phones already used java, so java was known in the industry.

6.2 IDE used - ECLIPSE

Eclipse is a multi-language software development environment comprising an integrated development and an extensible plug-in system.

6.3 SDK used - Android SDK

The android software development kit contains a full set of development tools. There are debugger, libraries, a handset emulator, documentation, sample code and even tutorials. And it is just perfect when working with eclipse.

6.4 Android version - 2.2

The android version I used is 2.2. This version is pretty much a very early version, but it has all the foundation I need to implement this application. And also, most of the android
smart phone are built in android 2.2 or above. So, this application is compatible to most android based smart phone.
7. TESTING AND RESULTS

7.1 Login page

Users need to type their username and password, then press button login to login. Or they can click on cancel button to quit this program as shown in Figure 7.1.

![Login page](image)

Figure 7.1 Login page
7.2 User page

In user page, there is a spinner for user to choose what they want to do next. And the choices are set to be selectable.

Figure 7.2 User page
7.3 Local event page

After selected from the spinner, the web browser opened successfully and redirect to the local event web page.

Figure 7.3 Local event page
7.4 Campus calendar page

After selected campus calendar, then the user needs to select which calendar year. As shown in figure 7.4, the 2011-2012 calendar shows and the important information extracted from web site successfully.

Figure 7.4 Campus calendar page
7.5 Bus schedule page

After selected from the spinner, the web browser and redirect to ccrta web page successfully.

Figure 7.5 Bus schedule page
7.6 University map page

After selected by user, the GOOGLE map based campus map shown to user successfully.

Figure 7.6 University map page

7.7 Professor information page

Professor information page appears successfully.

Figure 7.7 Professor Information page
Function of calling is successfully loaded.

Figure 7.8 Call view

Activity of sending an email is successfully loaded.

Figure 7.9 Send email view
7.8 International coordinator page

International coordinator page was loaded successfully.

Figure 7.10 International coordinator page

7.9 Student organization page

Student organization page was loaded successfully.

Figure 7.11 Student organization page
7.10 Where to page

After selecting “where to” option from the spinner, this view popped up successfully

![Where to page](image)

Figure 7.12 Where to page

After clicking on “Where to watch movie” button, a map view with some pins which indicate the location of cinema will appear. Users can also click on the pin to show some more detailed information about this place.
Figure 7.13 Where to watch movie page

Similar view will show up for “where to eat” and “where is Asian market” option.

Figure 7.14 “Where to eat” and “Where is Asian market” page
8. CONCLUSIONS AND FUTURE WORK

Smart phone is a trend and android is the center of the trend. It has many resources for us to use, providing people a lot of convenience. International students from other countries need help adjusting to student life in the USA. Our android application provides international student with help using the following features: bus schedule, local events, campus calendar, contact information for professors, the international coordinator and student organization, and a feature based on google map for finding points of interest. The process of completion of this project involves some software engineering skills, such as requirements gathering, analysis, designing, implementation, user study and testing.

The application is version 1.0 and could use some improvement such as: the user interface needs to be cleaned up. The main screen of where to will be added some pictures. The bus schedule should be parsed off the web site and represent in a clean manner. Class schedule feature will be added. Student can login to this system using their sail account username and password. And then, they can view their class schedule. In addition, known bug will be fixed, such as when user just login, the page will jump to the first option of spinner.
BIBLIOGRAPHY AND REFERENCES


[6] IHS Screen Digest


