Mobile Travel Guide For Tourism

by

Sukainah

Dissertation submitted in partial fulfillment
of the requirements for the
Bachelor of Technology (Hons)
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CERTIFICATION OF APPROVAL

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Sukainah Husein

A project dissertation submitted to the
Computer and Information Science Programme
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in partial fulfillment of the requirement for the
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(INFORMATION AND COMMUNICATION TECHNOLOGY)

Approved by,

_____

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UNIVERSITI TEKNOLOGI PETRONAS
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January 2006

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

SUKAINAH HUSEIN

ABSTRACT

The number of local and foreign tourists worldwide has increased dramatically. However, services provided are always not enough to satisfy the tourists. Tourists will need an easy access providing them information at anytime, anywhere, with affordable price. To overcome this problem, Mobile Travel Guide for Tourism project was initiated.

This system is using SMS as the user interface and it understands users' input with predetermined format as queries to access the database. Methodology that is practically adequate to be implemented in this system is Phased Development-based methodology. To compute directions to a place, the system is implementing Dijkstra algorithm which is efficient to find the shortest path.

The system implementation is done through a wireless modem connected to a server that contains the database of all information. SMS Gateway is installed in the system to interface between the modem and the users' request database. At the end of the project, it is expected that the satisfactory level of tourism industry will be appreciating.

ACKNOWLEDGEMENT

First of all, I would like to thank God for giving me the chance to be able to engage in this project. With Him, all things are possible.

I would like to thank my Supervisor Mr. Mohd Hilmi Hasan and Ms. Zuraidah Sulaiman, for their valuable guidance and advice in communicating how a Final Year Project should be done.

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LIST OF ABBREVIATIONS

API	Application Program Interface
BTS	Base Transceiver Station
GSM	Global System Mobile
PDU	Protocol Data Unit
SMS	Short Message Service
SQL	Structure Query Language
SMSC	SMS Center
USB	Universal Serial Bus
UML	Unified Modeling Language

CHAPTER 1
INTRODUCTION

1.1 PROJECT BACKGROUND

Recently, "Visit Malaysia 2007" program is being promoted around the world to boost Malaysian tourism industry. This program has been started for a few years back. Since the starting of the program, tourism has become one of the major industries in Malaysia. The number of foreign visitors has increased dramatically. This fact is shown in Malaysian statistic in Figure 1.1 from the Ministry of Tourism.

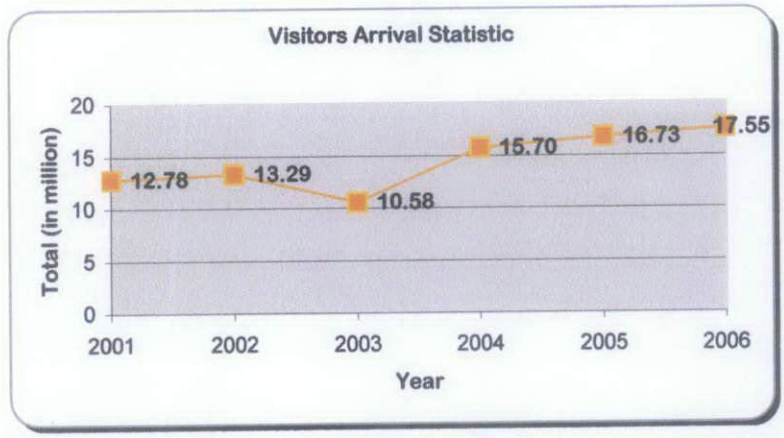


Figure 1.1 Visitors Arrival Statistic

These visitors are potential tourists who would be exercising financial activities in the country hence leveraging Malaysia's economic growth. Some numbers of tourism services had been delivered to aid the tourists, such as tourism centers, official map and brochures. However, services provided are very limited. There are only thirteen Tourist Information Centers laid throughout Malaysia (Minister of Tourism Malaysia, 2007); causing difficulties of finding tourism information instantly.

Other than Malaysia, many other countries are also promoting their tourism industry. In Thailand, tourism is a major economic factor (Wikipedia, 2007). Thai government is promoting the Amazing Thailand program. Tourism service is always in need to assist the countries' program.

1.2 PROBLEM STATEMENT

Problems arise when it comes to information acquisition. Several problems faced by the tourists are as follow:

- Tourism Offices are provided throughout the country to guide the tourists. But the number is limited to certain areas. These offices are mostly located at the city centers, terminals, airports, etc. *When the tourists need guidance in a certain area, they could not easily find a help other than the travel guide books, brochures, or maps, which sometimes are not updated.* A survey out of 60 respondents, whose result is depicted below, has proven that these information centers are not reachable when needed. The list of respondents' country of origin is tabulated in Chapter 2.

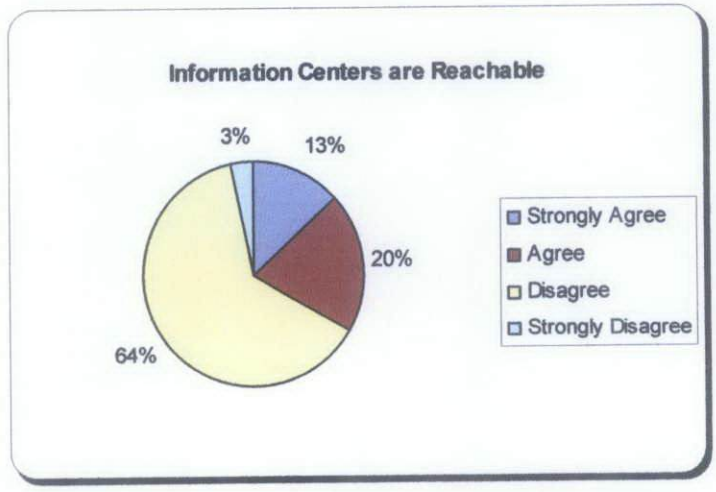


Figure 1.2 Information Centers Location Chart

The chart shows that 64% respondents disagree and 3% strongly disagree with the statement "Information centers are reachable". Hence, 67% of respondents said that the information centers provided are not easily reachable when needed.

- Psychologically, some people are reluctant to ask. Furthermore, not everyone is able to speak English and the English-speakers speak in different dialects which happen to be hard to comprehend by the tourists. *Some people might feel comfortable when initiating a conversation with the locals*, but some do not. This assumption is based on a survey result below.

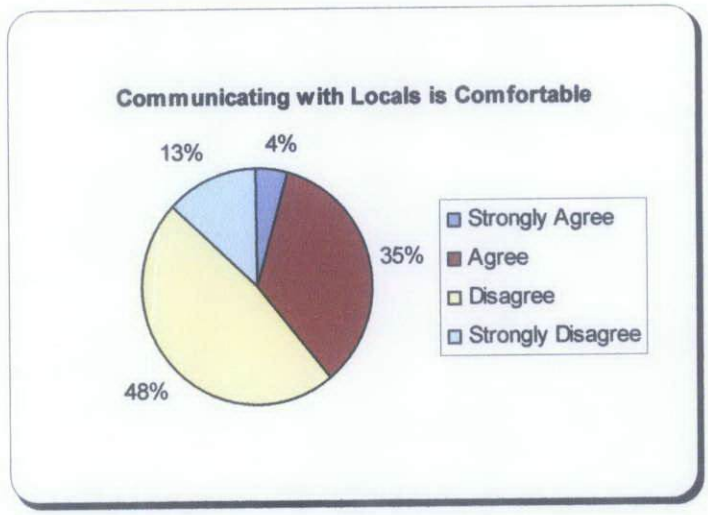


Figure 1.3 Communication with Locals Chart

Some respondents answered that it is comfortable to interact with the locals in obtaining direction, but most of them, 61%, admitted that it is uncomfortable to initiate a conversation with the locals.

- Some travel guide services available today requires GPS enabled devices. These devices are costly and still uncommon especially in developing countries.

To simplify, the problem statement that motivates this project is "Tourists need information regardless the area and there are not many information offices to encounter their enquiries. Language is one of communication barriers to ask for directions. Time and accuracy are further valuable constraints to realize their journey."

1.3 OBJECTIVES AND SCOPE OF STUDY

Inspired by the motivation above, a solution is taken to overcome the problem. Mobile communication has now played an important role in our daily activities. It is not a new technology and is understandable to most people. These advantages are taken into consideration to develop the system. The system will use SMS gateway as this service is accessible through any mobile devices at relatively low fare. Furthermore, a survey has been taken to assess the market needs on the system's mechanism.

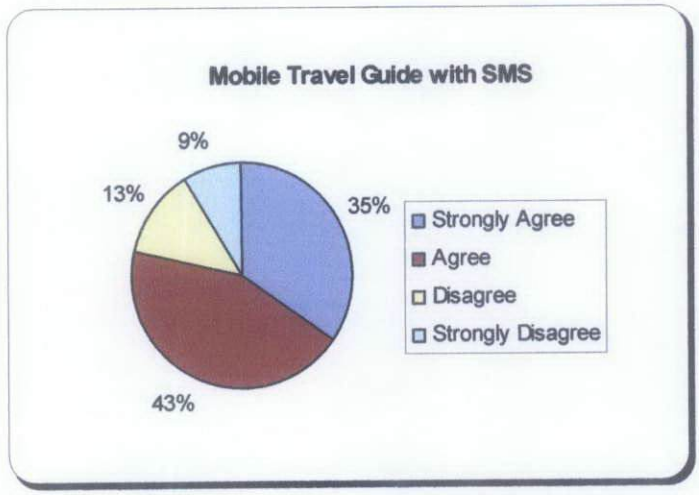


Figure 1.4 Mobile Travel Guide Mechanism Chart

From chart in Figure 1.4, 78% of total respondents agreed that the system has to use SMS. This result shows that there is still a huge demand on SMS application to be developed.

Hence, the ***objective of the project*** is to develop a mobile travel guide via SMS that is able to:

1. process users' input with predetermined format;
2. find directions from an area to another with user specified origin and destination;
3. search information for hotels, places of interests, as well as hospitals;
4. reply according to users' enquiries.

The ***scope of the project*** is limited to:

1. developing system's prototype that is covering Kuala Lumpur area only;
2. providing distance, cost and duration based on author's assumptions;
3. processing text inputs only;
4. replying in text only.

1.4 FEASIBILITY OF THE PROJECT

1.4.1 Technical Feasibility

Technical feasibility of the project involves familiarity of the application, project size and compatibility. The risk and assumption of each factor is listed in Table 1.1.

Table 1.1 Technical Feasibility Risk

Factors	Risk	Assumption
Familiarity of the application	Low risk	SMS technology is not a new technology; hence users are familiar with the technology and this kind of application.
Project size	Moderate risk	The system resulted in the end of this project will be a prototype that simulates the actual system. The scope of the prototype is limited to some extent which will be discussed later.
Compatibility	Moderate risk	The system is dealing much with hardware (GSM Modem, Server).

1.4.2 Economic Feasibility

The development of the prototype *does not require any costs* since the software used is open source and freeware. The hardware used is developer's personal belongings. This project benefits in customer satisfaction who is tourist in this context. It will increase the country's revenue over tourism industry indirectly.

However, actual development and operating costs of the actual product cannot be determined at this stage because it involves research on the actual information such as distance, duration, and cost of traveling.

1.4.3 Organizational Feasibility

From an organizational point of view, this project has *low risk*. The objective of the system is aligned with the organization's goal to improve the tourism industry. The actual project champion is expected to be the Minister of Tourism or his trusted subordinates. The users of the system, tourists, are expected to appreciate the benefits of mobile travel guide's system presence.

CHAPTER 2
LITERATURE REVIEW

During the initial phase of the project, there were some questions that arose on the concept of the system. To answer those questions, some literatures had been studied whose reviews are explained briefly in this chapter.

2.1 SHORT MESSAGE SERVICE

2.1.1. SMS Technology

According to IEC (2007)

Short message service (SMS) is a globally accepted wireless service that enables the transmission of alphanumeric messages between mobile subscribers and external systems such as email, paging, and voice mail system. It is very beneficial to operators as well as subscribers. From the subscribers' point of view, SMS is convenient, flexible and offering seamless integration of messaging service and data access.

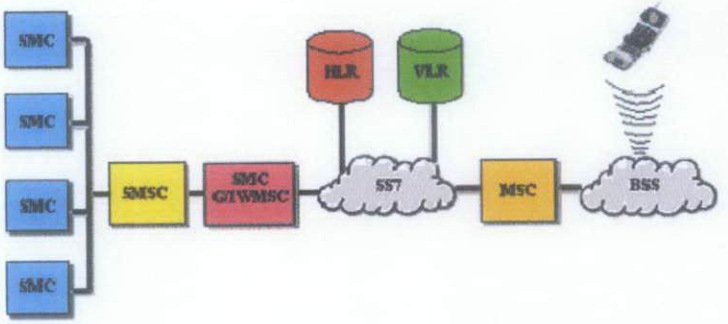


Figure 2.1 SMS Network Architecture by IEC

A characteristic of the service is that an active mobile handset is able to receive or submit a message at any time, independent of whether or not a voice or data call is in progress. SMS also guarantees delivery of the message by the

network. Temporary failures are identified, and the message is stored in the network until the destination becomes available.

SMS has been a marketable trend over years and many SMS applications have been developed. Compare to the latest technology such as WAP, SMS is still more marketable because of its cost saving and ease of use with any mobile device, where as using WAP subscribers need to have a sophisticated device. User familiarity of the technology also plays significant role in determining the success of a system. These facts brought SMS based application as a feasible project.

According to Developers' Home Web (2007)

SMS is a success all over the world. The number of SMS messages exchanged every day is enormous. SMS messaging is now one of the most important revenue sources of wireless carriers. SMS is a suitable technology for wireless applications to build on. Here are some of the reasons that make SMS a suitable technology for wireless applications to build on:

- SMS messaging is supported by all GSM mobile phones. Building wireless applications on top of the SMS technology can maximize the potential user base.
- SMS messages are capable of carrying binary data besides text.
- SMS supports reverse billing, which enables payment to be made conveniently. One way to accept payment is to use a reverse billing phone number obtained from a wireless carrier.

2.1.2. SMS Gateway

According to AveAccess (2003)

The SMS Gateway is a platform independent solution for text messaging. The SMS Gateway software enables the application developer to create solutions that can send short messages to wireless devices in a short amount of time. One of the important features of the SMS Gateway is that e-mail message arrivals can be notified to an SMS device.

According to IMImobile (2005)

SMS Applications can be delivered to users by interfacing them to an SMSC, which is the central component in an SMS network. SMS gateway is necessary for the following reasons:

- Compatibility; supports inter networking amongst various SMSCs implemented by various vendors.
- Conversion of SMS protocols such as SMPP/CIMD/UDP to HTTP format
- Handles and control of large traffic.
- Keeps track of the records such as user details, time stamp billing etc.
- Supports APIs for easy plug in of applications.

2.1.3. Ozeki NG SMS Gateway

Ozeki NG SMS Gateway provides the highest performance, availability and security to run the SMS applications. It has the capability of sending 300 SMS messages per second with 100 simultaneously connected applications from 64 concurrent SMSC connections. It also is also reliable as it works 24/7, manages network link failures, service provider failures, and tolerates server reboots. (Ozeki Informatics Ltd., 2007)

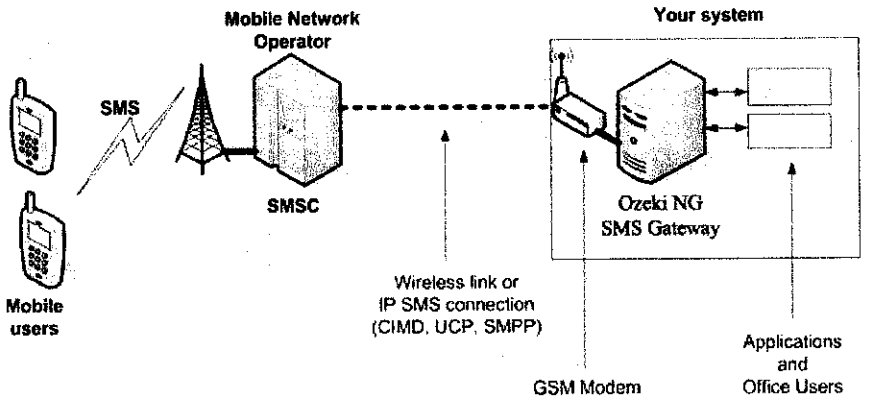


Figure 2.2 Ozeki NG SMS Gateway Architecture

2.2 SERVER CONNECTIVITY

2.2.1. GSM Modem

Message sent by user is captured by a device called GSM Modem. As defined by *Ihub (2006)*, A GSM modem could be an external modem device with a GSM SIM Card and connected to the computer via serial port. A GSM modem could also be a standard GSM mobile phone with the appropriate cable and software driver to connect to a serial port on your computer.

There are two modes supported by the modem, text mode and PDU mode. Text mode allows the modem to accept and view the message in an ASCII text format while PDU mode accepts the message and view it in hexadecimal number. PDU stands for Protocol Description Unit. "The PDU string contains not only the message, but also a lot of meta-information about the sender" says *Gunawan (2005)*.

Khang (2002) says that to ease our task of learning PDU codes, we can use PDUSpy software to encode and decode from PDU to text. PDUSpy is free software downloadable from internet.

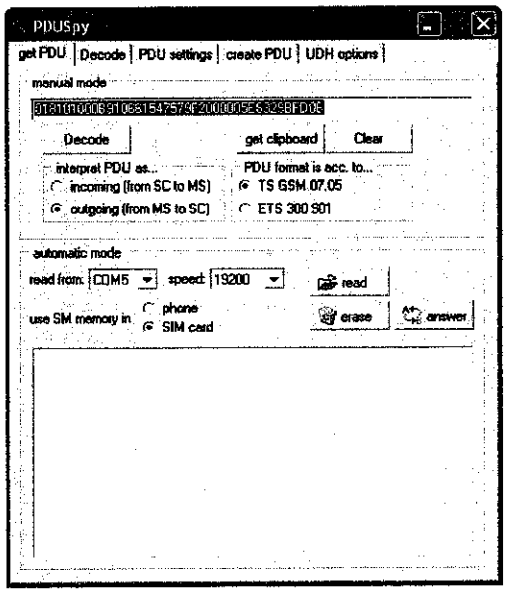


Figure 2.3 PDUSpy Software

After all, the modem can be controlled by sending instructions called AT commands. These commands are standard commands for modem connection. In assembly language, different microcontroller supports different set of commands. Same goes to AT commands where different hardware supports different set of commands. According to *Gunawan (2005)*, one way to send these commands is using Windows HyperTerminal. From here the messages are retrieved and sent to the users.

2.2.2. Java Communication API

According to Darwin (2001)

Controlling the modem automatically can be done using the Java Communications API, which is in package javax.comm. Sun Microsystems does not deliver the package anymore due to some reasons. However, we can use rxtx package developed by the Java forum, which is an open source package that has the same classes and modules with javax.comm package.

The Communications API is centered on the abstract class CommPort and its two subclasses, SerialPort and ParallelPort, which describe the two main types of ports found on desktop computers. CommPort represents a general model of communications, and has general methods like getInputStream() and getOutputStream() that allows user to communicate with the device on that port.

However, the constructors for these classes are intentionally non-public. Rather than constructing them, the static factory method CommPortIdentifier. getPortIdentifiers() let the user choose a port from this list, and call this object's open() method to receive a CommPort object.

2.3 DATABASE MANAGEMENT SYSTEM

In database management, a database is a logically integrated collection of data maintained in one or more files and organized to facilitate the efficient storage,

modification, and retrieval of related information. In a relational database, for example, data are organized into files or tables of fixed-length records. Each record is an ordered list of values, one value for each field. Information about each field's name and potential values is maintained in a separate file called a data dictionary. A database management system is a collection of procedures for retrieving, storing, and manipulating data within databases.

2.3.1. MySQL Database Server

According to MySQL AB (2007)

MySQL, the most popular Open Source SQL database management system, is developed, distributed, and supported by MySQL AB. MySQL AB is a commercial company, founded by the MySQL developers. It is a second generation Open Source company that unites Open Source values and methodology with a successful business model.

2.4 ROUTING MECHANISM

Places and highways can be seen as a network and when depicted in a graph, the specific places are referred to as nodes and the highways are the arcs. To find the routes from one node to another node, we need to define which arcs to be taken. Considering other factors or weight of the routes such as distance, time or fare, we can find the best route which then would be suggested to the user. A solution to the shortest path problem is sometimes referred as pathing algorithm.

According to *Cormen (2001)*, the most important algorithms for solving this problem are:

- Dijkstra's algorithm; solves single source problem if all edge weights are greater than or equal to zero. Without worsening the run time, this algorithm can in fact compute the shortest paths from a given start point *s* to all other nodes.
- Bellman-Ford algorithm; solves single source problem if edge weights may be negative.

- A* search algorithm; solves for single source shortest paths using heuristics to try to speed up the search
- Floyd-Warshall algorithm; solves all pairs' shortest paths.
- Johnson's algorithm; solves all pairs shortest paths, may be faster than Floyd-Warshall on sparse graphs.
- Perturbation theory; finds (at worst) the locally shortest path.

2.4.1. Dijkstra Alogorithm

The most common algorithm used to find the path efficiently or shortest path is Dijkstra algorithm.

According to Moy (1994)

To get the most efficient path in an area, we have to calculate the shortest-path tree for the area. This calculation yields the set of routes associated with an area. In a network, a router calculates the shortest-path tree using itself as the root. The formation of the shortest path tree is done here in two stages. In the first stage, only links between routers and transit networks are considered. Using the Dijkstra algorithm, a tree is formed from the subset of the link state database. In the second stage, leaves are added to the tree by considering the links to another area network. The area's link state database is represented as a directed graph.

According to Chamero (2006)

The algorithm works from a source (s) by computing for each vertex v pertaining to V the cost $d[v]$ of the shortest path found so far between s and v. Initially this value is set to 0 for the source vertex s ($d[s]=0$), and infinity for all other vertices, representing the fact that we do not know any path leading to those vertices ($d[v]=\infty$ for every v in V, except s). When the algorithm finishes, $d[v]$ should be the cost of the shortest path from s to v (or infinity, if no such path exists).

The basic operation of Dijkstra algorithm rests on the essence of Dynamic Programming and is named "edge relaxation". Let's suppose that we are looking

the shortest path that goes from s to v. If we know the shortest path from s to all possible u's connected to v and if there are edges from those u's to v, then the shortest known path from s to u ($d[u]$) can be obtained through a path (the best path) from s to v by adding edge (u,v) at the end. This path will have length $d[u]+w(u,v)$. If this is less than the current $d[v]$, we can replace the current value of $d[v]$ with the new value. Edge relaxation is applied until all values $d[v]$ represent the cost of the shortest path from s to v. The algorithm is organized so that each edge (u,v) is relaxed only once, when $d[u]$ has reached its final value.

The algorithm maintains two sets of vertices S and Q. Set S contains all vertices for which we know that the value $d[v]$ is already the cost of the shortest path and set Q contains all other vertices. Set S starts empty, and in each step one vertex is moved from Q to S. This vertex is chosen as the vertex with lowest value of $d[u]$. When a vertex u is moved to S, the algorithm relaxes every outgoing edge (u,v).

Dijkstra Algorithm

```
1 Function Dijkstra(G, w, s)
2  for each vertex v in V[G] // Initialization
3   do d[v] := infinity
4    previous[v] := undefined
5  d[s] := 0
6  S := empty set
7  Q := set of all vertices
8  while Q is not an empty set
9   do u := Extract-Min(Q)
10   S := S union {u}
11   for each edge (u,v) outgoing from u
12    do if d[v] > d[u] + w(u,v) //Relax( u,v)
13    then d[v] := d[u] + w(u,v)
14    previous[v] := u
```

Figure 2.4 Dijkstra Pseudocode

2.5 DEVELOPING SUSTAINABLE TOURISM SERVICES

According to TEAM (2007)

Tourism has been and will continue to be a key economic activity in Malaysia as it is in many countries in the coming decades. However, long term success of the

tourism in Malaysia hinges on the country's ability to develop sustainable tourism and attract repeat visitors. Both require the existence of a quality workforce that is attuned to the highest international standards yet deeply steeped in our culture, traditions and heritage. Excellent customer service will ensure that our guests look forward to return to Malaysia again and again.

One quality service that can be provided to tourists is a travel guide, might be in form of printed documents, e-travel guide accessible through internet, and or other travel guide services. This innovation would be very helpful especially in non-English speaking countries. Travelers tend to travel to countries whose language is understood by them. "While a matter of personal taste, willingness to learn foreign languages, and other stipulations, countries where the English language is not widely understood or holds little sway in everyday life can be seen as a hindrance for independent travel for those who do not speak the local language." (Wikipedia, 2007)

A case happened in Ireland where "hundreds of tourists visiting Gaelic-speaking areas of Ireland are getting lost since the government introduced a law that all road signs must be in the local language. The move is worrying the tourist industry, which is already suffering from inflated Euro prices and a drop in American visitors" (Telegraph News, 2005). Another case happened in Vietnam where "Vietnamese tourist industry is losing out as a result of Lacks Non-English Speaking Tour Guides" (Saigon Daily, 2007).

These problems can be addressed by serving a travel service that is customizable (from developer point of view) to meet the industry needs. Thus, language and lack of human expertise would not be an issue anymore. As stated by United Nation Economic and Social Commission for Asia and the Pacific Transport and Tourism (2006); one requirement for sustainable tourism development is facilitation of travel and development of transport and other tourism-related infrastructure.

Considering the market demand and the importance of this application, many developers have tried to emphasize on tourism industry related projects development. Some travel guide related products that are available in the market nowadays are:

1. LoL@ (Local Location Assistant), a Mobile Tourist Guide for UMTS, is a location-based multi-media UMTS application that aims at supporting this class of tourist. LoL@ offers maps, localization and routing functionality, and speaker-independent speech input, and a tour diary. It can be operated on smart or PDA phones. (Umlauft, 2000)
2. IMAGE aims to provide citizens across Europe with mobile, personalized, location-based information and services specifically related to transport and tourism, enabling the services to be reached and to be paid for them by flexible, mobile, and stationary means. It uses ambient intelligent agents to deliver web-based information and services through mobile phones and personal digital assistants (PDAs). (Blythe ,2004)
3. Online travel portal Travelocity.com has a suite of travel notification tools that allow Travelocity.com customers to take control of when and where they receive important trip updates. Notifications include customer care alerts and travel alerts such as arrival status, trip reminder, and trip information. (Clickatell, 2007)

LoL@ and IMAGE are mobile travel guide standalone applications that requires installation in GPS enabled devices to be able to work. They provide graphical map viewable through PDA phones. These products differ from author's system from the means of operation and devices required. Mobile travel guide for tourism that we are developing here does not require any GPS devices. It is accessible from any phones that support text messaging which means all phones available today. The means of operation here means that the system processes text inputs and produces text outputs rather than using map to guide the users. Each message received by the system will trigger a response from the system.

CHAPTER 3
METHODOLOGY

3.1 PROJECT SEGMENTATION

Initially speaking, in the early stage of project development, the system is further divided into several segments or components. This segmentation is meant to give a better understanding of the system itself. When things are broken down into smaller parts, it will be easier for us to focus on that part and will reduce the risk of the system not being delivered. Mobile Travel Guide system is segmented into three major components as follow:

a. GSM Network and server Interface
b. Query and Route Generator
c. Transportation System Database

3.2 DEVELOPMENT METHODOLOGY

Based on the segmentation above, the methodology that is practically adequate to be implemented in this system is *Phased Development-based methodology*. A phased development-based methodology breaks the overall system into a series of versions that are developed sequentially. Figure 3.1 below shows the phased development model diagram.

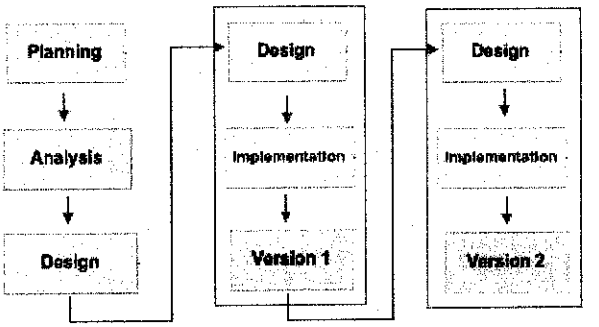


Figure 3.1 Phased Development-based Methodology

The phases will be developed sequentially one after another. Once a version of the system is delivered, the system development will be continued to the second version while in the implementation, the second version is integrated with the first and so forth until the final system scope stated in Chapter 1 is completed.

3.3 PROJECT SCHEDULE

The phased development based methodology consists of: (i) Planning, (ii) Analysis, (iii) Design, (iv) Implementation, and (v) Testing and Evaluation. Table 3.1 shows the project milestones throughout development life cycle. Refer to Appendix A for project activities for each phase and Appendix B for project Gantt chart.

Table 3.1 Project Milestone Schedule

Project Milestones	Date
Proposal	02/02/2007
Proposal Approval by Research Cluster	09/02/2007
Project Initiation	10/02/2007
Seminar 1 – Preliminary Reporting	26/02/2007
Survey	02/03/2007
Progress Report	21/03/2007
Seminar 2 – Progress Reporting	02/04/2007
Interim Report	18/04/2007
Oral Presentation – Final Reporting	30/04/2007
Submission of Progress Report 1	08/08/2007
Submission of Progress Report 2 (Final Draft)	19/09/2007
Seminar – Progress Reporting	27/09/2007
Poster Exhibition (Pre-Edx)	03/10/2007
Submission of Dissertation (soft bound)	05/10/2007
Oral Presentation	24/10/2007
Submission of Project Dissertation (Hard Bound)	02/11/2007

3.4 REQUIREMENTS GATHERING

Requirements gathering techniques used are questionnaires and observation. The questionnaires were distributed to 60 valid respondents to assess the significance and feasibility of the project. The respondents came from various countries with different objectives of visit. The distribution of respondents according to their country of origin is shown in Table 3.3.

Table 3.2 Respondents' Country of Origin Table

No	Country of Origin	No of Respondents
1	Indonesia	13
2	Thailand	9
3	France	10
4	Spain	5
5	USA	7
6	Australia	9
7	Norway	3
8	United Kingdom	4
	Total Respondents	**60**

Observation of the existing approach has also been done to assess the as-is system operation. Currently, tourists would have to refer to the information provided on the streets or possibility of pedestrians' guidance to find directions to a specific place. Using this automated mobile travel guide system, it is expected to reduce users' effort and increase users' satisfaction.

Some literatures were reviewed to provide more information on the need of the system. This technique also helped the author to get clearer view of the system design by inspecting the similar products that had been developed earlier. Information on similar products has been discussed earlier in Chapter 2.

3.5 REQUIREMENTS DETERMINATION

The requirements of the system are grouped as nonfunctional and functional requirements. Complete list of the requirements definition is defined as follows.

Table 3.3 System Non-Functional Requirements

NON-FUNCTIONAL REQUIREMENTS
1. Operational Requirements 1.1. The system will operate in Short Message Service (SMS) environment for both user to system interface as well as system to user interface. 1.2. The system will have to be accessed from any mobile devices that support SMS feature, equipped with SIM cards regardless the service provider in the country.
2. Performance Requirements 2.1. The prototype of the system will only be able to receive messages/requests at anytime 24/7. 2.2. The round time taken to obtain the reply from the system will also depend on the service provider.
3. Security Requirements 3.1. Updating, maintaining and modifying of the system will only be able to be done by authorized user (e.g. system admin).
4. Cultural and Political Requirements 4.1. The system will be able to process messages/requests in English. 4.2. The system will only be accessible in the country installing it.

Table 3.4 System Functional Requirements

FUNCTIONAL REQUIREMENTS
1. Maintain Database Information 1.1. Developer will enter the possible data entry which then can be modified and updated by system admin. 1.2. The system will automatically add/update the database in case of unknown location which then to be finalized by system admin.
2. Placing User Request 2.1. The user can send a request to the system using SMS from their mobile device with a predetermined format containing several information, such as origin and destination. 2.2. The user can get a respond from the system in form of SMS concerning the user's request which tells several possibilities of directions.
3. Processing User Request 3.1. The system should be able to detect if there is any request coming and receive that particular request from the user. 3.2. As the request received is in form of PDU mode, the system should be able to convert the request from PDU to text mode. 3.3. The system should be able to parse the request from a complete sentence and extract the information needed in that particular sentence to be passed to the next processing level. 3.4. The system should be able to generate query from the information generated in the parsing process. 3.5. The system should be able to generate the correct reply concerning the user's request such as generating route in case of route direction request. 3.6. The system should be able to arrange the reply into English as the language understood by the user. 3.7. The system should be able to convert the reply back to PDU mode to be sent back to the respective user.

3.6 SYSTEM ARCHITECTURE AND MODELING

The system is conceptualized into some components whose the architecture is depicted in Figure 3.2 below. The requests from users come from their mobile devices through SMS regardless the service providers and received by a modem connected to the server. The modem here can be a GSM Modem or Hand phone that has the capability of being GSM modem.

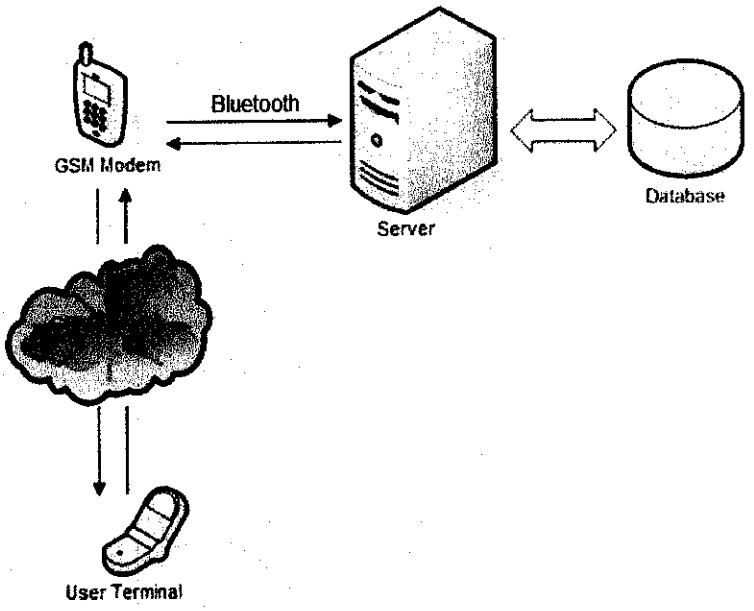


Figure 3.2 High Level Architecture

The connection from the modem to the server is using Bluetooth connection (the server used here is a personal laptop). The request is parsed and then a query is generated to access the database based on the request. The reply will be concatenated into strings by the server to be sent to the user through GSM modem. Users will receive the reply in form of SMS through their mobile device. The system architecture is broken down further in Chapter 4.

The complete model of the system is described in using UML Diagrams attached in the Appendices. Refer to Appendix D for Use case Diagram, Appendix E for Activity Diagram, Appendix F for Class Diagram and Appendix G for Sequence Diagram. Table 3.5 below provides the system versions design scope.

Table 3.5 System Versions Scope

Version 1	System that is able to send and receive SMS via GSM Modem connected to the personal computer without automatic reply.
Version 2	Enhancement from Version 1. The system is able to send and receive SMS with automatic reply.
Version 3	Enhancement from Version 2. The system is able to generate query from user request and return any values from the database.
Version 4 *(Final Version)*	Enhancement from Version 3. The system is able to generate query from user request and return correct values from the database with Dijkstra Algorithm implementation.

3.7 TOOLS REQUIRED

The tools required are divided into software and hardware used in the system. These tools are appropriate to be used in the prototype and are all open source (except for SMS Gateway which is shareware). The actual implementation of the system might need more sophisticated tools.

Table 3.6 Tools Required

Hardware	Personal Computer (Dell Inspiron 640m)
	GSM Modem (Sony Ericsson K750i) with SIM Card attached
Software	OzekiNG SMS Gateway; requires ODBC Connector 3.15
	PDUSpy
	Java 2 Standard Development Kit 1.4.2_03
	JCreator 3.50 LE
	MySQL Server 5.0; requires MySQL Connector Java 5.0.6

CHAPTER 4
RESULT AND DISCUSSION

4.1 SERVER DESIGN SCHEME

Most of the processes required in the system are executed in the server. The server must have all functionalities listed in functional requirements point number 3 which are referred as processing user request.

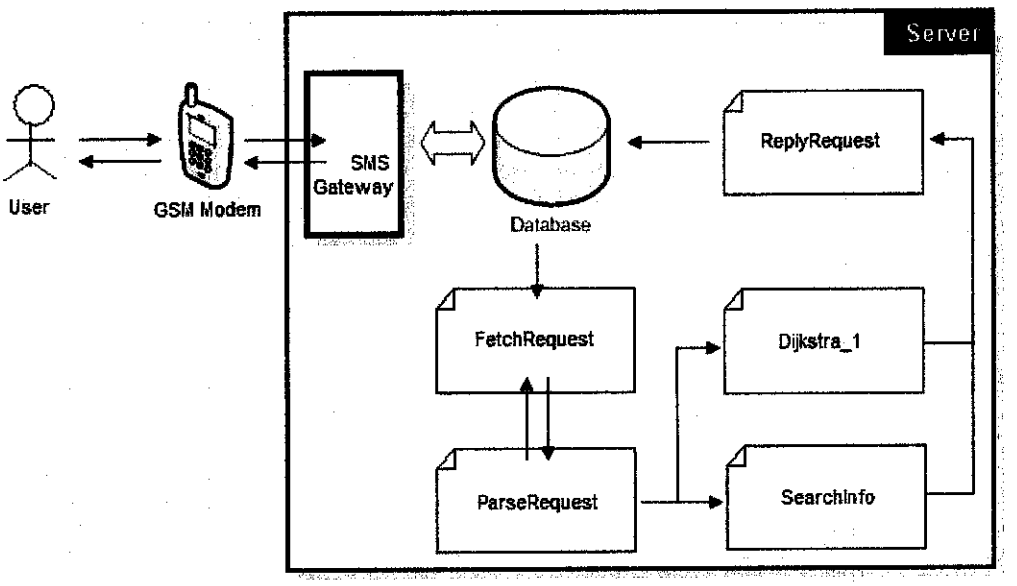


Figure 4.1 Server Architecture

The server consists of SMS Gateway application, database, and Java programs that build the system. Brief description of the architecture entities is explained at Table 4.1 below.

Table 4.1 Architecture Entities Description

User Interface	The system does not require building a user interface. Users can

	interact with the system solely by sending text messages from their standard mobile devices to the specified number. Text messages will be transmitted through overlaid GSM Networks.
GSM Modem	GSM Modem equipped with a SIM card receives the text messages (sent by users) and passes the messages to the server. GSM Modem and server are connected through Bluetooth connection.
SMS Gateway	SMS Gateway acts as an interface between GSM Modem and the server itself. It also converts the messages from PDU into text mode and stores the messages into the database. Every SMS Gateway available in the market has its own attributes and design. For this system, developer is using Ozeki NG SMS Gateway which is available as freeware. SMS Gateway fetches messages from GSM Modem and stores all incoming and outgoing messages to a database called OzekiSMS. Information on installation procedures and configurations for Ozeki NG SMS Gateway is attached on Appendix H.
Database	The database stores all required information that can be manipulated from any programs using SQL statements.
Java Programs	Java programs do all processes to complete the whole cycle of the system from message retrieval to message reply. Explanation of each program will be discussed later in this chapter.

4.2 DATABASE DESIGN SCHEME

The database for this system prototype is using MySQL which is an open source database server. According to class diagram that has been designed earlier, a database named MobileTravelGuide was created. For message recording, another database named OzekiSMS was created.

OzekiSMS database has two tables, ozekimessagein for incoming messages, and ozekimessageout for outgoing messages. Ozeki NG will automatically record incoming messages into ozekimessagein. To send a message, a new record should be

inserted into ozekimessageout. Records from sender and msg fields of ozekimessagein table will be passed to the programs for further process. The same value from sender field will be passed to ozekimessageout and inserted in receiver field together with the reply message in msg field to send a reply. Status from ozekimessageout is updated consequently until the reply is sent. The OzekiSMS database tables are shown in Figure 4.2 below.

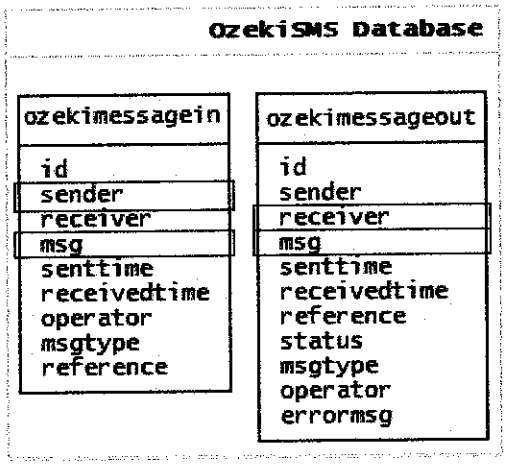


Figure 4.2 OzekiSMS Database

For the prototype purpose, six main tables in MobileTravelGuide database were created to simulate the computation of Dijkstra algorithm. The table Places is the main table which consists of possible tourism places, areas, and some other public places. User inputs are matched with the records in Places table and the area is selected and used to compute the shortest path. PlaceOfInterest, Hospital, and Hotel tables hold full information on specific records for specific types of services. The design of the database is depicted in Figure 4.3.

The Trains table holds LRT stations in Kuala Lumpur comprising of Putra LRT, Star LRT, and Monorail. Another Dijkstra search will be done using this table to find the train route. The database will be enhanced to obtain full capabilities of the system for further enhancement.

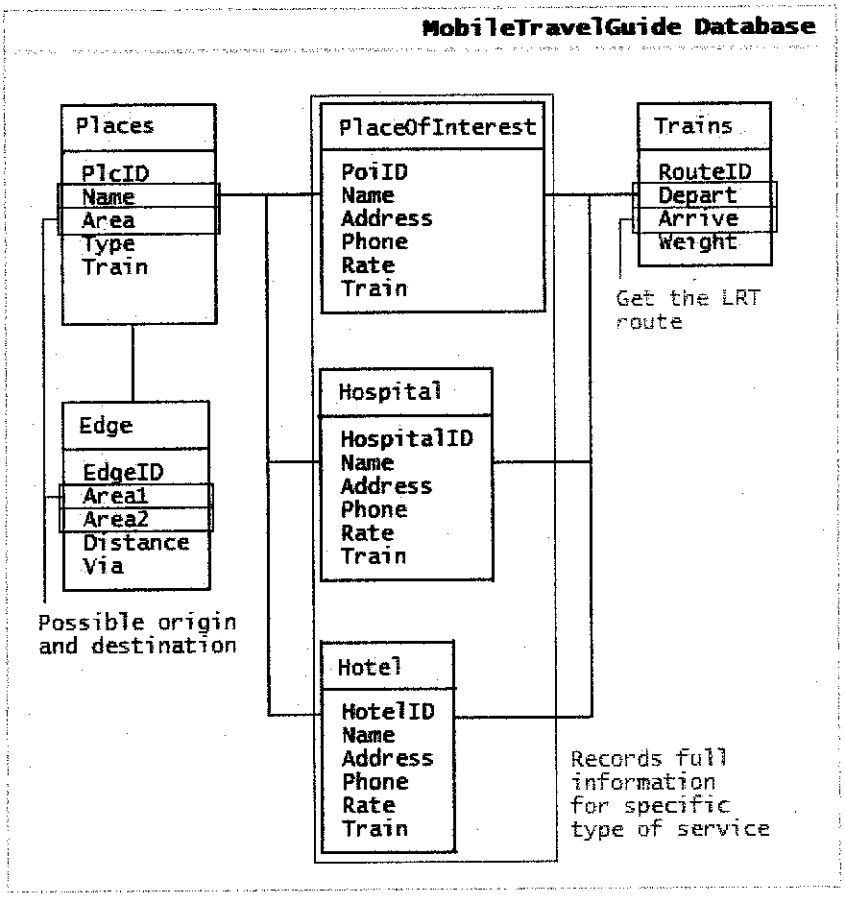


Figure 4.3 MobileTravelGuide Database Design

4.3 PROGRAM DESIGN SCHEME

4.3.1 Incoming Message Notification

Every incoming message is inserted into ozekimessagein table which should be retrieved by the program. To know when the incoming messages arrive, a notification program was created. This program does an endless loop that listens to any updates in the ozekimessagein table. When there is an incoming message, the program will fetch the latest message and pass it to other respective program. The program flow is shown in Figure 4.4. This program (*FetchRequest.java*) can be seen in the system architecture as it interfaces with the database.

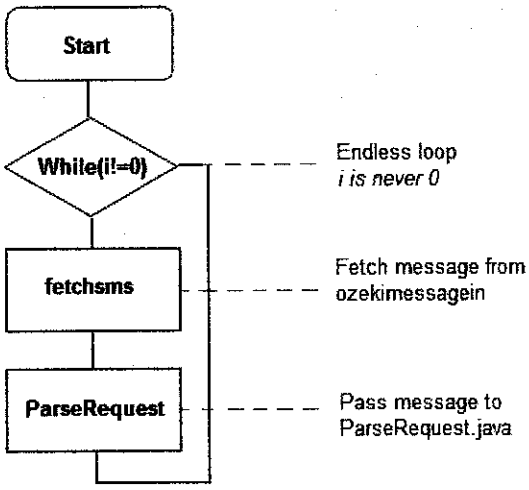


Figure 4.4 Incoming Message Notification Program Flow

4.3.2 Request Validation and Extraction

The request/message sent by users needs to have a predetermined format to be able to be processed. The predetermined formats are listed as follow.

1. **INFO A <origin> <destination>**
   Reply: *"<destination> is X km and Y minutes away from <origin>. ROUTE: street1-street2-street3-...-streetn. LRT: take Station1 to Station2, X minutes for RM X."*
2. **INFO B <hotel>**
   Reply: *"<hotel> is at address phone website. Rate RMX-RMY. ACCESS: LRT Station1, Taxi.*
3. **INFO C <places of interest>**
   Reply: *"<places of interest> is at address phone website. Rate RMX-RMY. ACCESS: LRT Station1, Taxi.*
   Note: Places of interest comprises of shopping centers, heritage sites, places of worship, museums, and other famous landmarks.
4. **INFO D <hospital/clinic>**
   Reply: *"<hospital/clinic> is at address phone website. ACCESS: LRT Station1 Taxi.*

This program is referred to *ParseRequest.java* and is visible in the system architecture layout. Request validation and extraction program flow is shown in Figure 4.5 below. This flowchart also illustrates the whole cycle of the program.

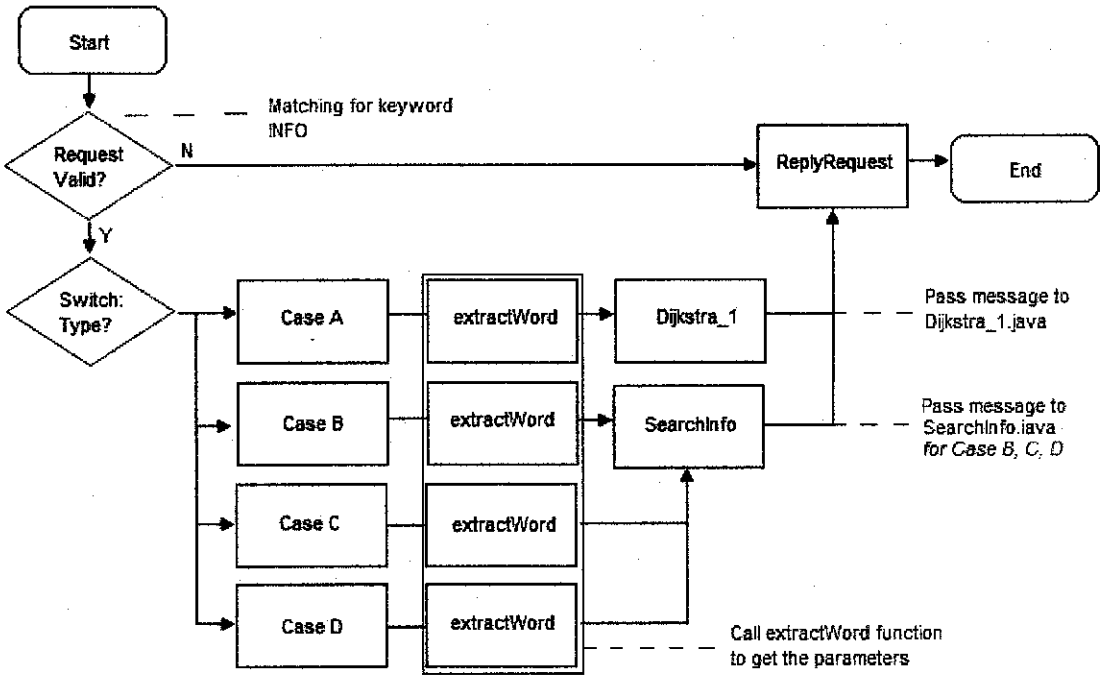


Figure 4.5 Request Validation and Extraction Flowchart

4.3.3 Dijkstra Algorithm Implementation

The places, streets, areas, and other possible landmarks are stored in the database as described earlier. However, the information is stored in form of relational database. A program was written to treat a place as a node/vertex and node to node as an edge. This program returns a Graph object. The flow of the program is illustrated in the flowchart below.

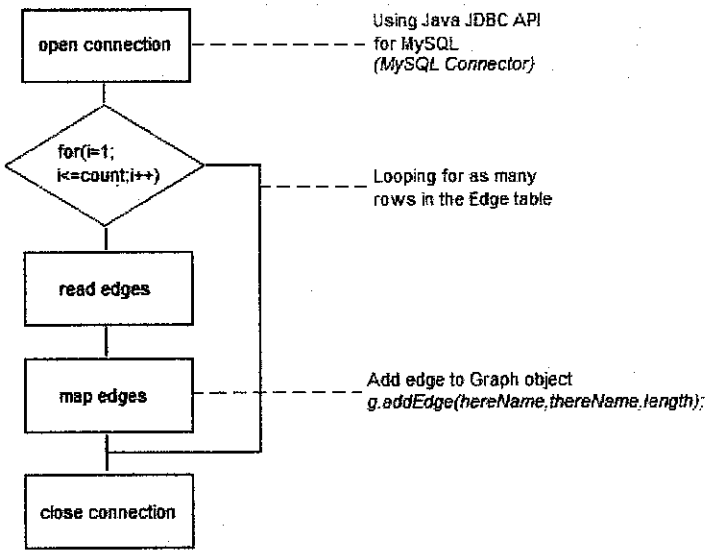


Figure 4.6 Graph Constructor Flowchart

For database access from Java programs, we need a connector. Since the database server used here is MySQL Server, the connector required is MySQL Connector (*mysql-connector-java-5.0.6-bin.jar*). If there is a modification on the Graph, we can simply rerun the program and a new Graph will be constructed.

The Dijkstra implementation imports structure package adopted from Duane A. Bailey (2001) to find the shortest road between two nodes. It is done after the user places a request. This method computes all possible routes from the starting node to all nodes in the graph and for each ending route, it selects the shortest distance. It then searches the route that ends at the requested destination. The flowchart for this program is depicted at Figure 4.7.

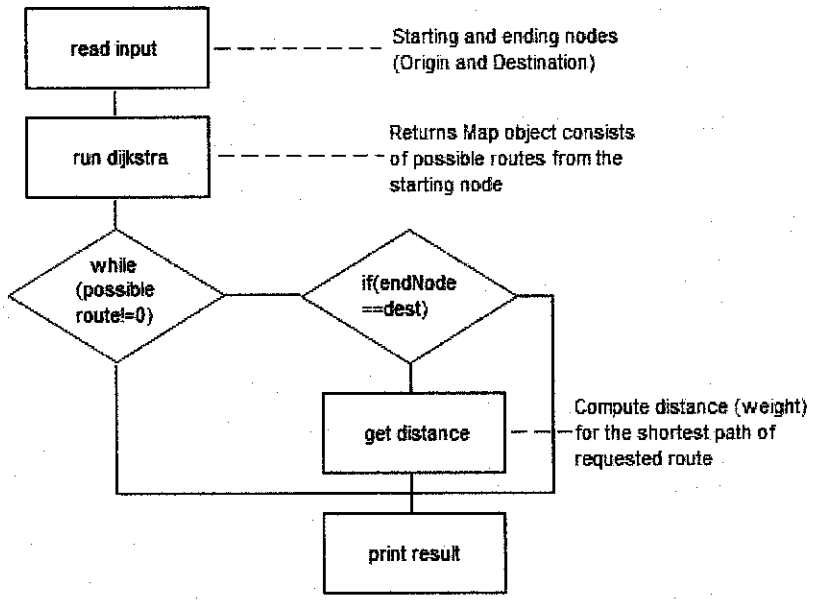


Figure 4.7 Route Formulation Flowchart

4.3.4 Message Reply Execution

After computations and the result have been formulated, a reply message should be sent to the respective user. To be able to reply, a new record containing the reply message, and user phone number should be inserted to ozekimessageout database. Then the SMS Gateway will automatically send the message through GSM Modem attached to the server.

4.4 SYSTEM PROTOTYPE

The end product of this project is Mobile Travel Guide system prototype whose scope has been defined earlier. Some snapshots of the prototype are provided below. In order to start the system, these steps need to be taken:

1. Start FetchRequest.java program from command prompt by typing *java -cp mysql-connector-java-5.0.6-bin.jar; FetchRequest.*
2. Assuming that the devices are on, connect laptop with GSM Modem via Bluetooth.
3. Start Ozeki NG SMS Gateway; the screenshot after Ozeki NG is started can be seen in Figure 4.8 below.

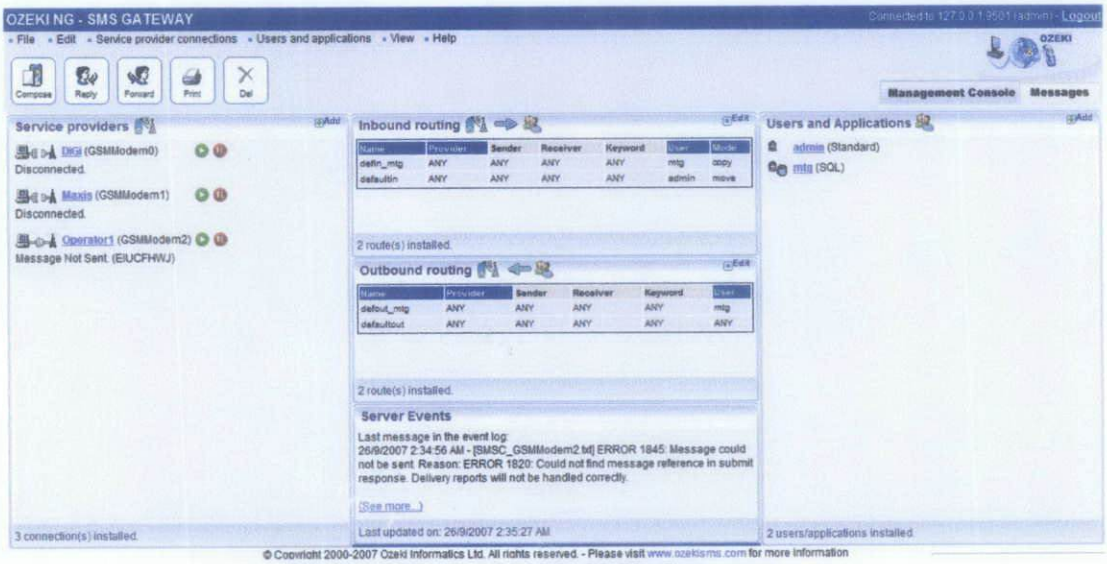
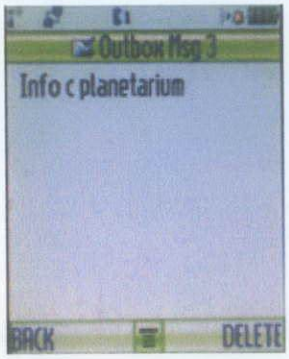
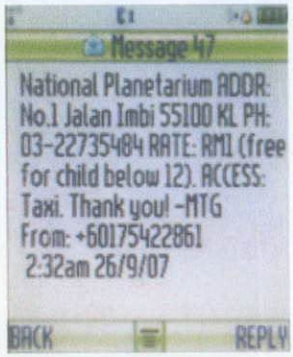


Figure 4.8 Ozeki NG SMS Gateway

4. Send an SMS to the modem number. The sample request is shown in Figure 4.9 below.

Table 4.2 Sample Request Reply

Service Type A		
Service Type B		
Service Type C		
Service Type D		

From the table, each row shows one type of services. There are 4 types of services overall. The first picture is the request sent by user and the second is the reply each user would get from the system.

4.5 SYSTEM TESTING

System testing for this prototype requires 3 types of testing:

(i) Unit Testing; test each module to find whether it works properly and error free. This test in done by developer by testing each main module.

(ii) Integration Testing; test defects in the interfaces and interaction between integrated components until the software works as a whole.

(iii) Acceptance Testing; test by novice users to validate the acceptance of the system.

4.5.1 Unit Testing

Unit testing requires testing of each module to examine whether it works properly and if it does not, the test should find the defects of the module. This testing involves database testing and program module testing. The complete list of the test plan is provided in Appendix I. However, some critical parts of the test cases are described as follow.

- **Database Testing**

  The database creation is successful tested. There are 3 test cases used to test the database as follow:

  1. Select database; using *use <database_name>* command.
  2. List all tables in the selected database; using *show tables* command.
  3. List all fields in a table; using *describe <table_name>* command.

  The result of the test cases is shown in figure 4.10 below.

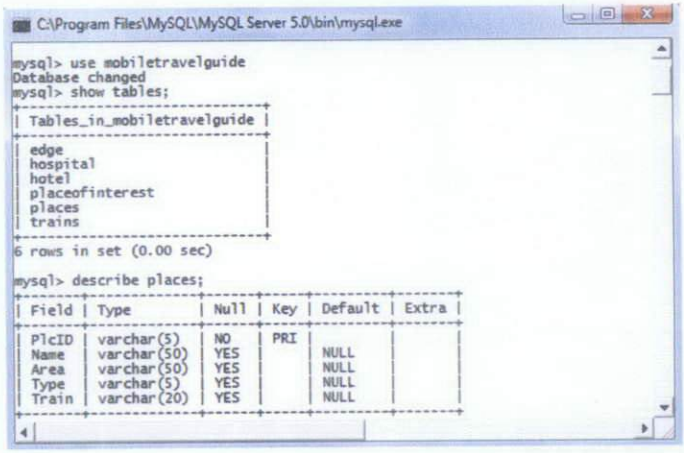


Figure 4.9 Database Testing Result

- **Program Module Testing**

The input manipulation, database retrieval, and route generation programs are successfully implemented. Fourteen test cases are implemented to test these programs. The complete list of these test cases is provided in Appendix I.

1. Test FetchRequest.java to check whether new messages are retrieved by the system.

Precondition:

```
mysql> insert into ozekimessagein (sender, msg) VALUES('+60164557972','info c a
Query OK, 1 row affected (0.06 sec)
```

Actual Output:

```
C:\Data>java -cp mysql-connector-java-5.0.6-bin.jar; FetchRequest
i = 43
msg: info c aquaria sender: +60164557972
```

Figure 4.10 Fetch Request Testing Result

2. Test ParseRequest.java and Dijkstra_1.java to compute the shortest path and train route. The result of this test case is shown below.

```
C:\Data>java -cp mysql-connector-java-5.0.6-bin.jar; ParseRequest
Insert Sentence= info a aquaria mesjid jamek
Insert Sender= 5
Mesjid India is 6 km from Aquaria (via Bukit Bintang). LRT: from KLCC to Mesjid
Jamek for 3RM.
```

Figure 4.11 Compute Direction Testing Result

3. Test ParseRequest.java and SearchInfo.java to provide service type B, service type C, and service type D. The result of this test case is shown below.

```
C:\Data>java -cp mysql-connector-java-5.0.6-bin.jar; ParseRequest
Insert Sentence= info b hotel maya
Hotel Maya ADDR: 138 Jalan Ampang 50450 KL PH: 03-27118899 RATE: RM100-300. ACCE
SS: KLCC Putra LRT. Thank you! -MTG

C:\Data>java -cp mysql-connector-java-5.0.6-bin.jar; ParseRequest
Insert Sentence= info c national planetarium
Sorry no entry for National Heart Institute. Please check your spelling. Thank y
ou for using our service! -MTG

C:\Data>java -cp mysql-connector-java-5.0.6-bin.jar; ParseRequest
Insert Sentence= info d national heart institute
National Heart Institute ADDR: 145 Jalan Tun Razak KL PH: 03-26178200-8316-8317
RATE: -. ACCESS: Taxi. Thank you! -MTG

C:\Data>java -cp mysql-connector-java-5.0.6-bin.jar; ParseRequest
Insert Sentence= info c planetarium
National Planetarium ADDR: No.1 Jalan Imbi 55100 KL PH: 03-22735484 RATE: RM1 (f
ree for child below 12). ACCESS: Taxi. Thank you! -MTG
```

Figure 4.12 Search Info Services Testing Result

4.5.2 Integration Testing

After testing every module in unit testing, integration test was taken to test the system as an integrated component. Some test cases are developed to test each service of the system. Integration testing approach taken is Big Bang. In this approach, all of the modules are coupled together to form a complete system and then being tested. The system is handling both correct and incorrect inputs successfully. The test cases can be seen in Table .4.2 below.

Table 4.3 Integration Testing Test Cases

1. **Testing correct input**
Precondition: INFO A Central Market Mandarin Postcondition: Distance of Mandarin Oriental from Central Market and LRT route Actual Result: Mandarin Oriental is 6 km from Central Market (via Kampung Baru). LRT: from Pasar Seni to KLCC for 4RM. Status: OK
2. **Testing incorrect input**
Precondition: INFO A Crrl Mkt Mndarn Postcondition: Error message Actual Result: No entry for Crrl Mkt Mndarn.Please check your spelling and service type.Type INFO to see our services. Thank you! - MTG Status: OK

4.5.3 Acceptance Testing

In acceptance testing, users are the one to conduct the test. Even though the participants were not actually in Kuala Lumpur, but these participants are potential users who would be using this system later on. Thirty queries were inserted from users' mobile devices. The complete list of the test cases is provided in Appendix J.

4.6 SYSTEM EVALUATION

Over 30 tests in the acceptance testing, the system faced several errors. Even though the percentage of error is minor, author expects to eliminate the error to its minimum level. The result of the acceptance testing is depicted in the chart below.

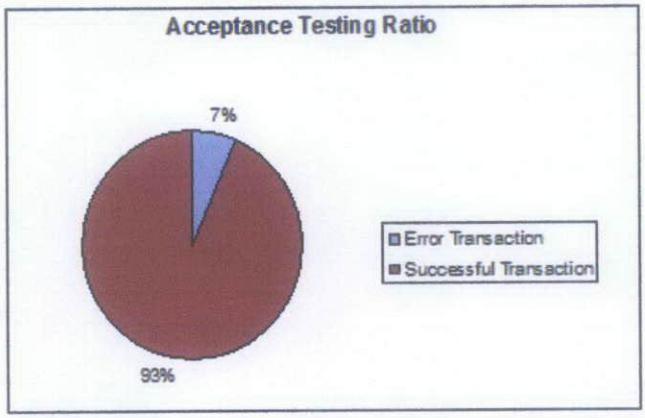


Figure 4.13 Acceptance Testing Transaction Ratio

The defects of the system are mostly in the Java programs which do all the processing. Possible limitations of the system are:

1. The system cannot determine the location of the user automatically. Users have to key in their location (in origin field for service Type A) in order for the system to give directions.
2. The system cannot process correctly inputs that have several similar names in the database. Such as hospital tawakal and hospital unversiti. Both of them have hospital as first words.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

Tourism has become one of the major industries in the world. The number of local and foreign travelers has increased dramatically. These visitors are potential tourists who would be exercising financial activities in the country hence leveraging country's economic growth. Some numbers of tourism services had been delivered. However, services provided are very limited, causing difficulties of finding tourism information instantly.

When the tourists need guidance in a certain area, they could not easily find a help. Besides, some tourists might feel comfortable when initiating a conversation with the locals asking for directions due to language barrier. Inspired by the motivation stated, a solution is taken to overcome the problem. This project is initiated to develop a mobile travel guide via SMS that is able to act as tourism information agent in helping tourist to find directions from an area to another with user specified origin and destination and search information for hotels, places of interests, as well as hospitals.

The methodology that is practically adequate to be implemented in this system is Phased Development-based methodology. Requirements gathering techniques used are questionnaires and observation. The questionnaires were distributed to 60 valid respondents to assess the significance and feasibility of the project.

The end product of this project is Mobile Travel Guide system prototype whose scope has been defined earlier. Over 30 tests in the acceptance testing, the system acceptance ratio is 93% due to accurate reply generated by the system.

5.2 RECOMMENDATION

For further enhancement, there are some improvements to be made to the system. Various ways of improving the system are:

1. For actual implementation of the system, there should be an allocated server to provide processes and database. There should also be an allocated phone number to the system. The project initiator might want to work with a service provider to provide SMSC for the system so there will be no limitation on the traffic.
2. Location Based Positioning enabled program to trace user location automatically. Since the system in using GSM network, one way of doing it is by tracing the BTS location from SIM card attached to the modem.
3. Improving the matching process to database so that there will be no error replies. This can also be done by adding synonyms of the database entries. This should lessen users' effort, and give them more flexibility.
4. Build a program that will recognize users' device, and if it supports Java, send a link to be opened by the users. Hence, a dedicated intelligent website should be built to entertain this type of users.

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APPENDICES

APPENDIX A: PROJECT ACTIVITIES

PROJECT PLANNING

Planning of the project had been started before the project officially started by looking at some possible literatures. During this stage, author produced:

(i) Project proposal submission and approval by the committee

(ii) Project plan creation that denotes methodology, schedule, and other supporting materials. Author developed Gantt chart to denote project schedule. *Refer to Appendix B for Gantt chart.*

PROJECT ANALYSIS

Author used 3 types of requirements gathering techniques;

(i) Survey by distributing questionnaires to potential users

(ii) Observation (in Kuala Lumpur which is the scope of the working prototype)

(iii) Document analysis (literature review)

Developed the requirements determination; requirements determination phase consists of:

(i) Requirements analysis, and

(ii) Requirements definition. *(Refer to Chapter 3 for system functional and non-functional requirements)*

PROJECT DESIGN

Design phase consists of 2 main stages; system modeling and system design. In system modeling stage, the author used:

(i) Functional models (Activity and Use Case Diagrams)

(ii) Structural models (Class Diagrams)

(iii) Behavioral models (Sequence Diagrams)

In the system design stage, author developed:

(i) System Architecture Layout

(ii) Programs Work Flow Design

(iii) System components and final deliverables definition of each

version of the system

PROJECT IMPLEMENTATION

Implementation involved the construction, integration, and installation of the *system prototype*. Brief idea of the works done are:

(i) Installing SMS Gateway and integrating it with GSM modem

(ii) Implementing database design

(iii) Developing programs to process users' requests

SYSTEM TESTING AND EVALUATION

The system went through testing and evaluation at the end of the development. Author developed test cases for several types of testing:

(i) Unit testing to test each program module

(ii) Integration testing to test the integrated system

(iii) Acceptance testing done by potential users

APPENDIX B: PROJECT GANTT CHART

PROJECT GANTT CHART – FYP PART I

Activities	Milestones	Week													
FYP PART I		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Planning															
Proposal	02/02/07														
Proposal Approval by Research Cluster	02/09/07														
Analysis															
Seminar 1 – Preliminary Reporting	02/26/07														
Observation to Kuala Lumpur															
Survey															
Phase 1															
Program Design															
Implementation *(Gateway installation and programs development)*															
System Version 1	**04/20/07**														
Progress Report	03/21/07														
Seminar 2 – Progress Reporting	04/02/07														
Interim Report	04/18/07														
Oral Presentation – Final Reporting	04/30/07														

PROJECT GANTT CHART – FYP PART II

Activities	Milestones	Week													
FYP PART II		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Submission of Progress Report 1	08/08/07														
Phase 2															
Automatic Reply Program Design															
Implementation *(Gateway configuration and programs development)*															
System Version 2	**04/20/07**														
Phase 3															
Database Design and Query Manipulation Program Design															
Implementation *(Database construction)*															
System Version 3	**04/20/07**														
Phase 4															
Dijkstra Implementation Program Design															
Implementation *(Gateway installation and programs development)*															
System Version 4	**04/20/07**														
Submission of Progress Report 2 (Final Draft)	09/19/07														
Seminar – Progress Reporting	09/27/07														
Poster Exhibition (Pre-Edx)	10/03/07														
Submission of Dissertation (soft bound)	10/05/07														
Oral Presentation	10/24/07														
Submission of Project Dissertation (Hard Bound)	11/02/07														

APPENDIX C: SURVEY FORM

Malaysian Tourism Survey

This survey is conducted to assess the need of ***Mobile Travel Guide*** as one of the tourism services in Malaysia. The result of the survey will be used wisely for educational purpose. Thank You for your participation!

Nationality _____

Gender ☐Male ☐Female

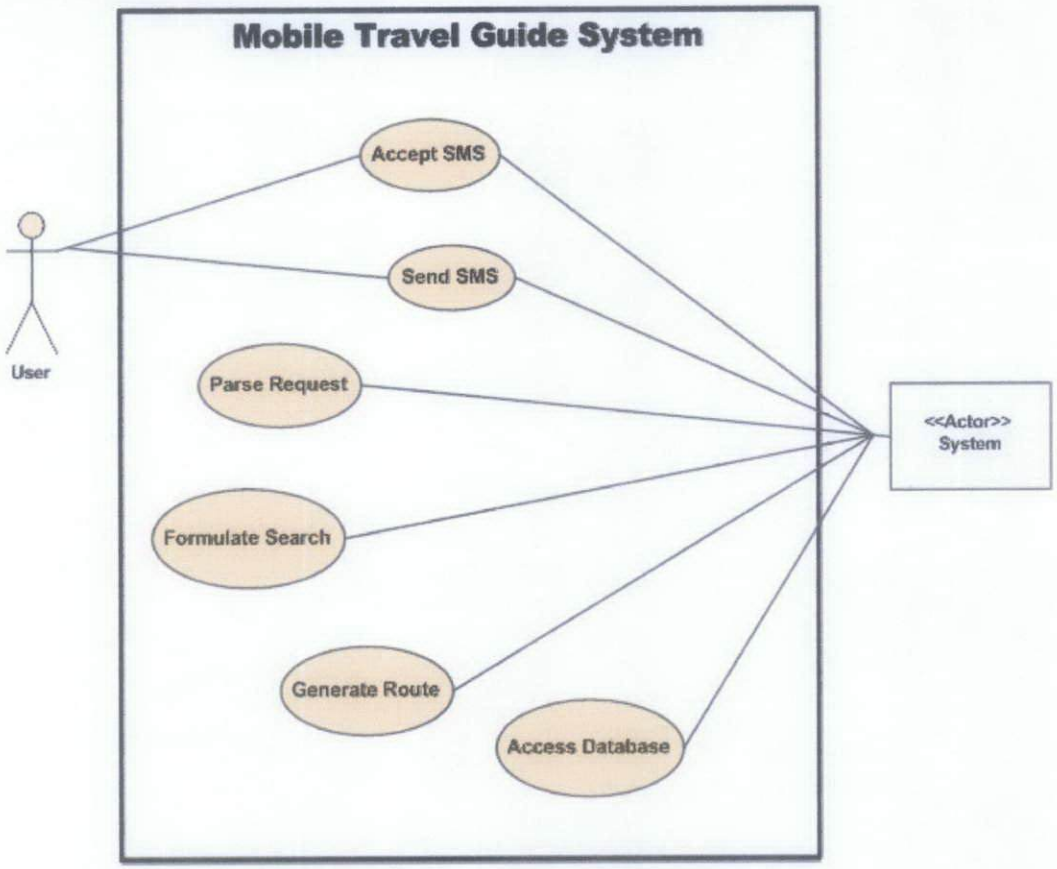
Reason for visit ☐Traveling ☐Business Trip

☐Education ☐Other _____

	Strongly Agree	Agree	Disagree	Strongly Disagree
Information centers provided is enough	☐	☐	☐	☐
Information centers are always reachable	☐	☐	☐	☐
Travel information provided is clear and enough	☐	☐	☐	☐
Communicating with locals is comfortable	☐	☐	☐	☐
Finding directions from the locals is easy	☐	☐	☐	☐
Directions given by the locals are accurate	☐	☐	☐	☐
Mobile Travel Guide is necessary	☐	☐	☐	☐
A Mobile Travel Guide should use SMS	☐	☐	☐	☐

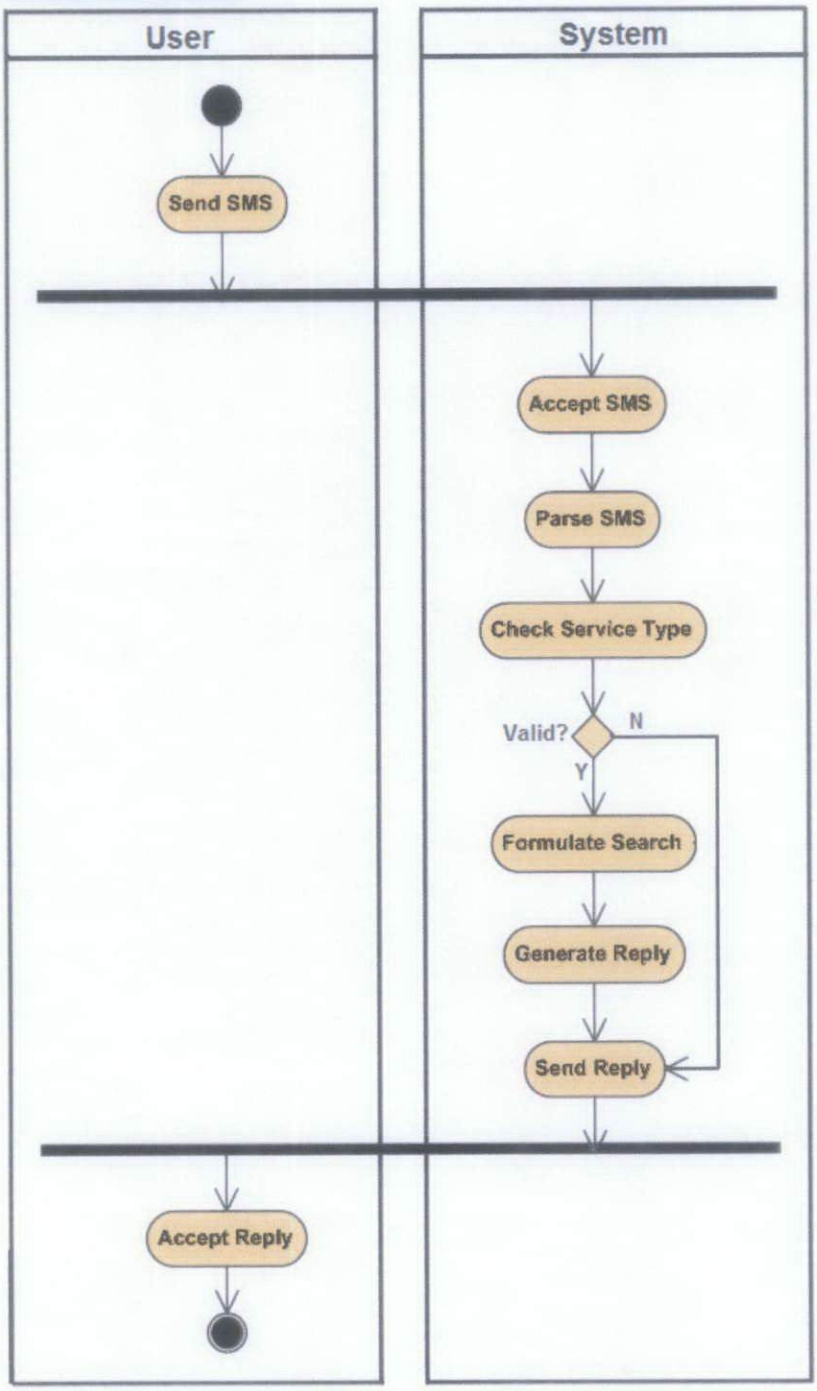
APPENDIX D: USE CASE DIAGRAM

Use Case Diagram



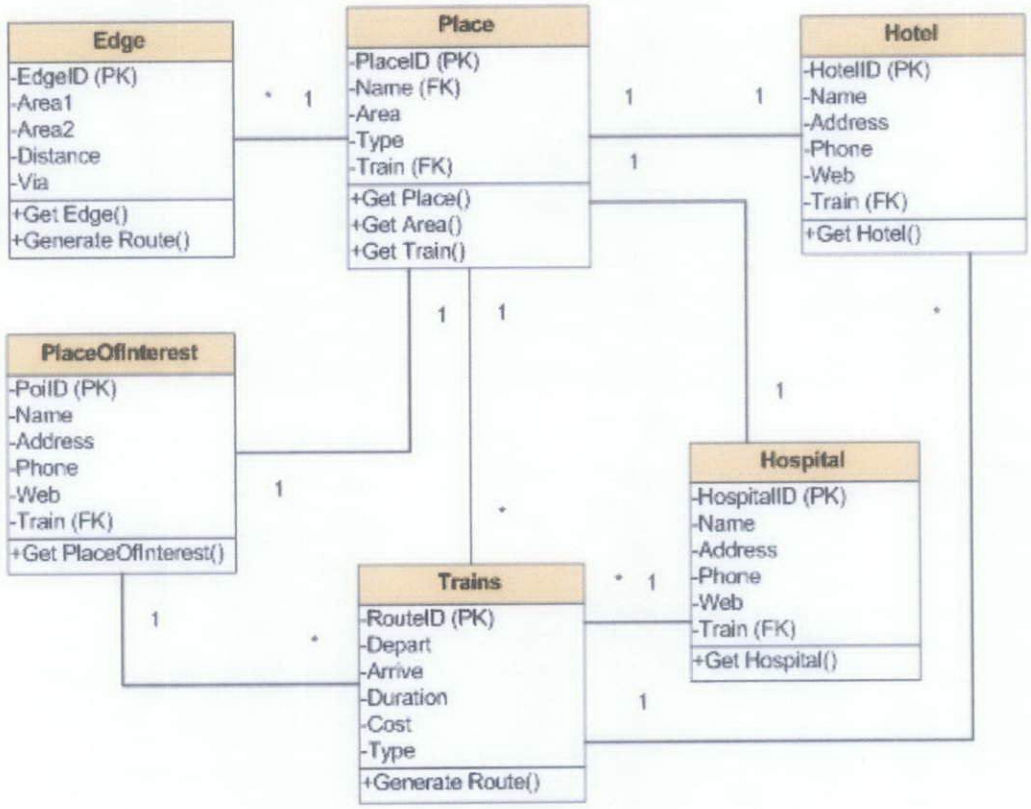
APPENDIX E: ACTIVITY DIAGRAM

Activity Diagram



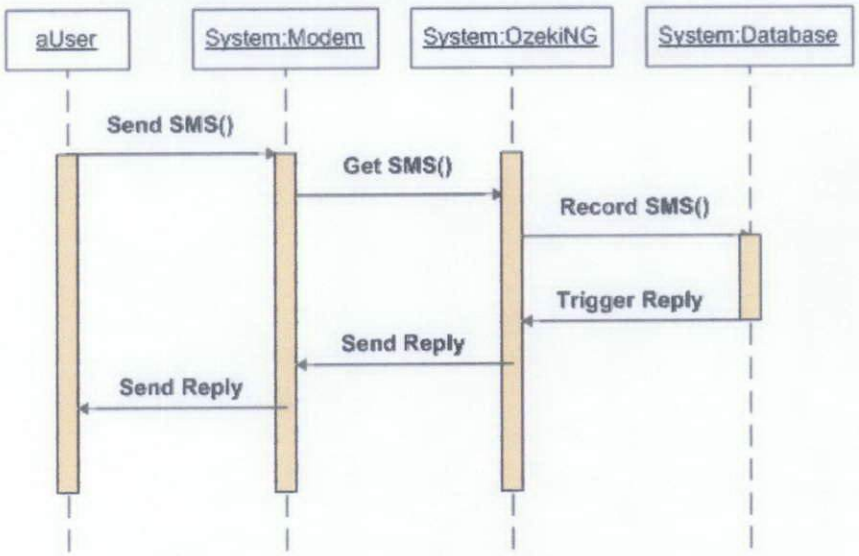
APPENDIX F: CLASS DIAGRAM

Class Diagram

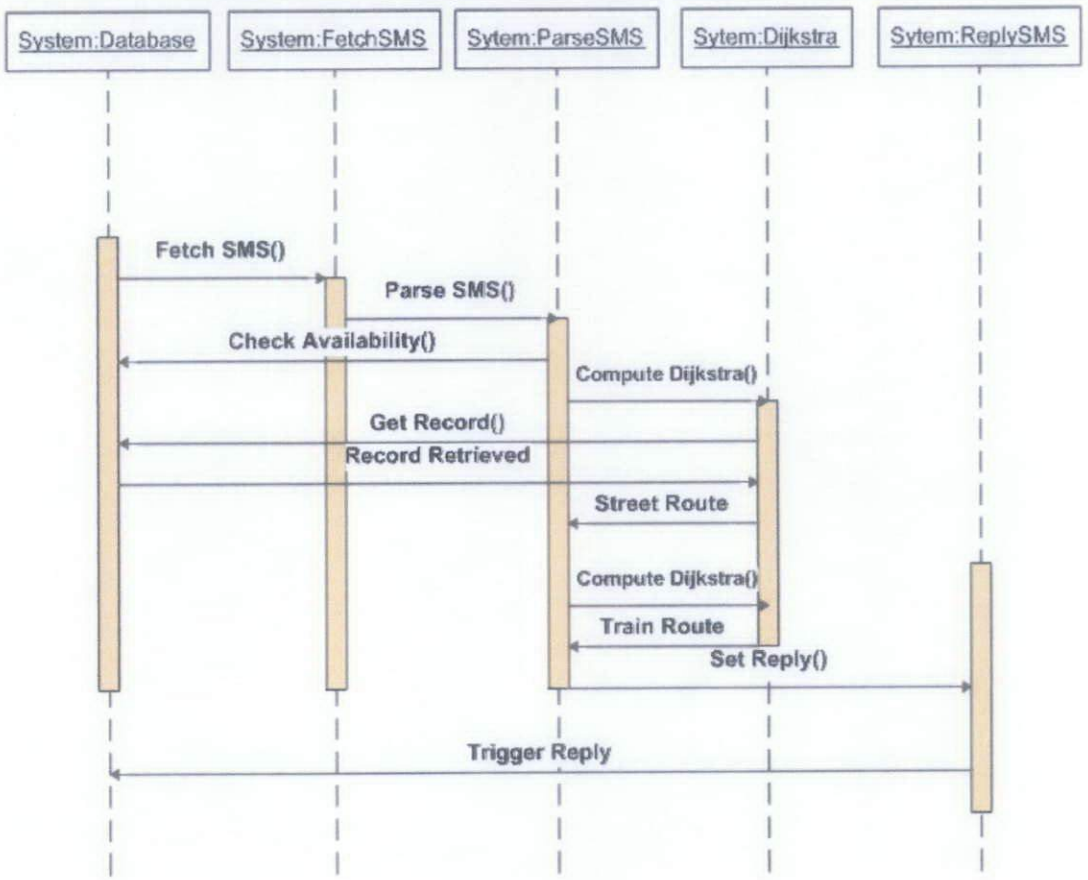


APPENDIX G: SEQUENCE DIAGRAMS

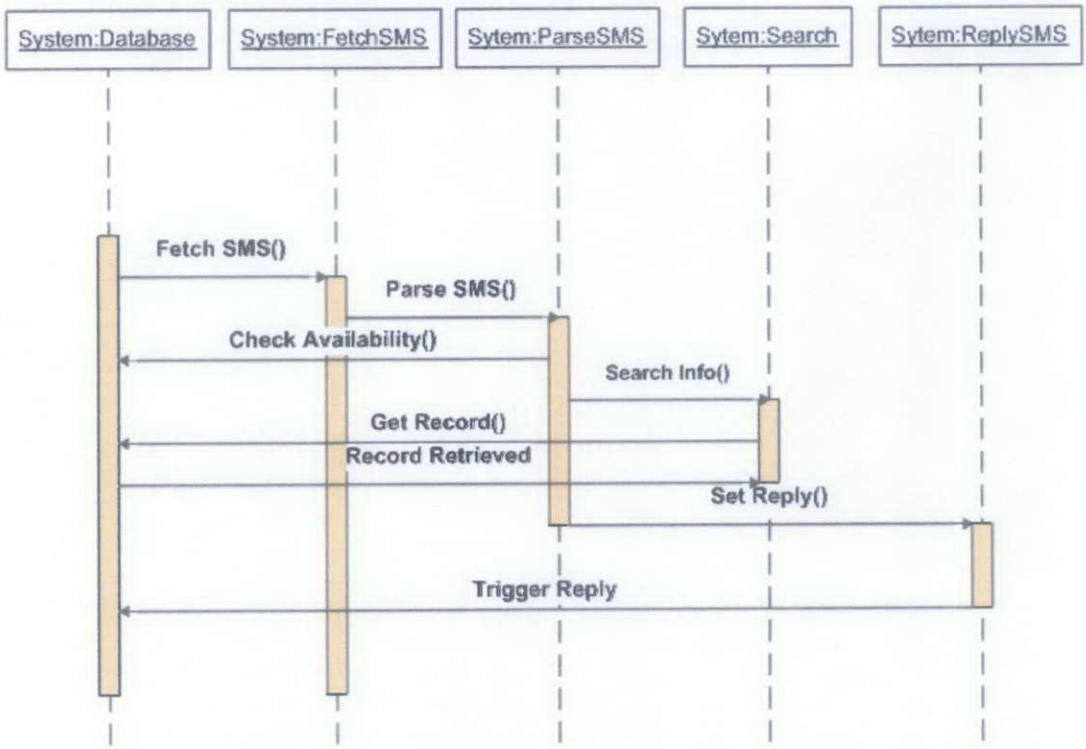
Sequence Diagram: Message Send and Reply



Sequence Diagram: Service Type A (Compute Dijkstra)



Sequence Diagram: Other Service (Search Info)



APPENDIX H: SMS GATEWAY CONFIGURATION

1. Download Ozeki NG SMS Gateway from www.ozekisms.hu and install by clicking setup.exe file and follow the instructions.
2. After the installation finishes, the login window will show up. Log in to start configuring the software. Default username is *admin* and password *abc123*.
3. To send SMS messages using GSM Modem or phone, we need to install and configure a service provider connection. Click **Add service provider** link or the **Add** button in the top right-hand corner of the **Service providers** panel on the left of the interface *(refer to Figure G.1)*. Select and install the **GSM Modem** in the list.

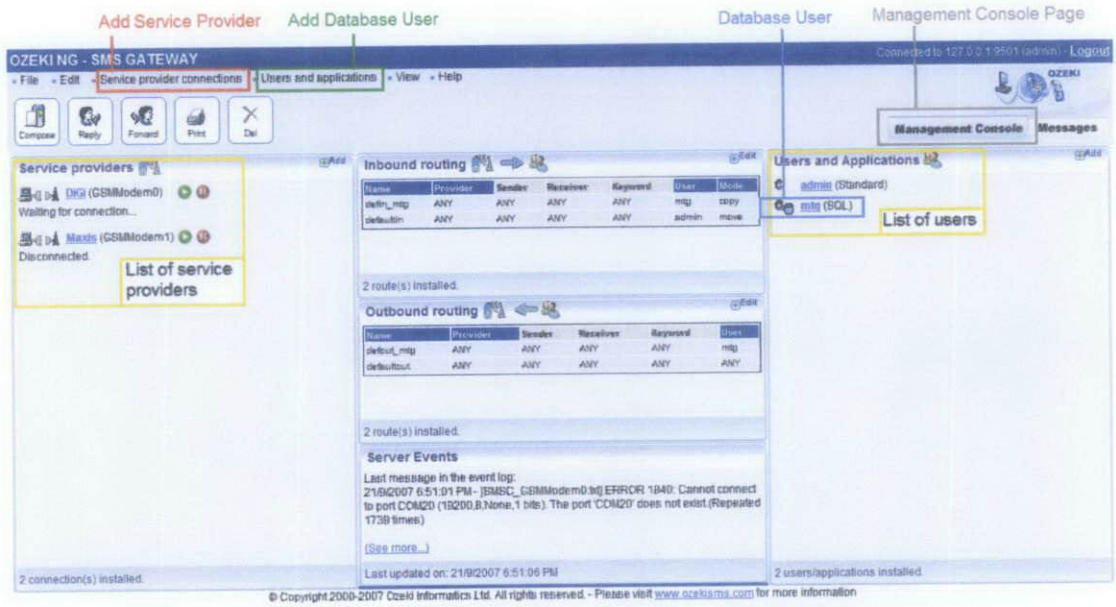


Figure G.1 Ozeki NG Management Console

4. Install MySQL database server and create two database tables: ozekimessageout and ozekimessagein. The ozekimessageout table is used for sending, while ozekimessagein is used for receiving SMS messages. Ozeki NG - SMS Gateway will connect to the database using an ODBC connection. Install the ODBC connector from MySQL website. Note that we are using ODBC 3.15 http://dev.mysql.com/downloads/connector/odbc/3.51.html

5. Install and configure a database user, click the **Add** button in the top right-hand corner of the **Users and Applications** *(refer to Figure G.1)*. Modify connection string according to our preference.
6. Installation done and SMS Gateway is ready to use. For more information on this software, go to www.ozekisms.hu.

APPENDIX I: UNIT TESTING TEST PLAN

Test case	Precondition	Postcondition	Actual Condition	Status
Database Test				
Test Case 1: Test the availability of the database	Use mobiletravelguide	Query ok	Query ok	OK
Test Case 2: List all tables in the database	Show tables	Show all tables	Showing all tables: edge hospital hotel placeofinterest places trains	OK
Test Case 3: List all fieds in places table	Describe places	list all fields	Showing all fields: PlcId Name Area Type Train	OK
Program Module Test				
Test Case 4: Test FetchRequest.java	New SMS inserted to ozekimessagein table; input: insert into ozekimessagein (sender, msg) VALUES('+60164557972',' info c aquaria');	Fetch SMS and sender no. Print SMS and sender no.	SMS: info c aquaria sender: +60164557972	OK
Test case 5: Test ParseRequest.java; Dijksta_1.java; valid request Type A	Input: info a aquaria Mesjid Jamek	**Mesjid India is 6 km from Aquaria** (via Bukit Bintang). LRT: from **KLCC to Mesjid Jamek** for 3RM.	**Mesjid India is 6 km from Aquaria** (via Bukit Bintang). LRT: from **KLCC to Mesjid Jamek** for 3RM.	OK
Test case 6: Test ParseRequest.java; SearchInfo.java; valid request Type B	Input: info b hotel maya	Hotel Maya ADDR: 138 Jalan Ampang 50450 KL PH: 03-27118899 RATE: RM100-300. ACCESS: KLCC Putra LRT. Thank you! -MTG	Hotel Maya ADDR: 138 Jalan Ampang 50450 KL PH: 03-27118899 RATE: RM100-300. ACCESS: KLCC Putra LRT. Thank you! -MTG	OK
Test case 7: Test ParseRequest.java; SearchInfo.java; valid request Type C	Input: info c national planetarium	National Planetarium ADDR: No.1 Jalan Imbi 55100 KL PH: 03-22735484 RATE: RM1 (free for child below 12). ACCESS: Taxi. Thank you! -MTG	Sorry no entry for National Heart Institute. Please check your spelling. Thank you for using our service! -MTG	ERROR
Test case 8: Test ParseRequest.java; SearchInfo.java; valid request Type D	Input: info d national heart institute	National Heart Institute ADDR: 145 Jalan Tun Razak KL PH: 03-26178200-8316-8317 RATE: -. ACCESS: Taxi. Thank you! -MTG	National Heart Institute ADDR: 145 Jalan Tun Razak KL PH: 03-26178200-8316-8317 RATE: -. ACCESS: Taxi. Thank you! -MTG	OK

Test case	Precondition	Postcondition	Actual Condition	Status
Program Module Test				
Test case 9: Test ParseRequest.java; SearchInfo.java; invalid request Type A	Input: info a aqria mejd jmk	No entry for aqria mejd jmk.Please check your spelling and service type.Type INFO to see our services. Thank you! -MTG	No entry for aqria mejd jmk.Please check your spelling and service type.Type INFO to see our services. Thank you! -MTG	OK
Test case 11: Test ParseRequest.java; SearchInfo.java; invalid request Type C	Input: info c plntrium	No entry for plntrium. Please check your spelling and service type. Type INFO to see our services. Thank you! -MTG	No entry for plntrium. Please check your spelling and service type. Type INFO to see our services. Thank you! -MTG	OK
Test case 12: Test ParseRequest.java; SearchInfo.java; invalid request Type D	Input: info d ntnl hrt inttute	No entry for ntnl hrt inttute. Please check your spelling and service type. Type INFO to see our services. Thank you! -MTG	No entry for ntnl hrt inttute. Please check your spelling and service type. Type INFO to see our services. Thank you! -MTG	OK
Test case 13: Test ParseRequest.java; invalid keyword	Input: inf b maya	Invalid keyword! Service: 1.INFO A <origin> <dest> 2.INFO B <hotel> 3.INFO C <landmarks> 4.INFO D <health care> Thank you! -MTG	Invalid keyword! Service: 1.INFO A <origin> <dest> 2.INFO B <hotel> 3.INFO C <landmarks> 4.INFO D <health care> Thank you! -MTG	OK
Test case 14: Test ParseRequest.java; valid keyword (help search)	Input: info	MTG Service: 1.INFO A <origin> <dest> 2.INFO B <hotel> 3.INFO C <landmarks> 4.INFO D <health care> Thank you! -MTG	MTG Service: 1.INFO A <origin> <dest> 2.INFO B <hotel> 3.INFO C <landmarks> 4.INFO D <health care> Thank you! -MTG	OK
Test case 15: Test ParseRequest.java; invalid Type	Input: info z	Invalid service type! Service: 1.INFO A <origin> <dest> 2.INFO B <hotel> 3.INFO C <landmarks> 4.INFO D <health care> Thank you! -MTG	Invalid service type! Service: 1.INFO A <origin> <dest> 2.INFO B <hotel> 3.INFO C <landmarks> 4.INFO D <health care> Thank you! -MTG	OK
Test case 16: Test Dijkstra_1.java; places located in the same area	Input: info a aquaria petrosains	Both **Aquaria and Petrosains** are in **KLCC**. Type INFO to see our services. Thank you! -MTG	Both **Aquaria and Petrosains** are in **KLCC**. Type INFO to see our services. Thank you! -MTG	OK
Test case 17: Test ReplyRequest.java	Input: message: Test ReplyRequest.java sender: +60164557972	New record in ozekimessageout inserted msg: Test ReplyRequest.java sender: +60164557972	New record in ozekimessageout inserted msg: Test ReplyRequest.java sender: +60164557972	OK

APPENDIX J: ACCEPTANCE TESTING TEST PLAN

Sender	Request	Reply	Status
+60164557972	info a aquaria	No entry for aquaria.Please check your spelling and service type.Type INFO to see our services. Thank you! -MTG	OK
+60164557972	info b aquaria	Sorry no entry for Aquaria. Please check your spelling. Thank you for using our service! -MTG	OK
+60164557972	info c aquaria	Aquaria ADDR: 138 Jalan Ampang 50450 KL PH: 03-23331888 RATE: RM38(adult) RM26(children). ACCESS: KLCC PutraLRT. Thank you! -MTG	OK
+60164557972	info d aquaria	Sorry no entry for Aquaria. Please check your spelling. Thank you for using our service! -MTG	OK
+60164557972	info e aquaria	Invalid service type! Service: 1.INFO A <origin> <dest> 2.INFO B <hotel> 3.INFO C <landmarks> 4.INFO D <health care> Thank you! -MTG	OK
+60165020454	info a tawakal universiti	Universiti Hospital is 18 km from Tawakal Hospital (via KL Sentral).	
+60165020454	info a ampang park mesjid jamek	Mesjid India is 7 km from Ampang Park (via Bukit Bintang). LRT: from Ampang Park to Mesjid Jamek for 4RM.	ERROR
+60165020454	info c planetarium	National Planetarium ADDR: No.1 Jalan Imbi 55100 KL PH: 03-22735484 RATE: RM1 (free for child below 12). ACCESS: Taxi. Thank you! -MTG	OK
+60165020454	info d glenagles	No entry for glenagles. Please check your spelling and service type. Type INFO to see our services. Thank you! -MTG	OK
+60165020454	info d heart institute	National Heart Institute ADDR: 145 Jalan Tun Razak KL PH: 03-26178200-8316-8317 RATE: -. ACCESS: Taxi. Thank you! -MTG	OK
+60165011047	info e bandar baru sentul	Invalid service type! Service: 1.INFO A <origin> <dest> 2.INFO B <hotel> 3.INFO C <landmarks> 4.INFO D <health care> Thank you! -MTG	OK
+60165011047	info	MTG Service: 1.INFO A <origin> <dest> 2.INFO B <hotel> 3.INFO C <landmarks> 4.INFO D <health care> Thank you! -MTG	OK
+60165011047	info a	No entry for .Please check your spelling and service type.Type INFO to see our services. Thank you! -MTG	OK
+60165011047	info d tawakal hospital	Tawakal Hospital ADDR: 202A Jalan Pahang KL PH: 03-40233599-7899 RATE: -. ACCESS: Bandar Baru Sentul Star LRT. Thank you! -MTG	OK
+60165011047	info d gleneagles intan medical	Gleneagles Intan Medical Center ADDR: 282-286 Jalan AMpang KL PH: 03-42571300 RATE: -. ACCESS: Taxi. Thank you! -MTG	OK
+60165011457	info c hilton tabung haji	Sorry no entry for Hilton. Please check your spelling. Thank you for using our service! -MTG	OK

Sender	Request	Reply	Status
+60165011457	info a hilton tabung haji	Tabung Haji is 10 km from Hilton (via KLCC). LRT: from KL Sentral to Ampang Park for 6RM.	OK
+60165011457	info a KLCC times square	Berjaya Times Square Hotel is 5 km from Suria KLCC (via Kampung Baru).	OK
+60165011457	info a ampang KLCC	Suria KLCC is 1 km from Ampang Park (via Ampang Park). LRT: from Ampang Park to KLCC for 1RM.	OK
+60165011457	info c universiti KLCC	Sorry no entry for Universiti Hospital. Please check your spelling. Thank you for using our service! -MTG	OK
+60176016506	info b hilton	Sorry no entry for Hilton. Please check your spelling. Thank you for using our service! -MTG	OK
+60176016506	info b mandarin hotel	Mandarin Oriental ADDR: KL City Center 50088 PH: 03-23808888 RATE: RM100-300. ACCESS: KLCC Putra LRT. Thank you! -MTG	OK
+60176016506	info b hotel nikko	Berjaya Times Square Hotel ADDR: No.1 Jalan Imbi 55100 KL PH: 03-21178000 RATE: RM100-300. ACCESS: Imbi Monorail. Thank you! -MTG	OK
+60176016506	info b Le Meridien	Le Meridien ADDR: 2 Jl Stesen Sentral KL PH: 03-22637888 RATE: RM100-300. ACCESS: KL Sentral Putra LRT. Thank you! -MTG	OK
+60176016506	info d renaisance	No entry for renaisance. Please check your spelling and service type. Type INFO to see our services. Thank you! -MTG	OK
+60175170538	info a mandarin aquaria	Both Mandarin Oriental and Aquaria are in KLCC. Type INFO to see our services. Thank you! -MTG	OK
+60175170538	info d Kuala Lumpur hospital	Kuala Lumpur Hospital ADDR: Jalan Raja Muda Abdul Aziz KL PH: 03-22821888 RATE: -. ACCESS: Taxi. Thank you! -MTG	OK
+60175170538	info a mesjid india hilton	Hilton is 4 km from Mesjid India (via Mesjid Jamek). LRT: from Mesjid Jamek to KL Sentral for 2RM.	ERROR
+60175170538	info c asean sculpture	ASEAN Sculpture Garden ADDR: Damansara Semantan Link KL PH: 03-23331888 RATE: Free. ACCESS: Taxi. Thank you!-MTG	OK
+60175170538	info c world trade center	Putra World Trade Center ADDR: Jalan Raja Laut KL PH: 03-23331888 RATE: Free. ACCESS: PWTC Star LRT. Thank you! -MTG	OK