ÇANKAYA UNIVERSITY
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
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MASTER THESIS

USING INTERACTIVE SOCIAL NETWORK TO REVEAL THE ROAD SITUATION

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Title of the Thesis: **Using interactive social network to reveal the road situation**

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I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science in Computer Engineering.

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This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science in Computer Engineering.

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ABSTRACT

USING INTERACTIVE SOCIAL NETWORK TO
REVEAL THE ROAD SITUATION

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M.Sc., Department of Computer Engineering

Supervisor: Asst. Prof. Dr. Murat SARAN

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This study introduces a method to extract useful information from social network activities in order to help the people who live in big cities to avoid traffic problems. In this study we developed an interactive social network to reveal the road situation in real-time via a mobile application. The system based on built-in Global Positioning System (GPS) on mobile and the Geographic Information System (GIS). We conducted a survey to investigate and evaluate the application in users' daily road activities combined in its social network frame. This study has shown that mobility of the social network can be used to reveal the road situation with 82% as general evaluation according to the conducted survey.

Keyword: GPS, GIS, Social Network, Mobile, Android

ÖZ

TRAFIKTE YOL DURUMUNU ORTAYA ÇIKARMAK IÇIN

İNTERAKTIF SOSYAL AĞ KULLANIMI

Abdulrahman ALKATEB

Yükseklisans, Bilgisayar Mühendisliği Anabilim Dalı

Tez Yöneticisi : Asst. Prof. Dr. Murat SARAN

TEMMUZ 2013, 61 sayfa

Bu tez çalışmasında özellikle büyük şehirlerde yaşayan insanlara trafikte yaşadıkları sorunlarda yardım etmek amacıyla sosyal ağ faaliyetlerinden yararlanarak faydalı bilgiler elde eden bir yöntem sunulmaktadır. Bu çalışmada, bir mobil uygulama aracılığıyla gerçek zamanlı olarak yol durumunu ortaya çıkarmak için etkileşimli bir sosyal ağ uygulaması geliştirilmiştir. Mobil uygulama, Coğrafi Bilgi Sistemi (CBS) ve Küresel Konumlandırma Sistemi (GPS) temel alınarak geliştirilmiştir. Kullanıcıların günlük yol faaliyetlerinde sosyal ağ çerçevesinde böyle bir uygulamayla ilgili görüşlerini araştırmak ve değerlendirmek için bir anket düzenlenmiştir. Anket sonuçlarına göre katılımcıların %82'si önerilen mobil sosyal ağ uygulamasının yol durumunu ortaya çıkarmak için kullanılabileceğini belirtmişlerdir.

Anahtar Kelimeler: GPS, CBS, Sosyal Ağ, Mobile, Android

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LIST OF ABBREVIATIONS

GPS	Global Positioning System
GIS	Geographic Information System
NMEA	National Marine Electronics Association
SDK	Software Development Kit
IDE	Integrated Development Environment
RIAs	Rich Internet Applications

CHAPTER 1

INTRODUCTION

Nowadays technology has become an essential component of an individual's life and a crucial partner in their social activities since the latter has turned to technology based one. For example, Facebook, Twitter, and Instagram are widely used as technology based social network tools for social activities and needs. With the high pace of technological development most of the individuals' desires have turned to reality by reflecting the demanded services of the users and turning it to applications to facilitate and simplify the daily based activities. The social networks with the support of their synchronized and asynchronized tools have simplified social activities and needs by allowing instant communication among the users

The main aim of the study is to define a method to extract useful information from social network activities to feed the traffic system in order to help the people who live in big cities. Through this study, we use social network to reveal the road situation in real time. We design the social network to be more interactive for users. The system is based on Global Positioning System (GPS) data and the Geographic Information System (GIS) and we will develop a mobile application to realize the system in real life settings. For that reason we conducted a survey to investigate and evaluate the acceptance of using this application in users' daily road activities combined in its social network frame.

The study contains five chapters. In the first chapter, we give related literature. Then, an introduction to the developing environment then, we study the suggested cases then review the results and conclusions; in the last chapter we show the recommended future work.

According to Stanley Wasserman definition, "a social network is a social structure made up of a set of actors (such as individuals or organizations) and the dyadic ties between these actors"[1]. The social network gives a powerful method of analyzing

the structure of the social entities. The social network analysis is applied to define the local and global patterns, locate effictive structures, and test network dynamics [2].

In current online social networks, they help in creating connections among people based on their shared interests, values, membership in particular groups (i.e., friends, professional colleagues), etc. These social networks make the searching process easier for those who want to find and communicate with people who are in their networks via using a web as the user interface [3].

1.1 Statement of Problem

We define two cases where our solution can be utilized. These are social network case and the road information case.

1.1.1. Social network case

In general social networks, interfaces are pages that contain text, photos and videos. For example, Facebook's user interface is represented as a wall which recently was updated to timeline interface where users can write and post multimedia. Instagram interface is an online photo and video sharing, and social networking environment that enables its users to capture pictures and videos, then add digital effects to them. We developed a social network application with different interfaces in order to make the social network more interactive by visualizing the real user activity on the map. In our application users can see the other users' activities in real time.

1.1.2 Road information case

The current methods which used to extract road information are video streaming, satellite images, and vehicle tracking systems. These methods need very powerful processors regarding the fact that they are costly. In addition, real-time image processing is a difficult action for traffic video monitoring and satellite images are inappropriate and costly to work on the real time application [4] that will be evaluated through the study.

We developed a mobile application to extract the road information by using a social network. The mechanism is explained in detail in the following section.

1.5 Mechanism

1- **Mobility:** The main tool in this social network is mobility. Getting the data from each user and upload them with their coordinates.

2- **Setting location:** There are different methods to get the location

   A- Via GPS: by gathering and calculating the signals from the satellites

   B- Via Wireless network

   C- GSM

   D- Hybrid

3- **Server**: The activity of users and their coordinates will be uploaded to the server

4- **Feeding**: The data which saved to the server can reveal the traffic system.

The structure of the mechanism is presented in Figure 1.1.

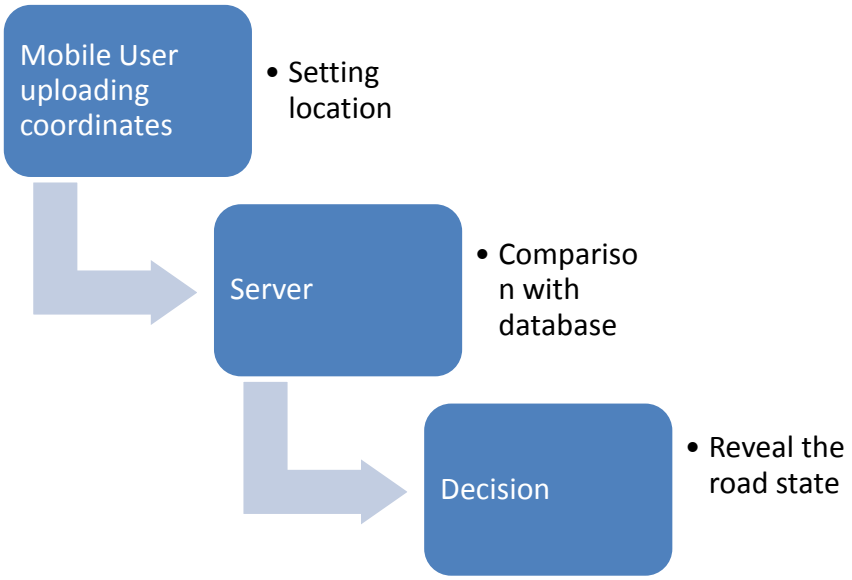

Figure 1.1: Flow of data

1.6 Significance of the Study

The aim of the study is to make the social network more interactive and using the social network information to reveal the road situation in real time. We propose a method to visualize the location of the user on the map and using the coordinates of the users to extract information. The study may help the user to optimize the time reach the destination at the same time by defining a solution using mobile devices.

CHAPTER 2

SOCIAL NETWORK AND GPS DATA

Social networks nowadays are an important interaction facility spread among people, where by people can share their interests, membership, and personal information, and also contact new people. People are interacting with social networks in an effective way that is just like an actual community, since social networks are open widely to the world. Social networks make it easier through web interface for the community to increase the potential user who is looking for these sharing services in actual life. As an illustrative example, consider the following: 1 billion active users on Facebook in Oct 2012 [5], Twitter has 200 million active users in Fab 2013 [8], each minute there are 277000 logins, on Facebook, 100,000 new tweets of Twitter, and 20 million flicker photos [6] (Figure 2.1).

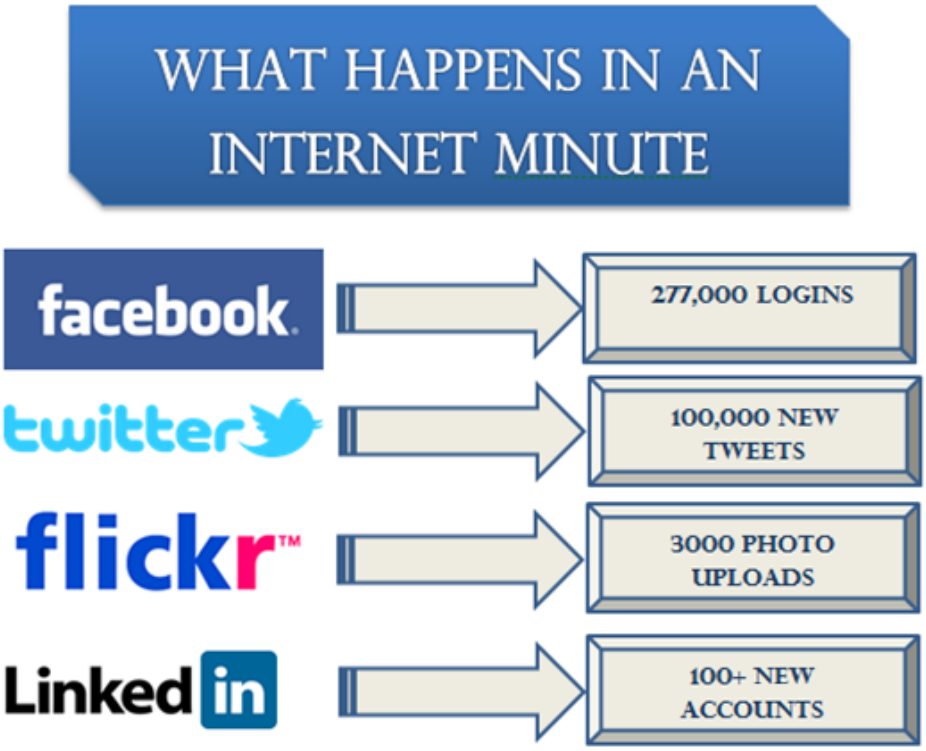

Figure 2.1: Activity of Social Network

2.1 Facebook

In August 2012 Facebook announced that it had more than 900 million active users and over 50% of them were using Facebook on smart phone and PDA devices, 300 million photos per day uploaded to the site. “The Social Habit” reported by Edison Research supports the fact that, 54% of Facebook users use mobile devices to browse Facebook (See Figure 2.3). The same research also explains that 33% of Facebook users use their mobile devices to access the site most. The study also shows the number of users who start their day with Facebook (See Figure 2.4). The flexibility of Facebook Application Programming Interfaces (APIs) helps to integrate the Facebook into other application (third party application) so that Facebook can be used out of its main domain. Facebook provides applications and APIs for mobile platforms. Almost every user with a smart phone and a Facebook account has the “Facebook application” installed. According to Google Play Store statistics of August 2012, Facebook Android application was downloaded more than 100 million times in 30 days [10].

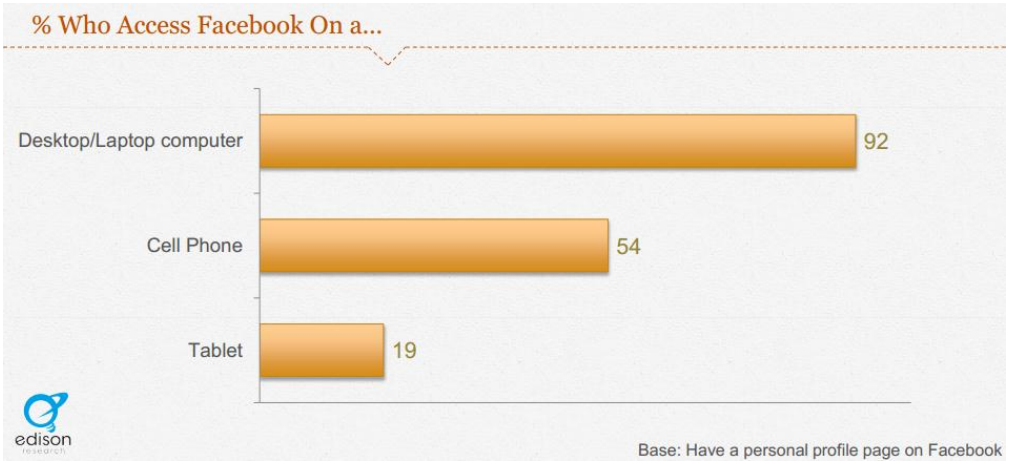

Figure 2.3: Distributions of users by device used to access Facebook by Edison Research

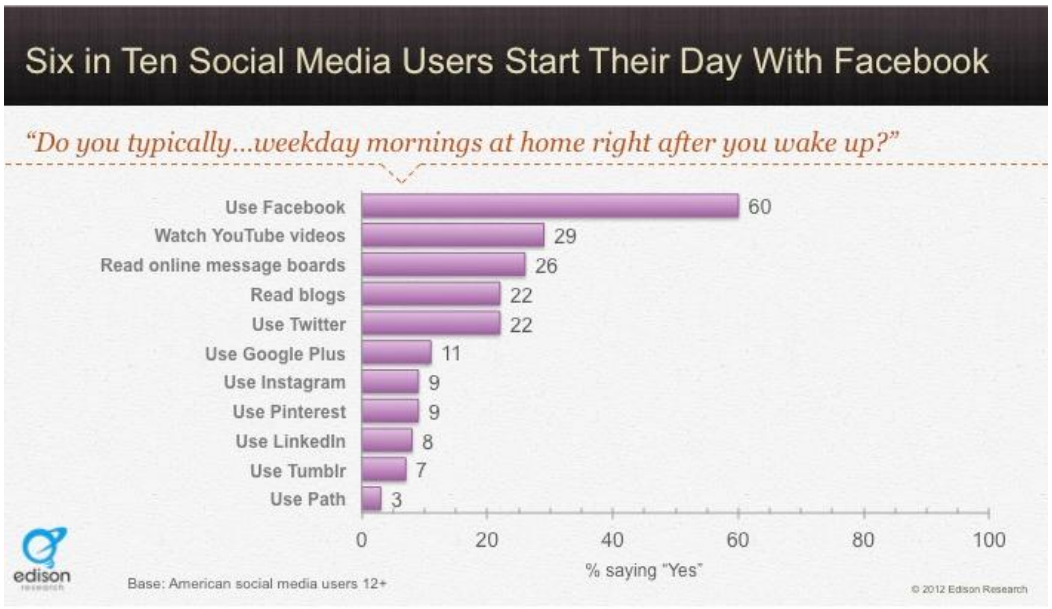

Figure 2.4: User start their day with the Social Network by Edison Research

2.2. Twitter

Twitter is an environment wherein users publish their thoughts, activities, information and articles in 140 characters of text or less. It allows to communicate globally cheaper and measurable. Profiles are (generally) public audience; they can see what you write, unless you change the privacy sittings in order to make your profile private. Users "follow" each other in order to follow and chat with specific people [11]. The research of Edison on "The social Habit" shows that 10 percent of the United States communities are users on Twitter and 25% of them update their status messages via mobile and 61 percent of Twitter users own smart devices [12].

Tweets immediately reach followers and they spread through the social network by re-tweets. When retweeting brings some premium retweets in the Twitter stream, then a user may unlike to follow retweets on a larger scale. The most popular retweets tend to consider as the preferable articles and the most important stories of the whole Twitter society. This can be magnificent if a user wants to look for important articles, study helpful blog, or wants to track emerging trends. Now Twitter is an important advertisement tool and marketing platform [13].

Twitter functions renews press releases; people now just tweet about things they want to announce. Some political leaders are actively using twitter to broadcast or declare their thoughts on public matters. The first main requirements of turning Twitter into publicity or advertisement platform for normal users or business purposes is to have more followers. If there are no followers then no one will know about the tweets. Twitter followers are the audience, the user can reach them when he/she wants to, and they can help to spread the user's tweets by retweeting. The second main requirement in a successful Twitter employment for advertisement is having the ability to manage the tweet subject of business. By adding "#" tags, a search engine optimized expression may be able to produce more profits from Twitter.

2.3 Instagram

Instagram is a social network and photo-sharing service which gives the users the ability to capture photos, apply effects to them, and then share them through multiple social networks, such as Facebook, Twitter, Flicker, and Tumblr. The captured image has the rectangle shape with the ratio 16:9; also Instagram supports taking pictures from the gallery and crop them with the same ratio [14].

The Instagram is officially launched in Oct 2010. Instagram has quickly become popular, with more than 100 million active users as of April 2012 [15]. Instagram now supports IOS devices and Android devices. One of the important tools helped Instagram to be rapidly popular is other social networks; in this sense, Mark Zuckerberg stated that Facebook was "committed to building and growing Instagram independently" [16].

2.4 Global Positioning System (GPS)

For thousands of years, people have navigated by the position of the stars today using satellites instead of stars, a handheld device can display the exact position in any case day or night, cloud or clear sky.

The Global positioning system is a set of satellites connected to control systems that allow a receiver to calculate its location anywhere on earth through 24 hours [17]. The technical advance of navigation developed the devices of navigation to be handled and allowing the requirements of device components to shrink in cost and size.

2.4.1 Generating GPS Signal Transit Time

There are 28 satellites orbiting around the earth with an angle 55° to the equator. All satellites complete their paths in 11:58, the height of the satellites from the earth is 20,189 km, and each satellite has more than 4 atomic clocks on board (See Figure 2.5). Such system needs very high accuracy which given by the Atomic clocks the error ratio is one second error every 30,000 to 1,000,000 years. Reduction methods used to give more accuracy by synchronizing the atomic clocks from multiple control points on the ground. Each satellite sends its position with accurate time at the frequency of 1575.42 MHz and the transmission time is (300,000 km/s) which is the same speed of light that makes the position information takes about 67.3 ms to arrive the location on the surface position directly under the satellite. The signal needs extra 3.33 μs for each boost travel's kilometers. When the person needs to find his/her place on the ground or in the air or at the sea, he or she needs a precise clock. This is usually achieved by means of computing the access time of the signal with the time of the moment which sent out the signal (See Figure 2.6) [18].

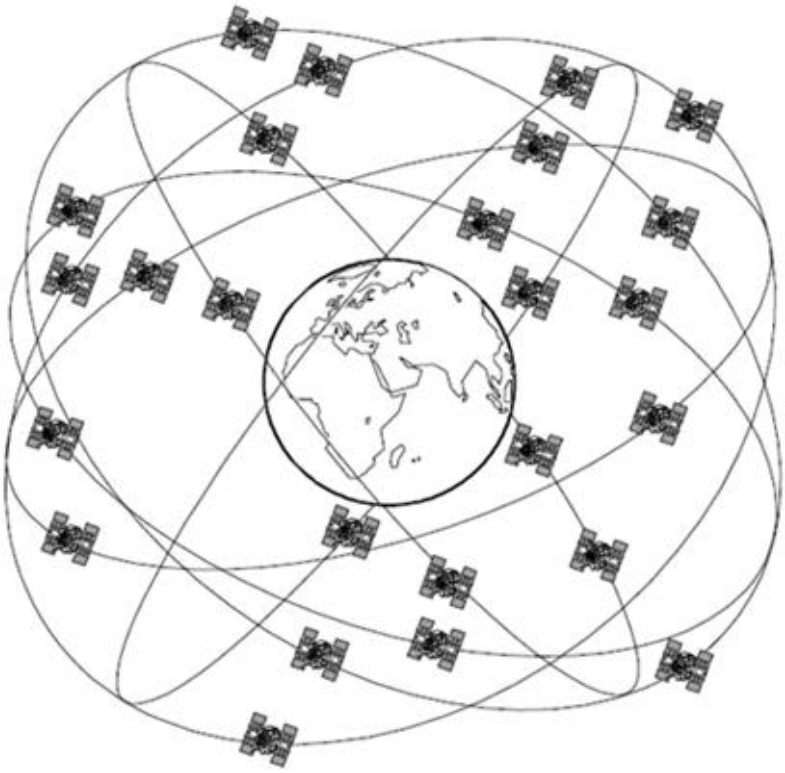

Figure 2.5: GPS satellites

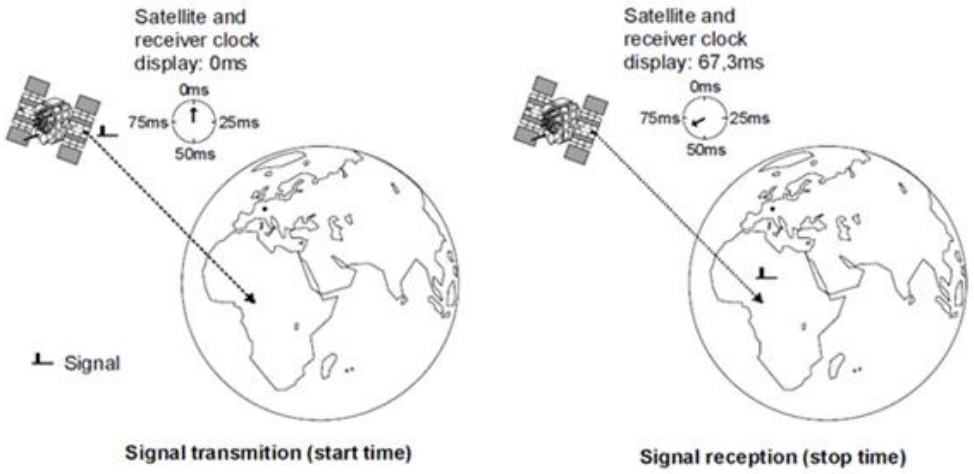

Figure 2.6: Determining the transit time

So the length [L] from the position on earth to the satellite position can be calculated by the defined transmission time τ:

Length = Signal travel period • the speed of light

$L = c*\tau$

Calculating signal transmission time and finding out the length to reach a satellite is not useful to determine an object's location in 3-D space. To calculate the 3D coordinates of an object, four different transit times from four different satellites are

needed. That's the purpose of using four independent satellites is to determine the accurate position. To archive measuring transmission time for the receiver with high accuracy, coincided a clock is required. When the transmission time is lost by 1 μs, this is known as faulty position with the usual occurrence of 300m. An error happens even when three satellites are synchronized and having the same clock board. It requires having N deferent equations from deferent satellites [19]. If the time computation is added to a fixed anonymous fault that will lead to anonymous values in three-dimensional spaces:

• (X) Longitude
• (Y) Latitude
• (Z) Height
• (Δt) Time error

That is why 4 satellites are needed to achieve the position in three-dimensional spaces (See figure 2.5)

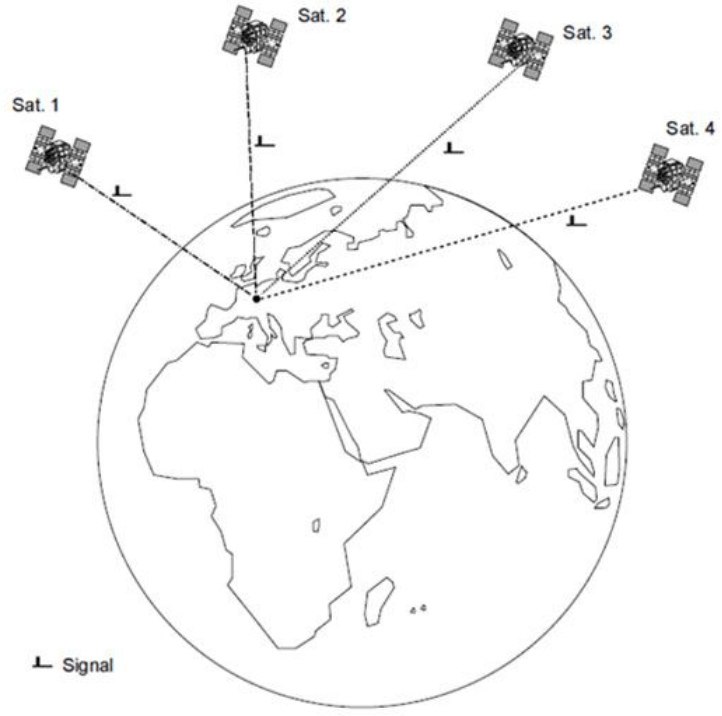

Figure 2.7: The four satellites which needed to calculate a position in 3-D space

2.4.2 Data interfaces (The NMEA-0183 data interface)

NMEA-0183 data interface

To represent GPS values and calculate or query them, it is required to know the interface of GPS data. The interface of GPS modules is serial interface (TTL or RS-232 level). The significant basics of receiver data are broadcasted through the serial interface in a specific data format [20]. The National Marine Electronics Association (NMEA) has regulated the GPS data format. Nowadays, GPS data represents according to NMEA-0183 protocol definition. NMEA defined data sets for multiple employments in terms of, e.g, GNSS (Global Navigation Satellite System), GPS, Loran, Omega, and Transit with some other manufacturers.

To rebroadcast GPS data, 7 data sets and GPS modules used seven data sets are required [21]:

1. GGA (GPS Fix Data, fixed data for the Global Positioning System)
2. GLL (Geographic Position–Latitude/Longitude)
3. GSA (GNSS DOP and Active Satellites, the degradation of accuracy and the Number of active satellites in the Global Satellite Navigation System)
4. GSV (GNSS Satellites in View, satellites in view in the Global Satellite Navigation System)
5. RMC (Recommended Minimum Specific GNSS Data)
6. VTG (Course over Ground and Ground Speed, horizontal course and Horizontal velocity)
7. ZDA (Time & Date)

$GPRMC,130303.0,A,4717.115,N,00833.912,E,000.03,043.4,200601,01.3,W*7D<CR><LF>
$GPZDA,130304.2,20,06,2001,,*56<CR><LF>
$GPGGA,130304.0,4717.115,N,00833.912,E,1,08,0.94,00499,M,047,M,,*59<CR><LF>
$GPGLL,4717.115,N,00833.912,E,130304.0,A*33<CR><LF>
$GPVTG,205.5,T,206.8,M,000.04,N,000.08,K*4C<CR><LF>
$GPGSA,A,3,13,20,11,29,01,25,07,04,,,,,1.63,0.94,1.33*04<CR><LF>
$GPGSV,2,1,8,13,15,208,36,20,80,358,39,11,52,139,43,29,13,044,36*42<CR><LF>
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$GPGSV,2,2,8,01,52,187,43,25,25,074,39,07,37,286,40,04,09,306,33*44<CR><LF>

Table 2.1: Recorded Data of NMEA protocol

Field	Description
$	Start of the data set
GP	Information originating from a GPS appliance
DTS	Data set identifier (e.g. RMC)
Inf_1 bis Inf_n	Information with number 1 ... n (e.g. 175.4 for course data)
,	Comma used as a separator for different items of information
*	Asterisk used as a separator for the checksum
CS	Checksum (control word) for checking the entire data set
<CR><LF>	End of the data set: carriage return (<CR>) and line feed, (<LF>)

Table 2.2: The definition of the single NMEA DATA SET blocks

2.5 Road Information Extraction Using GPS

Usually control units of the traffic systems that belong to the municipality have operators to follow and achieve the collecting process for the extracted information related with the road situations for the on-road automotive, such as road conditions.

Always, the information of the road is complicated to be calculated with classical extraction ways like video streaming, sensors, aircraft images or satellite images. Although video streaming, sensors are used high intelligent system with high

processors to extract the information, the results are not accurate enough. For the aircraft images and satellites it gives good results but they are so expensive and impractical to cover all the roads. One of the best methods is extract information using the attributes of the location information saved in e-map with GPS and accurate map. Then, compare the position coordinates with Map information which will be the index of the system [22].

The main processes of GPS/MAP road information extraction is:

1- Map data files: the map file contains the road geographic data which represented as the attributes of each road section
2- Vehicle location: The vehicle coordinates are calculated then they are converted to the flat Cartesian coordinates of an electronic map system.
3- Comparing the parameters : corresponding the actual vehicle coordinates (X,Y) and active direction with the path section which is in the saved in the Map database file can determine the road section
4- Forwarding the extracted data to the control system : The control system will take the decision after receiving the information via vehicle activities

2.6 Information Extraction Using Social Network

There are many studies conducted to investigate information extraction process via social networks, such as, the one that conducted by Kyung Soo Cho and his friends, used real-time extracting semantic written texts on a social network [23]. They used opinion mining to extract semantic information from the social network. For example, they analyzed the paragraph in Figure 2.6 listed the results in Table 5.

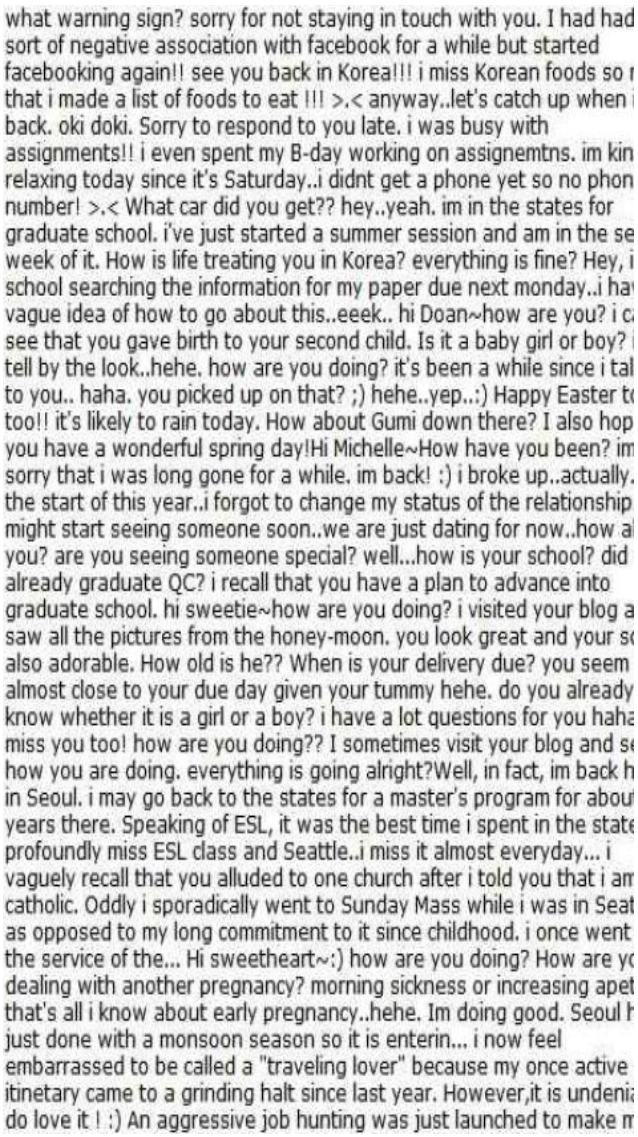
what warning sign? sorry for not staying in touch with you. I had had
sort of negative association with facebook for a while but started
facebooking again!! see you back in Korea!!! i miss Korean foods so
that i made a list of foods to eat !!! >.< anyway..let's catch up when
back. oki doki. Sorry to respond to you late. i was busy with
assignments!! i even spent my B-day working on assignemtns. im kin
relaxing today since it's Saturday..i didnt get a phone yet so no phon
number! >.< What car did you get?? hey..yeah. im in the states for
graduate school. i've just started a summer session and am in the se
week of it. How is life treating you in Korea? everything is fine? Hey, i
school searching the information for my paper due next monday..i ha
vague idea of how to go about this..eeek.. hi Doan~how are you? i c
see that you gave birth to your second child. Is it a baby girl or boy?
tell by the look..hehe. how are you doing? it's been a while since i tal
to you.. haha. you picked up on that? ;) hehe..yep..:) Happy Easter t
too!! it's likely to rain today. How about Gumi down there? I also hop
you have a wonderful spring day!Hi Michelle~How have you been? im
sorry that i was long gone for a while. im back! :) i broke up..actually.
the start of this year..i forgot to change my status of the relationship
might start seeing someone soon..we are just dating for now..how a
you? are you seeing someone special? well...how is your school? did
already graduate QC? i recall that you have a plan to advance into
graduate school. hi sweetie~how are you doing? i visited your blog a
saw all the pictures from the honey-moon. you look great and your s
also adorable. How old is he?? When is your delivery due? you seem
almost close to your due day given your tummy hehe. do you already
know whether it is a girl or a boy? i have a lot questions for you haha
miss you too! how are you doing?? I sometimes visit your blog and s
how you are doing. everything is going alright?Well, in fact, im back h
in Seoul. i may go back to the states for a master's program for abou
years there. Speaking of ESL, it was the best time i spent in the state
profoundly miss ESL class and Seattle..i miss it almost everyday... i
vaguely recall that you alluded to one church after i told you that i am
catholic. Oddly i sporadically went to Sunday Mass while i was in Seat
as opposed to my long commitment to it since childhood. i once went
the service of the... Hi sweetheart~:) how are you doing? How are yo
dealing with another pregnancy? morning sickness or increasing apet
that's all i know about early pregnancy..hehe. Im doing good. Seoul h
just done with a monsoon season so it is enterin... i now feel
embarrassed to be called a "traveling lover" because my once active
itinetary came to a grinding halt since last year. However,it is undeni
do love it ! :) An aggressive job hunting was just launched to make m

Figure 2.8: Text resource of comments of anonymous user

Dimension	data	Personal texts	Formal texts
Self-references (I, me, my)	7.31	11.4	4.2
Social words	12.39	9.5	8.0
Positive emotions	1.94	2.7	2.6
Negative emotions	2.64	2.6	1.6
Overall cognitive words	6.57	7.8	5.4
Articles (a, an, the)	5.67	5.0	7.2
Big words (> 6 letters)	12.99	13.1	19.6

Table 2.3: Analysis of comments from the captured paragraph

The study explained that people can calculate identities from the social network services which have no information on identities. This is a significant reality, and it explains that the noble way is able to be used in various fields. For instance, the method can be used to discover evidence of pursuing a felonious in a judicial field, and data for sales in a marketing field.

Another study by Elisa H. M. Huzita, Tainan G. F. de Souza and Yan H. Kabuki explained an application called EPITrans which aims at captured messages from Facebook users, and extracting important information, pointing out several instances on transit as traffic jams, accidents and floods [24]. EPITrans application is based on an intelligent system. This system enquires the Facebook users so that, by data mining, get a guided map that refers to the most neoteric transit events recorded by the users. Therefore, "it is expected to contribute with useful information that helps any user to take decisions about the best path to be performed for his locomotion, avoiding, for example, traffic jams or accidents that are blocking roads they normally use" [25]. The interface of this system is shown in (Figure 2.7).

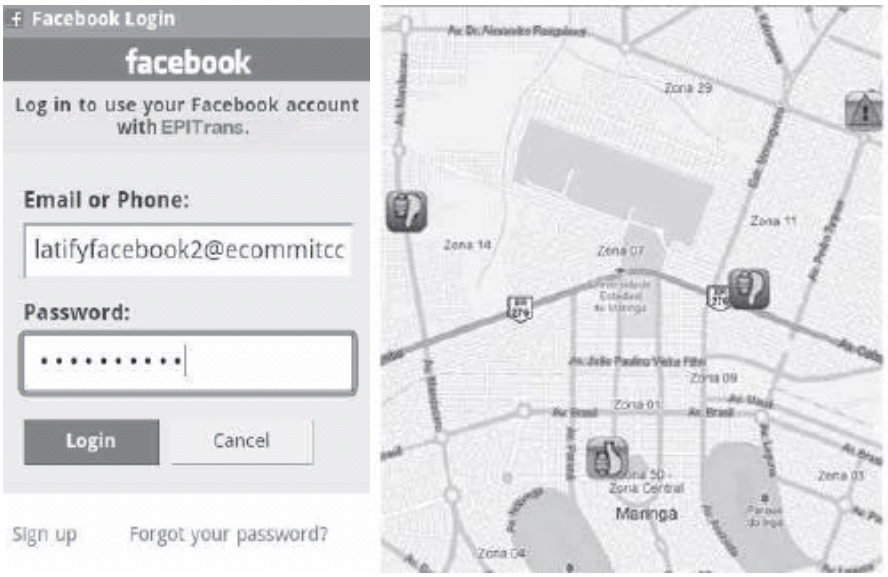

Figure 2.9: User interface of EPITrans application

Another similar study by Kushani Perera and Dileeka Dias [26] used Facebook with mobility of users to extract the information for the drivers, accessible by smart phone. The basic connotation of the system is to assist drivers to organize their actions, best time utilization along the way, decreasing the effect of traffic. This is in contrast to the existent approaches concentrated on controlling traffic in highways.

Vehicle is constantly tracked along the travel and information given to the user is adapted according to his position and time dimensions. "System is based on a decision tree based classification model to predict the future traffic and use those results for decision-making. The system mines spatio-temporal data to build the decision tree, therefore developed in a distributed architecture to avoid load for a single server" [27].

The System is exposed to the society by existing social networks, bringing social networks into vehicular context. Decision trees to predict traffic are periodically regenerated employing the most new information, therefore this is a smart system which realizes over experimental data, and best suited for a dynamic vehicular medium.

2.7 Road Information Extraction Using Video Streaming

One of the first methods used for traffic management and roadway analysis is Video cameras. This method is used to analyze data manually by operators. The present-day revolution of high processors has helped us to digitize and analyze the imagery which captured with high performance cameras and intelligent software which extract information from images and transform them as a flow of information (See Figures 2-8, 2-9). The Traffic Control Center of Istanbul Municipality calculates real-time images through a video processing system composed of 110 cameras of several characteristics. The operator monitors the images at the control room to realize any condition such as accidents or sudden road case. Video processors can sort vehicles by their length and record vehicle intensity and speed for each class and path video processors which track vehicles may also have the ability to record locomotion change and path changes. Vehicle density and link travel time are prospective traffic parameters that can be acquired by analyzing data from a flow of image processors which specified along a section of roadway [28]

Figure 2.10: Control center cameras

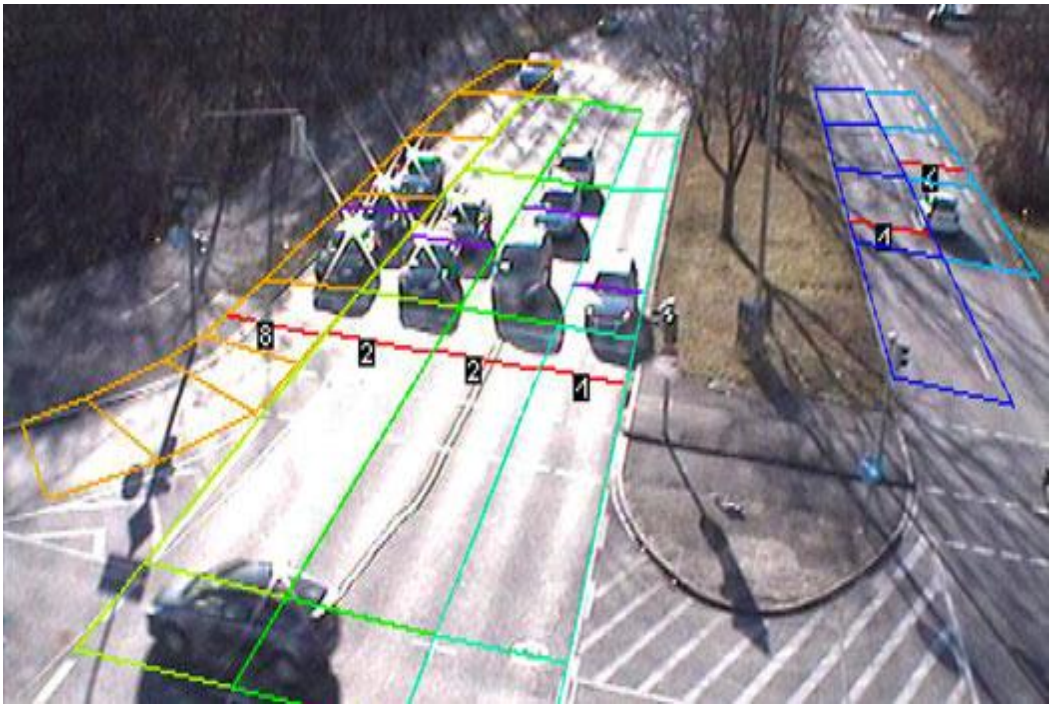

Figure 2.11: Analyzing traffic state

2.8 Road Information Extraction Using Satellites Images

With a quick development of automobile manufacture, automobiles have become something usually to use and it's widely used. However, the increases of automobiles led to crowded roads; In order to make the automobile achieve automatic shift transmission speedily and correctly, the current and subsequent road information of automobiles indicates serious importance to decrease overcrowding pressure [29]. At the moment, "the man stall transformation strategies depend on automobile state

parameters (such as throttle, driving speed, engine speed, et al.) as guiding data, without considering the vehicle current road status and drivers' individual factors and so on"[30]. Along the generalization and development of positioning technology and satellite navigation via GPS, and with the development of precision methods based on inertial guidance, GPS + DR crossbred positioning technology [31] , a precise positioning is possibly reached at. Developing cartography, surveying and mapping the high accuracy electronic map [32] has taken place of old methods to represent the map such as the manual draw of a map, the electronic map has been recognized. Meantime, the technique of merging the navigation and location data with map corresponding is in greatly developing process, and the real-time and precision are quite progressed. Vehicle navigation and many other areas are widely utilized. Based on above cases, a study by (WEI Da-chuan) has been proposed on GPS and the digital map. At first, using the GPS location method is to calculate the actual data of the vehicle location and direction, then to confirm the extracted data then, to be merged with the data of the inseparable road values of the digital map to calculate the road values of actual vehicle position and a front part of driving way. The algorithm can find road information precisely and entirely, and currently show the road status and driving status of actual position of vehicles on the digital map [30].

2.9 Road Information Extraction Using Vehicle Tracking

A study by Sophia Karagiorgou [33] has addressed the challenges of developing map data sets by working across the automatic map and attribute generation from large amounts of vehicle tracking information. An algorithm is used to extract information automatically from road network diagram and regarding attributes such as road categories from tracking information calculated using installed GPS on vehicles. Progresses in mobile computing have basically led to a development of online navigation services with a large number of users, this has helped them to set and convey their location. The development of Web applications that have the ability to set location as their core theme has further helped to increase the amount of tracking information that is currently available for data analysis.

CHAPTER 3
APPLICATION DEVELOPMENT ENVIRONMENT AND SYSTEM IMPLEMENTATION

The application is developed using Flex environment and Android SDK with Google API. The development environment and system implementation are explained in this section

3.1 Flex

We used in our implementation Flex Framework while developing the mobile application. Flex is a cross-platform development framework for creating Rich Internet Applications (RIAs). Application which implemented through flex environment can be played using Flash Player which is in website in general and Adobe AIR (Adobe Integrated Runtime) which is Desktop runtime of flex [34]. Flex basics are [35]:

- Tag based markup MXML serves as the basis for Flex projects
- MXML is a custom XML name space, like <mx:Tag></mx:Tag>
- Component based development: Containers/Layout Components, UI Elements, and Data Connectors
- Actionscript 3 can be used to add action within MXML
- MXML components brought to the stage by the GUI similar to Dreamweaver or VisualStudio

- Writing Markup by hand with code assist, similar to Dreamweaver or Visual Studio
- MXML components have attributes which able to modify of the application layout.Components can be extended for additional capabilities or reuse via MXML or AS or a combo of both
- Containers control layout (Canvas, Vertical Box, Horizontal Box)
- UI components display data, control and display states with visual feedback (Datagrids, lists, buttons, selects menus,
- Radio buttons, etc.)
- Data components are load or send data (Services, XML, Remoting, etc)
- Other tags include: Script, Style,etc
- Tags can be nested similar to HTML/XML

3.2 Adobe Flex Builder

Adobe Flex Builder was used as an integrated development environment in this study. Adobe Flex Builder (newly known as Adobe Flash Builder) is an integrated development environment (IDE) based on Eclipse Platform; this coding environment gives the developers the ability to use MXML and ActionScript editors to update MXML application. It also offers an interactive debugger, which shows the executing process, browsing variables and sees the comments. Recent version supports analyzing of performance. The side view shows the statistical data about memory usage with execution time [36] (See Figure 3.1).

Figure 3.1: Adobe Flex builder

3.3 Flex Features

With the last version of Flash Builder 4.7, the cross platform offers very powerful features, such as developing games with Actionscript with dot features to see the available function for each type of variables. Actionscript works under multi-threading smoothly with a wizard-based interface. Flash builder offers multi way to compile and test the application for IOS and Android application by USB and Wi-Fi (See Figure 3.2).

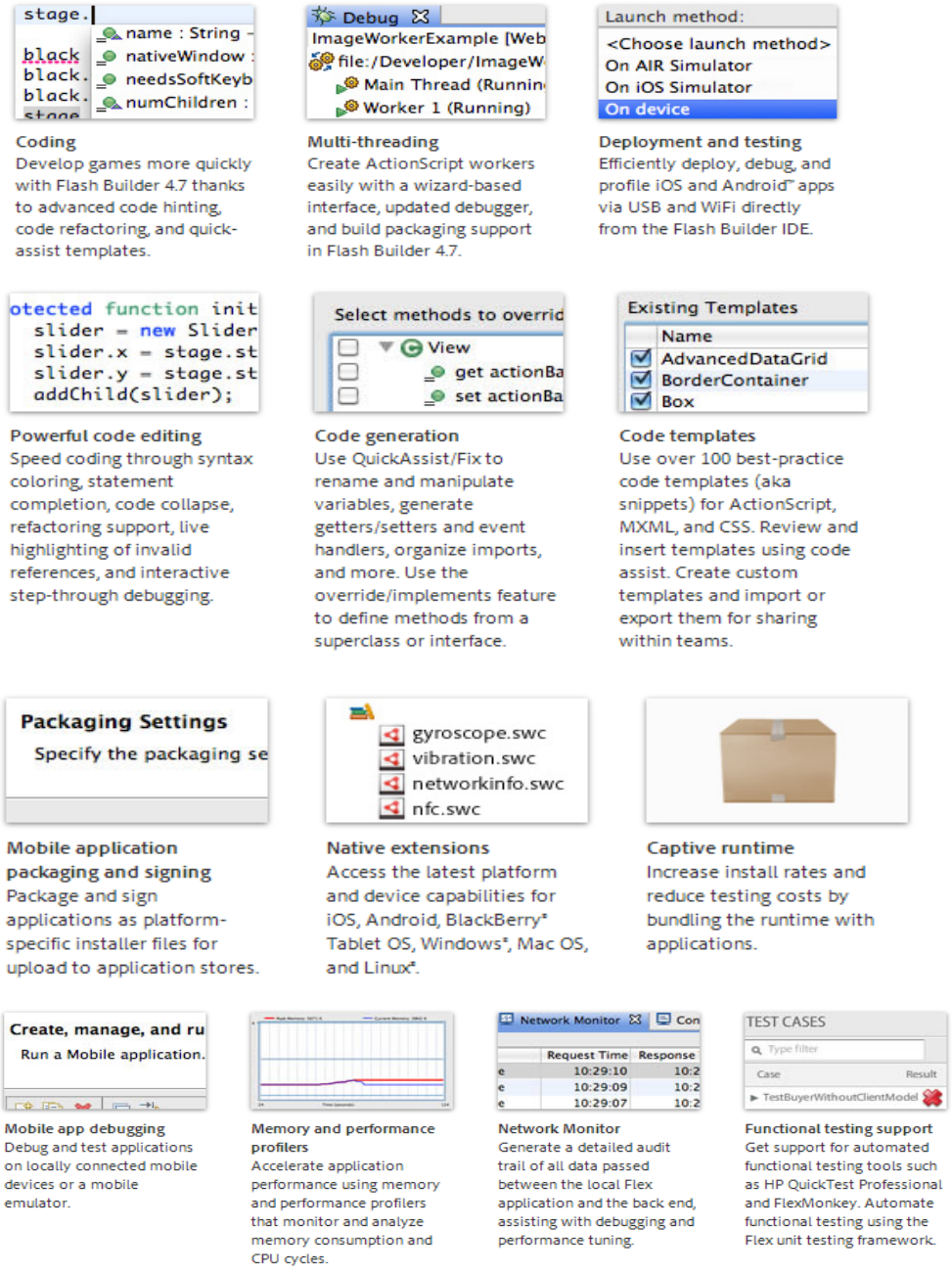

Figure 3.2: Flash builder features

3.4 Android Software Development Kit (SDK) and Air Runtime

To develop and Android application under Flex environment, the first requirement is installing Android SDK from Google which is available freely. The SDK package contains last versions of Android APIs and even older versions to give the developer a space to develop applications for multi, types of user devices also the package contains extra tools like (Google USB Driver, Google Play services, Android Support Library.. etc.) (See figure 3.3).

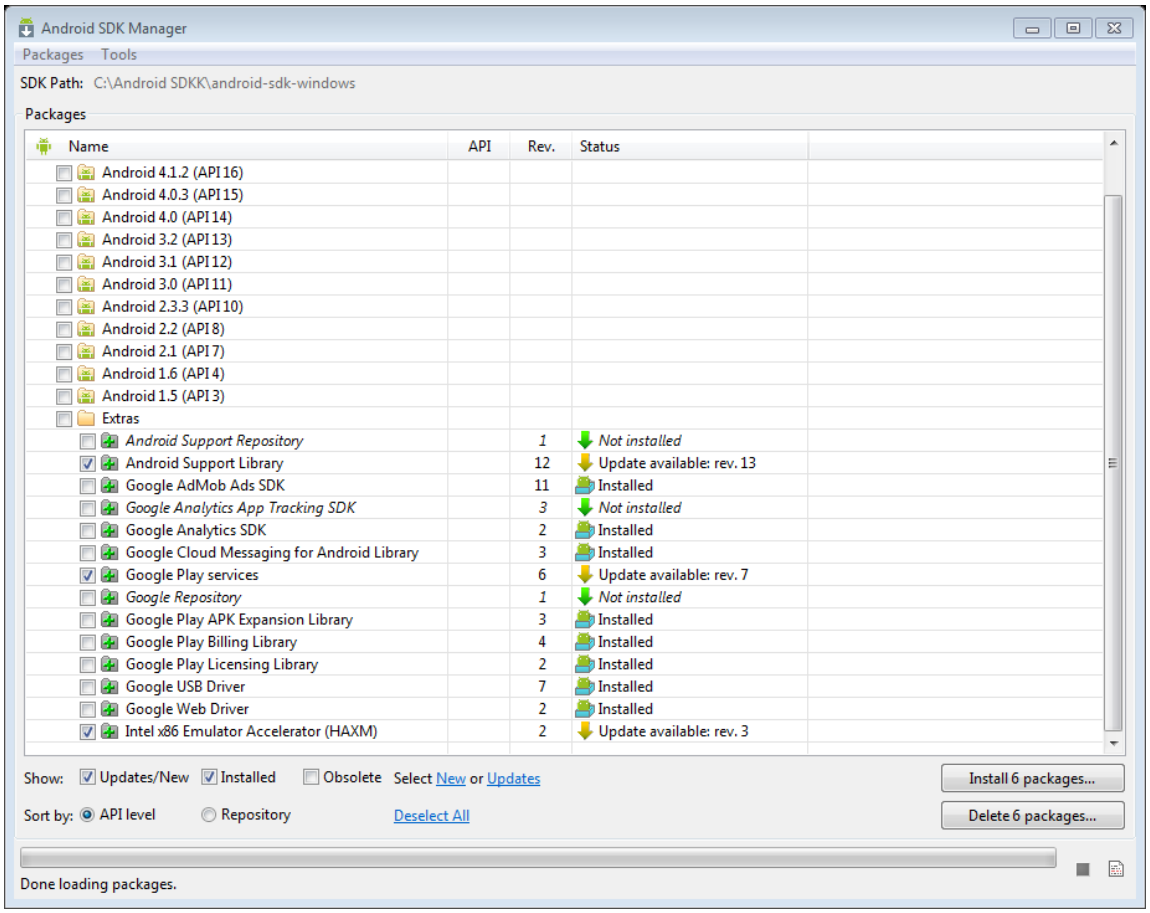

Figure 3.3: Android SDK package

The second requirement is Adobe AIR which is runtime of several of the operating system and various screens. It helps developers to make a powerful application which is able to play through multi platforms like web application, mobile application and Desktop application. To make mobile application developers should use ActionScript 3.0 which is runs under Adobe Flex and adobe Flash. For Desktop application, it's available to use HTML, JavaScript and Ajax. Adobe AIR offers multi environment skills inside one application. An application can be implemented with Flash, Flex and ActionScript or Ajax, JavaScript and HTML. For other side Users can run the AIR application in similar as native application. The runtime offers symmetric cross-operating system platform and framework to publish application therefore removes cross-browser testing by confirming regular functionality on personal computers. Instead of making application for specific platform, the powerful features of AIR are:

- Applications developed for AIR can play across various platforms without any extra plugins added by the developer. AIR achieves regular and prospective submission and interactions over the entire platforms confirmed with AIR.

- Implementation of an application can be faster by offering developers the opportunity to use web developing technologies and design pattern. They can provide web application to the desktop without knowing extra tools and technologies which are specific for desktop application or complication with a native tool.

- Developing an application is simpler than traditional language like C or C++. AIR offer APIs and framework packages have each platform confirmed with AIR.

- Native extensions for Adobe AIR, which provide ActionScript APIs that provide you access to platform-specific functionality programmed in native code. Native extensions can also provide access to legacy native code, and a native code that provides higher performance

3.5 System Implementation

The main requirements to develop this application are:

1- Flash Builder 4.6
2- Android SDK
3- Wamp Server
4- Google Map API
5- Geolocation library

Two applications were developed in this study. The first one is the Social network application and the second one is the Road information application. The first

important confirmations needed to develop such application are setting the accessibility of the application for the internal devices of the mobile like camera, Bluetooth and GPS. For this application it is important to set permission to access the internal GPS, reading the phone state and using a network and this process can be implemented by going to the (app.xml) file which is created within the package of an application and it contains all the features like the display name of the application and the access tags of an internal device. Inside the xml file under Android tag there are sub tags to get access to the internal devices.

```
<android>
    <manifestAdditions>
      <![CDATA[<manifest>
<uses-permission android:name="android.permission.INTERNET"/>
<uses-permission android:name="android.permission.WRITE_EXTERNAL_STORAGE"/>
<uses-permission android:name="android.permission.READ_PHONE_STATE"/>
<uses-permission android:name="android.permission.ACCESS_FINE_LOCATION"/>
<uses-permission android:name="android.permission.ACCESS_COARSE_LOCATION"/>
<uses-permission android:name="android.permission.CAMERA"/>
<uses-permission android:name="android.permission.RECORD_AUDIO"/>
<uses-permission android:name="android.permission.DISABLE_KEYGUARD"/>
<uses-permission android:name="android.permission.WAKE_LOCK"/>
<uses-permission android:name="android.permission.ACCESS_NETWORK_STATE"/>
<uses-permission android:name="android.permission.ACCESS_WIFI_STATE"/>
</manifest>]]>
    </manifestAdditions>
  </android>
```

READ_PHONE_STATE: needed to record the time of events
ACCESS_FINE_LOCATION: needed for accessing the GPS
ACCESS_NETWORK_STATE and ACCESS_WIFI_STATE: needed to access the server

After setting the permission tags we need to connect the application to Wamp as explained by Flep studio [37]

When the application is connected now all methods are available to interact with the database (Create, Delete and Update).

The third requirement is Google Map API. Google offer freely access to Map API with the package of the library which contains all the function to interact with the map. These libraries are packaged in file called SWF, which is available on google map APIs page [38].

The directory of the Google map SDK and contains the map_flex_*.swc. Now the application packaged all libraries to interact with the map, but Google limited the use of their map recently by adding a key for developers and to get the key the developer should have Google account to have access to Google API console's page (https://code.google.com/apis/console/). To get a specific key for an application it requires to have a Certificate (fingerprint SHA1) and URL of an application which is in local case is http://localhost. After putting these requirements Google console create specific API with features like limiting the number of user of this map or creating API keys for platforms like IOS and web application. In this case android key should be created to implement this application. Now all the functions of Google Map is ready to use. To call the map we can drag and drop a map from the component menu or write the code in the mxml file of the application.

```
<maps:Map id="map" x="11" y="240" width="340" height="326"

                                    key="MAP API KEY HERE"

                                    sensor="false" url="http://localhost"/>
```

To interact with the map we have to import the libraries which contain the needed function and for this application the libraries are:

```
import com.google.maps.ClientBootstrap;
import com.google.maps.ClientFactory;
import com.google.maps.LatLng;
import com.google.maps.LatLngBounds;
import com.google.maps.Map;
import com.google.maps.MapEvent;
import com.google.maps.MapMouseEvent;
import com.google.maps.MapOptions;
import com.google.maps.MapType;
import com.google.maps.controls.ControlPosition;
import com.google.maps.controls.MapTypeControl;
import com.google.maps.controls.ZoomControl;
import com.google.maps.controls.ZoomControlOptions;
import com.google.maps.interfaces.IPane;
import com.google.maps.overlays.Marker;
import com.google.maps.overlays.MarkerOptions;
import com.google.maps.styles.FillStyle;
import com.google.maps.styles.StrokeStyle;
```

To set the layout of the map we need to create an event for the map which contains all the main view of the map like the center of the map, the value of zoom and the map type.

```
Private function onMapReady(event:MapEvent):void {
this.mapp.setCenter(new LatLng(10,10), 14, MapType.NORMAL_MAP_TYPE);
mapp.setInitOptions(new MapOptions({mapType: MapType.NORMAL_MAP_TYPE, zoom: 14}));
mapp.addControl(new ZoomControl(new ZoomControlOptions({position: new
ControlPosition(ControlPosition.ANCHOR_TOP_LEFT)})));
mapp.addControl(new MapTypeControl());
```

The library (`import flash.sensors.Geolocation;`) is the library of Geolocation which get the package of GPS data.

This library enables the application to access the GPS of the mobile and read the NMEA protocol and package which contains (Longitude, Latitude and Altitude, Speed and time stamps) as explained in chapter 2

3.6 Application Structure

The structure of the application contains a specific database for each user. Each database of them is connected to all databases of other users if we assumed that all the users in the system are in contact with each other. For the other case as a minimum requirement of the system each user's database should be connected to one database of another user. Users' databases are connected to 2 databases. The first database is read only database which contains road coordinates and users can only

read from it. The second database is the database of the decision which extracted according the activity of users and users can write inside it and read the extracted decision The structure can be further detailed as follows for minimum requirements (see Figure 3.4) for the implementation structure (see Figure 3.5).

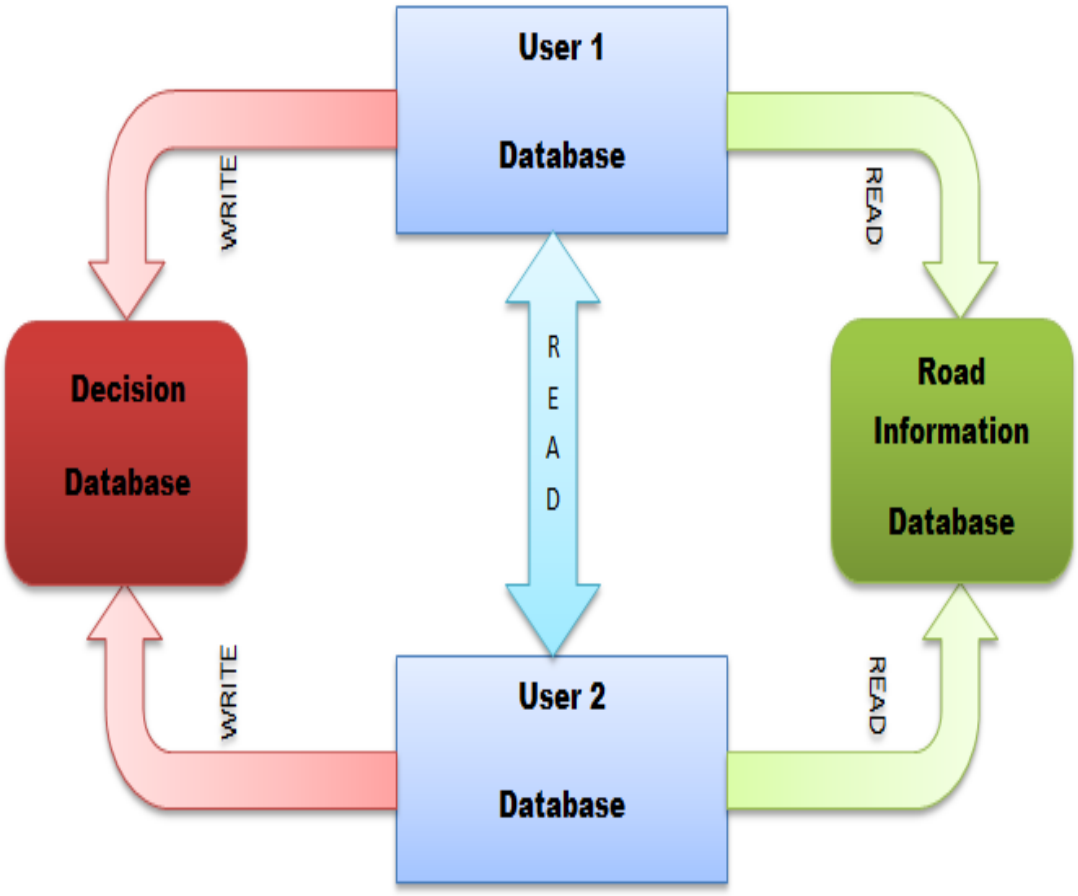

Figure 3.4: The minimum requirements

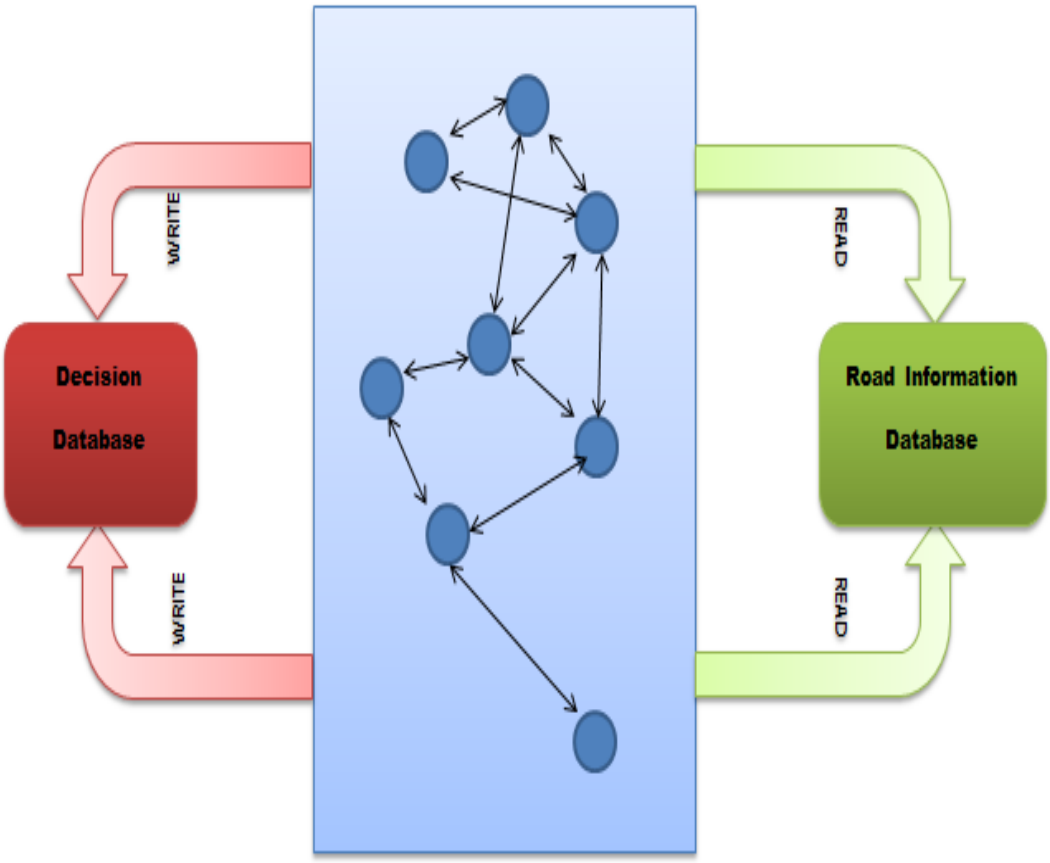

Figure 3.5: The Application structure

Users can access this decision database via Road Information Application and read the extracted information by social network users, (see Figure 3.6)

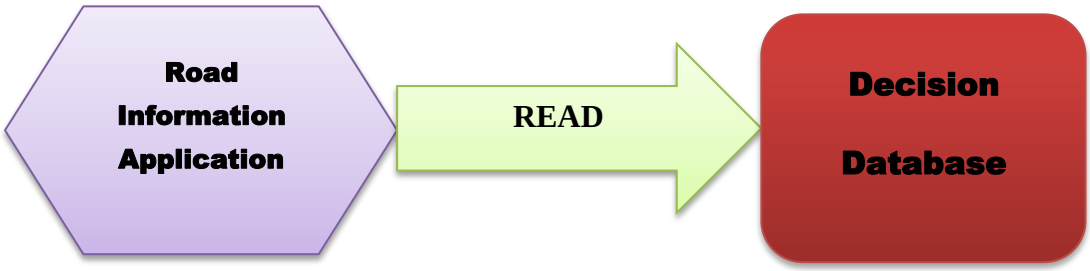

Figure 3.6: The structure of road Information application

The structure of the social network can be explained in (Figure 3.7)

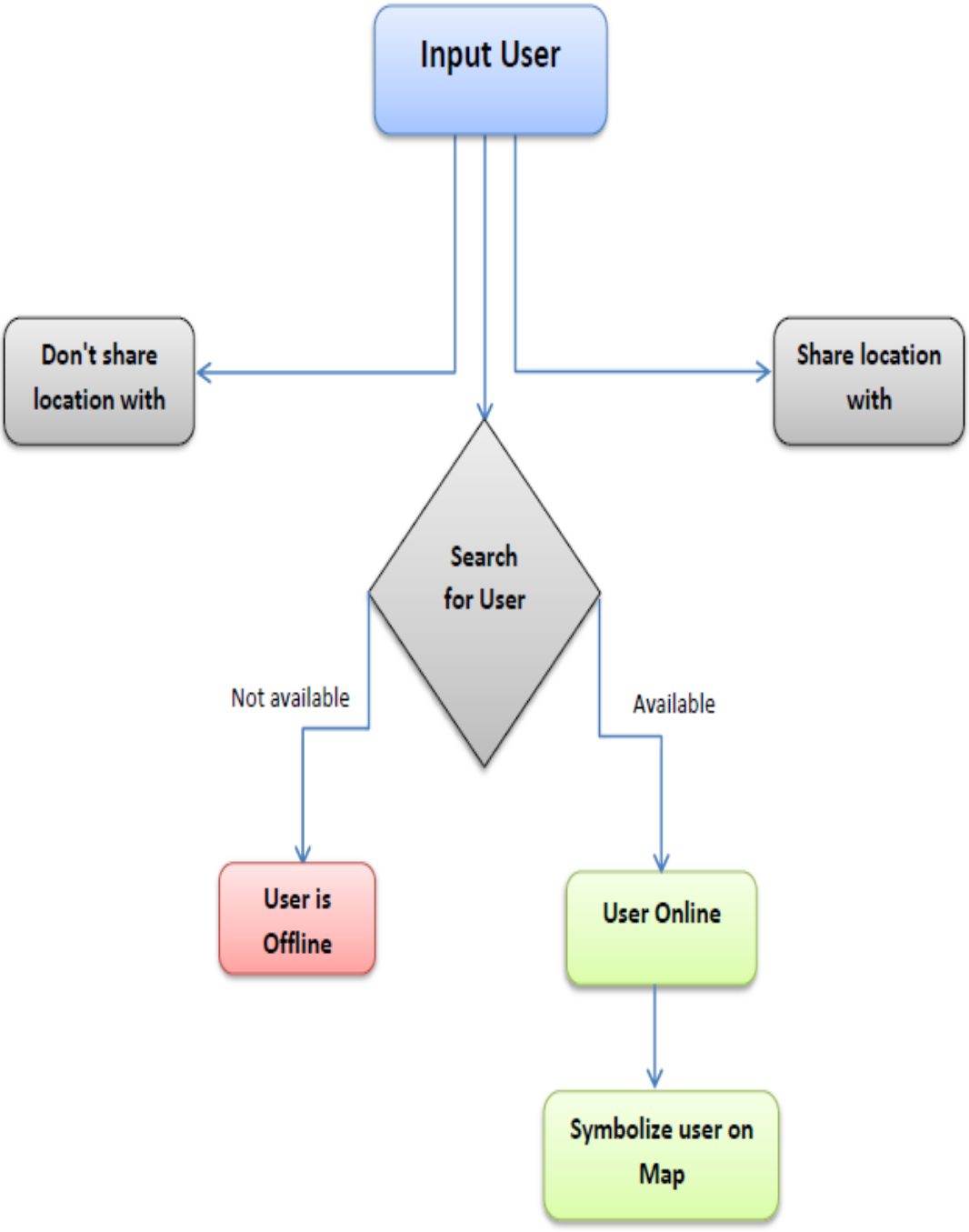

Figure 3.7: Social Network structure

3.7 User Interface

The main view of the application contains the text area to input the user ID and three buttons regarded to the social network and two buttons, one for GPS information and

one for Road information. In addition, the location of the current user will be symbolized by the Red mark on the map (See Figure 3.8)

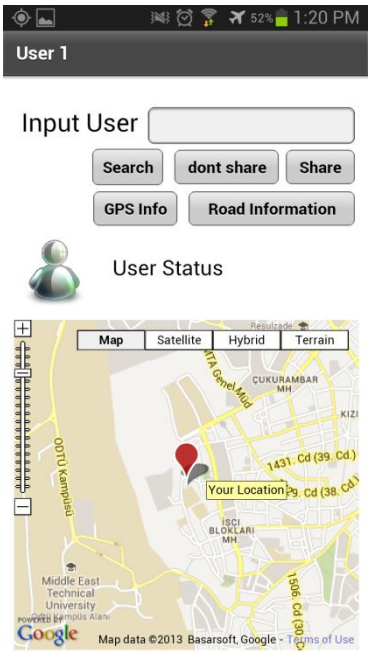

Figure 3.8: Main view

The first button "Search" interacts with what written inside the text area, when the selected user is available, then the target user will be projected on the map with The Green mark (See Figure 3.9)

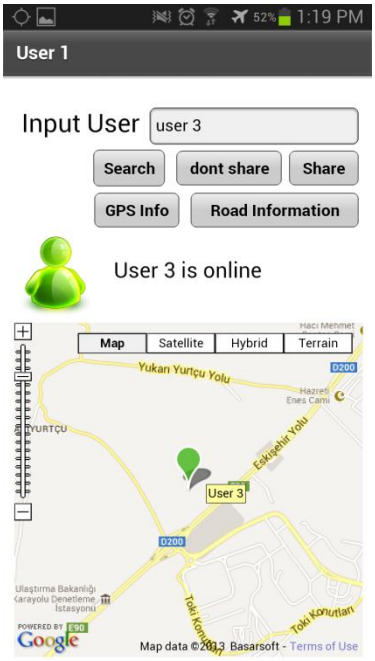

Figure 3.9: Symbolize targeted user

If the target user is offline then the status area show a message "User is offline" and show the Red symbol (See Figure 3.10)

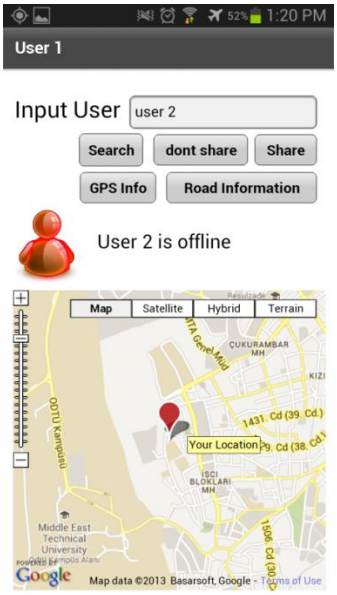

Figure 3.10: An offline user

The second button "Don't share" will prevent the selected user to see the current user location (See Figure 3.11). The third button share will allow the selected user to share the current user location (See Figure 3.12).

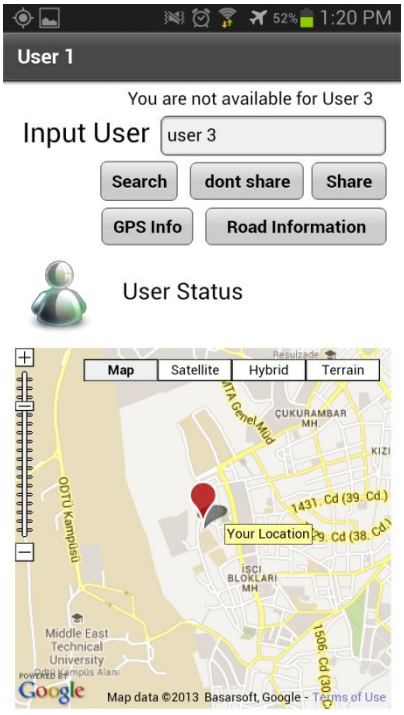

Figure 3.12: Share action

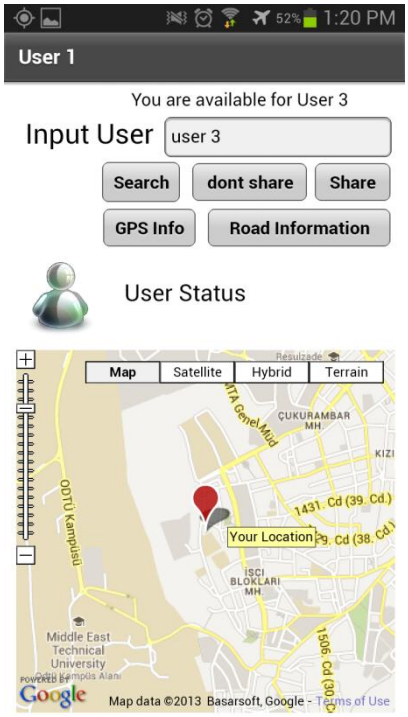

Figure 3.11: Don't share action

GPS info action shows the received GPS information of the current location (See Figure 3.13).

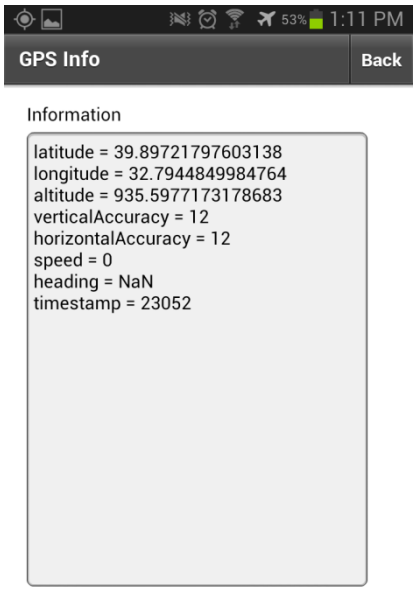

Figure 3.13: GPS information

Road information button action is opening a new page contains "Text input" and "check" button, the "Text input" is the road ID area and the "check" button search for the status of the requested road ID and show the status of the road and the record time of the status (See Figure 3.14)

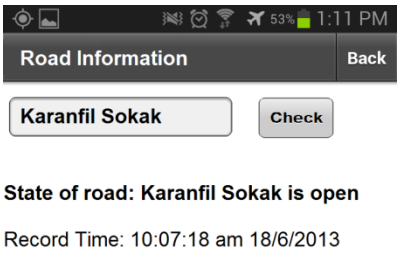

Figure 3.14: Road status

CHAPTER 4

RESULTS

In this study the application developed offers a mechanism to merge a social network with traffic system depending on the mobility features of the social network. The extracted information from the social network is the reason to reveal the traffic systems. The environment of the social network will be represented on the map, and users will be simulated on it to give the social network more interactivity. During the study, we found that the application can be used in some cases. According to the suggested case we made a survey to see the response and need of the application.

4.1 Case 1: Family Member's Application

This application offers a way to keep family members in touch. Each member of the family can share his/her location with all family members or can set specific person to share the location with. We made a survey for this application and we set Iraq as the target area to apply this application. For reasons related to an unsafe situation, we found that this application can be applicable. We used the Google survey through this study and the Questions that we used are:

1- How do you evaluate this application considering the situation in Iraq?
2- Do you think this application can contact family members easier and faster?
3- As a parent will you use the application to follow your family members?
4- As one of the family members will you allow the other family member to follow you?
5- What is your device platform?

The survey results with 80 responses that can be explained as follows:

- People evaluated the application with 82% as an important application in Iraq, 13% as an average application, 4% as not important and 1% said we don't know (see Figure 4.1).

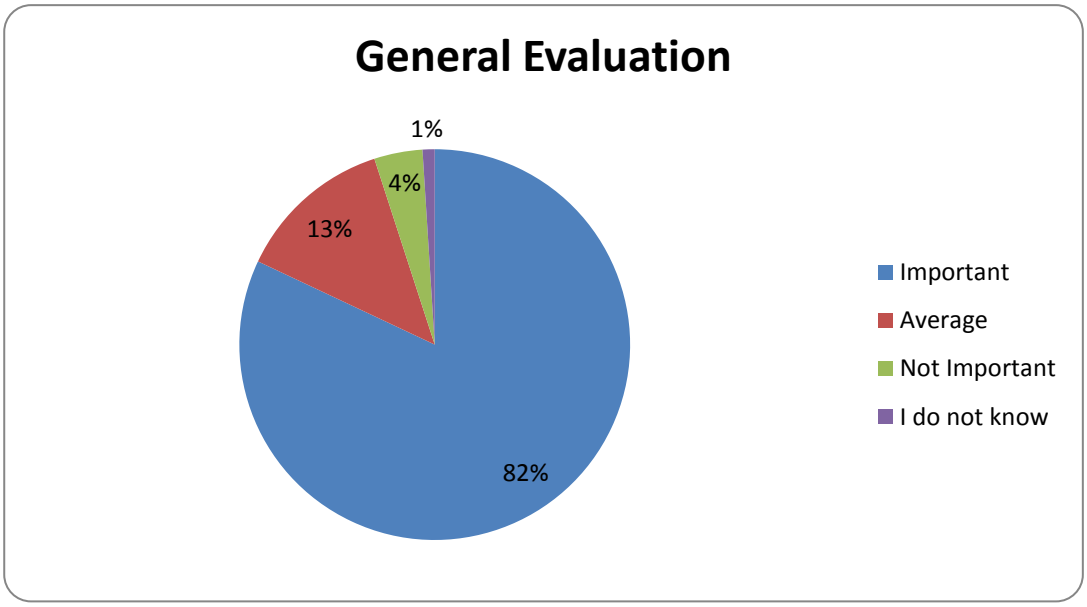

Figure 4.1: General Evaluation

- For the flexibility of the application and fast communicating, 8% said we do not know, 5% answered No and 87% answered Yes (see Figure 4.2)

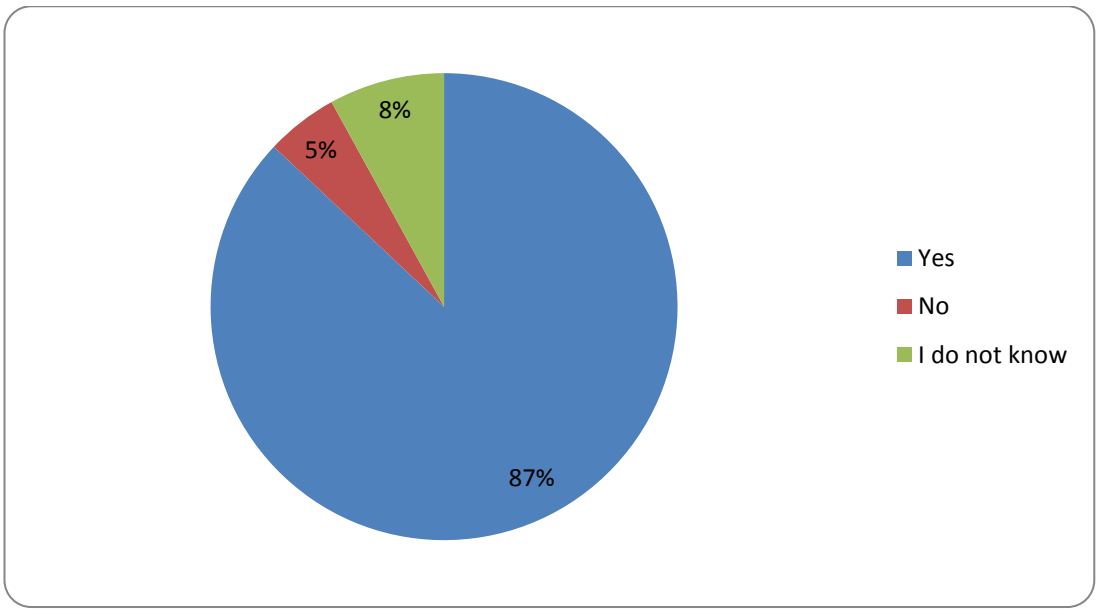

Figure 4.2: Motivation

- For the parents case, whether they will use the application to trace their sons or not, the results show 14% said we do not know, 11% answered No and 75% answered Yes (see Figure 4.3):

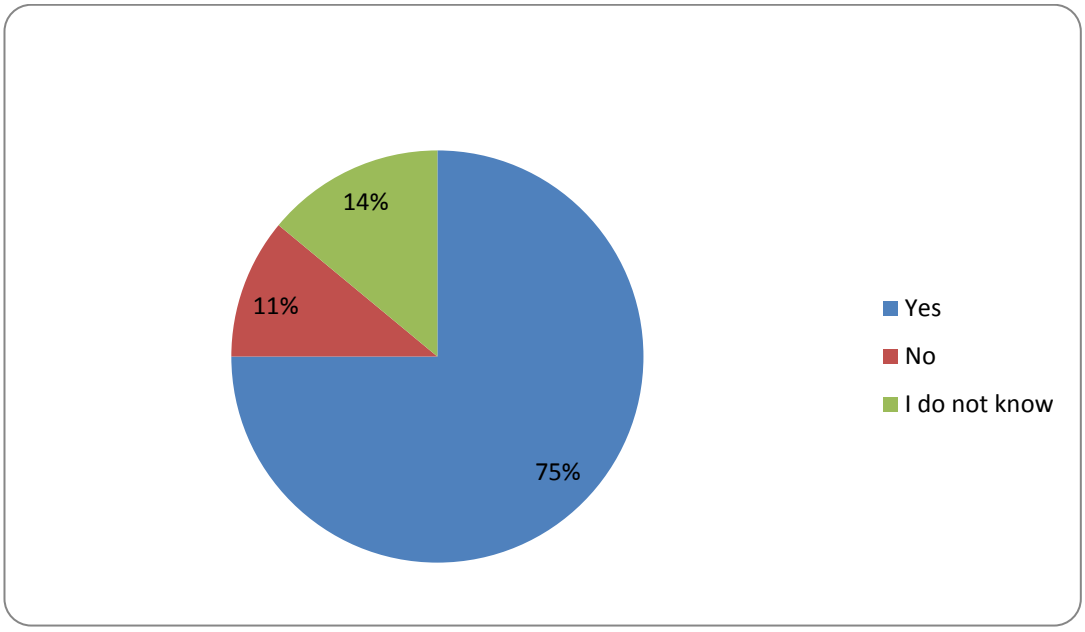

Figure 4.3: Parents use

- For the members of the family case, 23% said we do not know, 34% answered, yes, we share our location with specific persons or parents and 43% answered, yes, we share our location with all family members (see Figure 4.4):

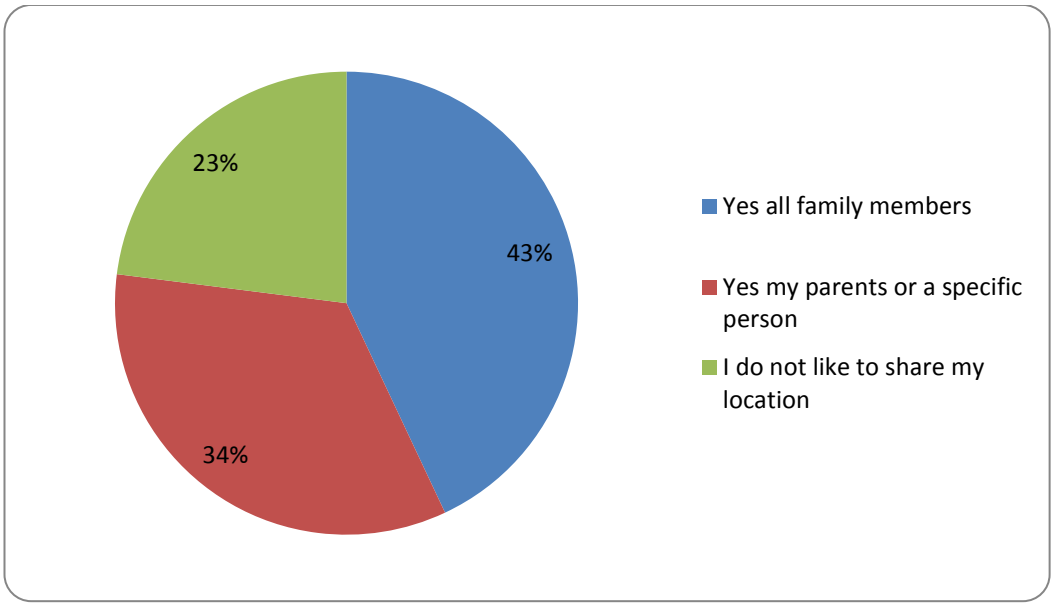

Figure 4.4: Family member use

- For the user device and platform, the results show 20% Nokia, 34% IPhone, 43% Android Device and 3% for other devices (see Figure 4.5):

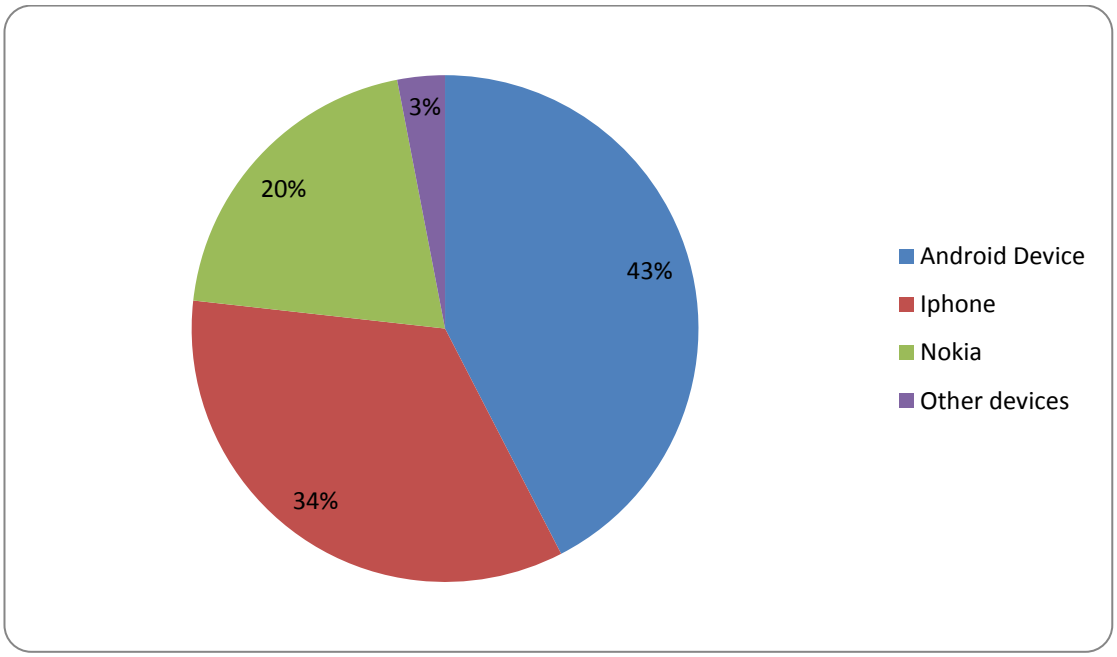

Figure 4.5: Mobile Platforms

4.1 Case 2: Business Use

In this case, the application offers an easy way for the owners of companies to monitor their employees. Smartphones with GPS capabilities authorize employers to track the whereabouts of their employees when they travel out of the work area

- Employers can use the GPS data to identify unauthorized activity that shows up the employer to responsibility or lost profits, such as moonlighting, speeding in company vehicles and inefficiency resulting in excess overtime
- Workers goal to what they comprehend as exceeding, particularly where employers keep an eye on worker movements during off-work hours.

Employee-who has smartphones, will play over 56% of the business smartphones shipped in 2013, for an overall of 56.7 million smart phones going into the hands of individual operators in the next three years [39].

4.3 Recommended Features

Through the survey people have recommended some features for the application:

1- **Emergency Button:** Emergency button function can send an alert to the connected members through the social network. The alert can be represented as a recorded text or voice message. This feature is suggested according to the unsafe situation and kidnapping operations which happen in Iraq.
2- **The Messenger:** Users can send Instant messages among themselves.
3- **Historical activity:** By recording the user activity daily or through a period, like visiting places with acceptance of the target lead to what is called historical activity.

4.3 Future Work

For future work, we find that the application can make the system more applicable and increase the accuracy of extracting information with the following features:

1- **3D Map:** Instead of using Google map, a specific 3D map can symbolize the users as 3D characters that can increase the interactivity of the application.
2- **Improve analyzing algorithms:** Powerful software is needed to extract more information from the user activity like finding the traffic load and recommending for another path**.**
3- **Data resources:** Connecting to more road databases can make the application more applicable and expand the area of use.
4- **Support other platforms:** It's important to support other smartphone platforms (IPhone, Windows Phone and Blackberry) to increase the number of users, in order to increase the extracted information of the roads.

Increase Location accuracy: This study using only GPS to set the location and the accuracy can be increased by using an alternative method like setting the location by Internet network; this feature can increase the accuracy of the application to work in the indoor environment.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

In this study, we have proposed a mechanism to use a social network activity to reveal the road information system. We have presented a free resource of information by user activity. At the same time, we have designed the social network to be interactive, and has been used a map to simulate the users on it. The system is based on smartphone's GPS. There are two applications developed for this study. The first application is the social network which represents the map view and user projection. The second application is the road information application which represents the extracted information from the social network application. The main implemented goals for this study are summarized as follows:

1- Using free information resources
2- Making the social network interactive
3- Revealing Road information
4- Using mobile device to represent the system

5.1 Application Process:

The application is based on four parts:

1- **GPS coordinates:** For this study GPS data are used.
2- **Server:** Wamp server to store the data is used
3- **Map:** We have used Google Map as the environment of the social network
4- **Mobile Application:** We have used Flash Builder 4.6 to develop the application

5.2 Application Results

Our application has used users' activity with data analysis as a resource to give information. As explained in chapter 2, using satellite image needs very powerful processors with powerful software, and also capturing the satellite images is costly. Video Streaming needs cameras with high resolutions and smart software to extract information. Our application uses the same mechanism of extracting information from the vehicle tracking system, but it considers the mobility of user as the resource. The development of smart devices with the social network has helped us to have a huge number of data which comes independently through users' activity. By using algorithms, the application offers information about the traffic. The increasing number of users helps to extract more information. The application offers an interactive social network by simulating the users on the map.

While implementing the application, the extracting of the results and the conducting of the application has been compared it with some studies in the literature (as listed below):

- For the vehicle tracking method: a study of WEI Da-chuan [29] used an algorithm of road information with GPS data and GIS system to determine the current information of the vehicle position, and check the extracted information. The algorithm can gain road information with accuracy in real time.

  Our study has used similar structure, but instead of vehicle tracking user activity has been used through the social network as the resource to extract the road information.

- For the video streaming method: A study by Erhan Bas [28] has explained that in the Istanbul municipality more than 110 video cameras along the major arteries in the city has been installed, and this number is increasing and powerful processors are needed to digitally process and analyze these videos in real-time in order to extract useful data on traffic flow and to find traffic events.

Our study has used social network data analysis as the resource of information.

- Extracting information from the social network:
    1. A study by Kyung Soo and his mates [23] has used real-time extracting semantic written texts on a social network.
       In this respect our study has used auto committed data of social network users to extract the information.

    2. A study by Elisa H. M. Huzita, Tainan G. F. de Souza and Yan H. Kabuki [25] has explained an application called EPITrans which aims at capturing messages from Facebook users and extracting important information, pointing out several instances on transit as traffic jams, accidents and floods.

       Another study by Kushani Perera and Dileeka Dias [27] has used Facebook with mobility of users to extract the information for vehicle drivers, accessible via mobile phone.

       Apart from the above study, we have used a native social network in our study to avoid the privacy policy of other social networks like Twitter, restricts access and use of the information published.

Through this comparison, the activity of the social network has become the resources of the extracted information that can be used to reveal the traffic system; In addition to the points of differences that have been referred in each comparison with each study, the social network that we have designed will be interactive and projected, since it is based on the provided efficient road information by the users; building on this, we can conclude that these two methods implemented separately in each study, stand in contrast to the one that we implemented here.

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APPENDIXES

Appendix (A)

Mobile Application survey

How do you evaluate this application considering the situation in Iraq?

- Important
- Average
- Not Important
- I do not know

2- Do you think this application can contact family members easier and faster?

- Yes
- No
- I do not know

As a parent will you use the application to follow your family members?

- Yes
- No
- I do not know

As one of the family members will you allow the other family member to follow you ?

- Yes all my Family members
- Yes my parents or a specific person
- I do not like to share my location

What is your device platform?

- Android Device
- Iphone
- Nokia
- Other Device

Appendix (B) - CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Alkateb, Abdulrahman

Nationality: Iraqi (IQ)

Date and Place of Birth: 20 august 1988, Mosul

Marital Status: Married

Phone: +9647711899923

Email: abd_alkatb@yahoo.com / c1171505@student.cankaya.edu.tr

EDUCATION

Degree	Institution	Year of Graduation
MS	**Çankaya University, Computer Engineering**	**2013**
BS	**Al-hadba'a University College, Computer Technology Engineering**	**2011**
High School	**Al-Resala**	**2007**

WORK EXPERIENCE

Year	Place	Enrollment
2012-Present	**TEDxBaghdad**	**Mobile Application Developer**

FOREIGN LANGUAGES

Advanced English, French, Turkish

HOBBIES

Swimming, Football, Bowling, Billiard, Table Tennis.