FACILITATING DISTRIBUTED WORK WITH MARKETING AGENT MONITORING SYSTEM (MAMS)

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Dissertation Submitted In Partial Fulfillment Of
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CERTIFICATION OF APPROVAL

Facilitating Distributed Work With Marketing Agent Monitoring System (MAMS)

by

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Mr. Abdullah Sani Abdul Rahman

UNIVERSITI TEKNOLOGI PETRONAS

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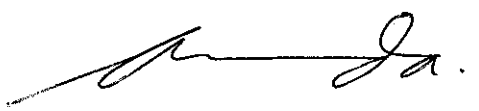
CERTIFICATION OF ORIGINALITY

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 acknowledgement, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.



AMANDA ROFI'AH HIDAYATI

ABSTRACT

Many companies today are averaging productivity gains 15 per cent to 20 per cent by assigning managers and workers distributed work arrangement according to some exploratory research. Thus, in order to decentralizing the work of marketing and sales representatives, companies are throwing a lot of field representatives or marketer to supermarket, offices, and other public places where they might sell their product or services. Few systems have been developed in order to support marketer work. Nevertheless, some of the system had shortcomings. The marketer can not access the system from the client site. Hence, he or she should spend a few hours in the evening to report their work. The marketer also found the system to be inflexible. The input given is menu driven so that important information might not be recorded. The system is also prone to input error because marketer needs to re-enter the information. Moreover, the system can not assist the manager in monitoring and supervising their employee performance when they are not based in the office. The objective of the study is to develop a monitoring system that will save marketer time. Besides that the monitoring system should be accessible and have minimum error. In addition, it should cost efficient in terms of economic perspective.

Marketing Agent Monitoring System (MAMS) is developed to assist the manager supervising the marketing agent. Short Message Technology (SMS) Gateway technology is utilized in this system. In MAMS, marketing agents' mobile phone and department's computer will be connected by the system which consists of a mobile phone and a personal computer. The information to and from marketing agents will be handled by MAMS.

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ABBREVIATIONS

API	Application Program Interface
AT command	Attention command
GPRS	General Packet Radio Service
GSM	Global System for Mobile communication
IVR	Interactive Voice Response
MAMS	Marketing Agents Monitoring System
MS	Mobile Station
PDA	Personal Data Assistance
SMSC	SMS Center
TE	Terminal Equipment
WAP	Wireless Access Protocol

CHAPTER 1
INTRODUCTION

1.1 Background

Technological advances and changes in the global economy are increasing the geographic distribution of work in industries as diverse as banking, book and retail selling, and clothing design (Hinds, 2002). Workers communicate regularly with distant coworkers; some monitor and manipulate tools and objects at a distance. Worker spread across different cities or countries, even though they are in the same team.

According to Culp (2000), distributed work is decentralized. Distributed workers tend to be separated each other geographically and time zone. Such work relationships survive through technology, beginning with telephone, email and fax machine at the most basic level and will rely increasingly on video conferencing and satellite, as well as groupware application that make computer based project possible when people work at distance. Not all workers are good distributed workers. A recommended break down for knowledge workers in this area is managers, sales or marketing employees, internal consultant or trainers, communication specialist and technicians. For the purpose of this study, we are going to focus on the work of marketing employees.

1.1.1 Distributed Work in Marketing and Sales Department

Marketing deals with customers. It also means managing profitable customer relationship and involves satisfying customer needs (Kotler, 2005). However, many sellers tend to focus on selling their product rather than providing solution to a need. They often caught in marketing myopia. They focus on existing demands and forget to understand the customer needs. The most logical reason is the seller does not really understand the customer needs. Thus, many methods of promoting have been taken in order to understand the customer needs better.

Advertising, sales promotion, publicity, and direct selling are methods of promotion frequently practiced. Many companies employ hundreds of field seller who visit

supermarkets, office, and others to close business deals (Turban, 2006). This method of selling has proven to be fairly effective. In most cases of direct selling, it is necessary for the company to know, as quickly as possible, when a deal has been close or if there is any problem with the customer. Thus, a marketer or field representatives need to update information about their daily activities to help the management to understand the trends in the market. The information which they need to up date to the management is varied. It is depend on the needs of the management and department involved.

1.1.2 Mobile Computing

Lee (2004) said that mobility is the capability of being able to move or be moved easily. In the context of mobile computing, mobility pertains to people's use of portable and functionally powerful mobile devices that offer the ability to perform a set of application functions un-tethered, while also being able to connect to, obtain data from, and provide data to other user, application, and system.

In order to do so, a mobile device must have certain characteristic. A mobile device should be portable. It should be able to be carried around. Today, in order to be considered as portable, a mobile device should be able to be carried by hand. Moreover, a mobile device should be usable and functional. It should be easily used by any kind of people in any environment. It should serve multi purposed and have wide and varied types of functionality. At last, a mobile device should be connectable. Although the previous characteristics have been fulfill, the primary function of a mobile device is still to connect people and/or system, and transmit and receive information

1.2 Problem Statement

Information Technology has been used extensively to support marketer mobility. However, in one particular case, the current supporting system (*i.e.* interactive voice response) had several drawbacks. Firstly, it was found that marketers were late in reporting frequently. Secondly, the process of key in information was inflexible due to system fixed-menu. And also, the reports from the system sometimes reach the management days or weeks too late. The effect of this problem is the managers'

difficulties to monitor and supervise their marketer performance. The managers' can not use the daily report that should be a tool to monitor the marketers work. Furthermore, as being said by Turban (2006), they might miss the important changes in market trends and the opportunities to act in time.

1.3 Objectives and Scope of Study

For the purpose of this project, we have narrowed down the system scope for the purpose of marketing agent monitoring system. Based on the problems that has been stated, we define the objectives of this project as follow:

1. To produce a monitoring system that will not be time consuming.
   This new system is not supposed to take up time of marketing agent. We also aim to help marketing agent to concentrate better by eliminating the overtime that the marketing agent spend to do a clerical work for a particular day.

2. To produce a monitoring system that is accessible.

   This new system supposed to be accessible daily by both marketing agent and managers. Marketing agent should be able to access the system from any of the client sites where the marketing agent is working. Furthermore, the managers should be able to get a full access to monitor the marketing agent work as well as improve their project awareness.

3. To produce a monitoring system with data reliability and accuracy.

   This system should reduce a data-entry error. The system should be directly connected to the database, so that no data re-inputting is needed.

4. To produce a monitoring system that is cost efficient

Marketing Agent Monitoring System (MAMS) will be a better system that will improve marketing agent in any industry. However, like we have mention before, this project will only cover the system contribution to marketing agent work. We believe this method will contribute significantly to the success and prosperity of the company.

This project will cover the development of SMS Gateway server i.e. mobile phone or GSM modem connected to personal computer along with the supporting software that will be used as the user interface. These applications will monitor the work of marketer. Thus, in its operation the system will have function as follow:

- To send and receive message from marketing agent

  The message sent and/or received by the marketing agent is in the form of standard SMS messaging.

- To store and process message in the database

  The SMS sent to and/or received from marketing agent will be directly stored in the database. Thus it will minimize data-entry error.

- To provide up to date information for the management

- To provide a data support for clarification process of marketing agent's work in the end of the month.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

In this chapter, the necessary of mobile application for business is introduced. An overview of SMS gateway system for mobile application is also presented. This chapter presents an overview of current and previous work related to distributed mobile application and SMS gateway.

2.2 Business Context behind Mobile Application Development

2.2.1 People Being Mobilized

According to Lee (2004), the convenience and powerful functionality offered by mobile device, such as cellular telephones, has resulted in many people already being mobilized. Two of the largest groups of people that use mobile device are workers and consumers.

1. Worker

Many enterprises have already initiated serious effort to mobilize their workforce and many more are making the effort every day. The types of workers that have been identified as primary candidates for mobilization include Road Warriors, Sales and Service personal, Consultants, Corridor Warriors, and even certain Back Office Workers. Road warrior refers to employees who travel for much of their work life and often stay in hotels and use various modes of public transportation. Company managers in many industries might typically fall into this category of worker.

Sales and service professional are subsisted, operating within nearly all industries. The definition for this category of worker is simply that the one that performing sales and regularly travel from their own company to sale and provide a service to a customer. Consultation is also a type of service, but the unusual sequence of event is somewhat different from typical service task. While selling is a complex and highly specialized

business, there are also ordinary activities that sales people will commonly perform, including:

- Preparing for customer meetings
- Traveling to customer site
- Meeting with customers
- Reading/ writing business notes
- Performing service or initiating follow up task
- Performing administrative task

Lastly, the term corridor warriors refers to office workers who have to move around an office a great deal or perhaps move to another office or conference room for meetings on another floor or nearby site. Meanwhile back office workers work within company and normally do not interact face to face with customers. These employees may include system administrators and human resource and warehouse personnel.

2. Consumers

A large number of consumers can also be expected to use mobile device and mobile solutions. Two types that we will consider are the young and adult mobile consumer. Young consumers can be expected to utilize mobile devices for communication, entertainment and education purposes. Meanwhile adults' consumers include off-duty professionals and technologist, gamers, shoppers, and entertainment buffs.

2.2.2 Activity When People Mobilized

Probably the most fundamental thing mobile user wants to do is communicate. Communication, in this context, refers to the ability to exchange voice, audio, text, and image information. Users communicate with each other through voice using mobile device such as cellular telephones. They also use mobile device to receive and send message (*i.e.* text data or images) to friends and family. Besides that, users of mobile user want their mobile device or mobile application to make their work life easier or better in some fashion. Mobile device provide several ways to do this, including

simplifying the exchange of information and the issuing of instruction. The types of information exchanged (i.e. obtained and updated) between mobile clients and an application running on a server is very wide. Some common types of information that users typically interchange are email and instant message, news, schedule, task, and other work-related information.

2.2.3 Mobilized Enterprise Pro's and Con's

The ability to mobilize and connect people has both subtle and extraordinary consequences in the way we interact with one another and with existing technology. Below are several common benefits to mobilizing a company according to Lee (2004). Some directly affect the employees, while others affect their interaction with your customers and existing business applications, while still others affect the business finances.

1. **Improve people's lives.** Mobile solution can help improve people's personal and professional lives. For example, cellular telephones can help working parents communicate with children, schools, ranging from simple logistics to helping better protect their children by being in continual contact.

2. **Increase employee flexibility and accessibility**. Providing employees with mobile solution gives them flexibility fro location and time perspective. By being able to access critical information in the field, employees can move activities-such as selling process-closer to customer. In addition, employees may be able to exchange information with the office at a convenient time eve when they are away from the office.

3. **Improve employee safety**. Providing employees with up-to-date information can improve worker's safety, especially if the employees are working in a hazardous environment.

4. **Improve workflow efficiency and productivity**. Mobilization also helps eliminate redundant activities such as having to re-enter data. Reducing the

amount of repetitive and redundant tasks allows employees to be more efficient and productive.

5. **Improve data currency and accuracy**. A mobilized workforce can receive and provide information to existing business system in a timely fashion. The number of errors can also be reduced during the data gathering and reporting process. Thus, data currency and accuracy are improved.

6. **Improve existing business process**. A mobilized workforce can be viewed as an additional channel that provides data to and accepts data from existing business systems. In doing so, enterprises may be able to find improvements and eliminate redundancies in existing workflows.

7. **Improve inventory control**. Enterprise can utilize mobile devices to help monitor equipment, and other asset. This helps reduce inventory losses and lowers collection cost.

8. **Increase customer satisfaction**. Customer satisfaction may be enhanced once sales and service process become more efficient and responsive. This, in turn, can lead to increased revenue.

There are situations, however, where mobilizing a company may not necessary. Below are some of the businesses, social, privacy/security, and environmental reasons that should be considered.

1. **Business consideration**. Before mobilizing a company, we need to understand how to manage the cost of mobilizing the company and how to manage and finance this cost. If the cost is lesser than the return to the company, it would be beneficial to mobilize a company and vice versa. Factors that contribute to a high cost include:

    - Hardware and software cost
    - Communication cost

- Development and deployment cost
- Disruption to existing service
- Operations cost
- Miscellaneous cost (e.g. employee and customer dissatisfaction)

2. **Social Consideration**. Being connected all the time also means that people can also reach you at all time, which is not necessarily good thing. Many people now feel that the excessive use of mobile devices such as cellular telephones is rather antisocial.

3. **Privacy and security consideration**. While having information on a mobile device is very convenient, privacy and security considerations need to be addressed when user, company, or customer information is moved to device. Mobile devices are not highly secure. They are easily lost and the data on them can be easily compromised if care is not taken to secure it.

4. **Environmental considerations**. We often threat mobile device as though they are disposable. Unfortunately, they really are not. The fact that they are small does not make their component less toxic.

2.3 Introduction to SMS Gateway

Short message service (SMS) is a basic mobile service allowing the exchange of short text message between subscribers (Le Bodic, 2005). SMS is widely used around the world by many users ranging from children to adults. The main reason that SMS had achieved a great success through out the world is summarize below:

1. SMS is supported by 100% GSM mobile phone.
2. SMS can be sent and receive at any time.
3. SMS is accessible from anywhere, providing there is a GSM signal.
4. SMS is less disturbing while you can still communicate with others.

SMS gateway enables a computer to mobile station interoperability by connecting both devices to SMSC. Technical specification defines interface protocols for control of

SMS functions between the Mobile Station (MS) and an external Terminal Equipment (TE) via an asynchronous interface (Le Bodic, 2005). The MS and the TE are connected with a data cable, an infrared link, or any other similar link as shown in figure 1 below.

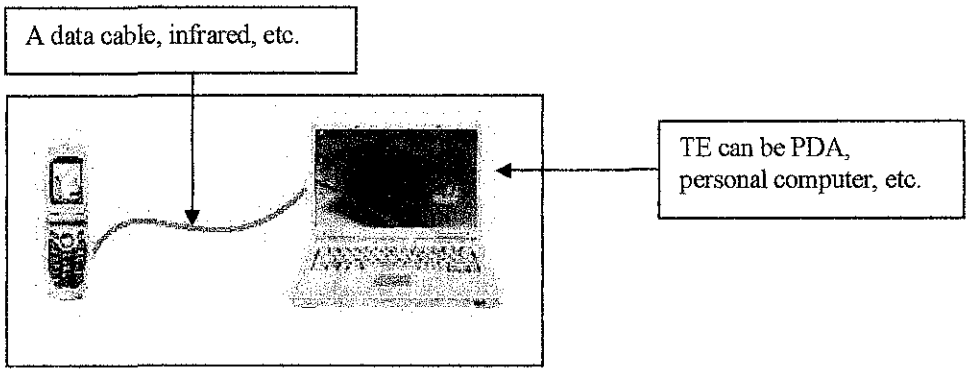


Figure 1: MS connected to TE

Basically, there are two ways of sending SMS from personal computer to mobile phone. The first one is to connect the mobile phone or GSM modem to Personal Computer (PC) by using connection media like data cable, infrared, etc, and used PC and AT command to send the message.

In this approach, both device does not need to be connected to any internet service (stand-alone) (Gunawan, 2003). The second way is by connecting the personal computer to the SMS Center or SMS service provider. Then send message using a protocol or interface supported by the SMSCs (developers.com).

For the purpose of implementing this monitoring system, the first option will be the best option and the list of AT command that might be use is listed in Table.1 below.

Table 1: AT command (Gunawan, 2003)

AT command	Meaning
+CMGS	Send message
+CMSS	Send message from storage
+CMGW	Write message to memory
+CMGD	Delete message
+CMGC	Send command
+CMGF	Operate in text mode

2.4 Current Monitoring System

2.4.1 Interactive Voice Response (IVR)

As been written in Wikipedia, Interactive Voice Response, or IVR, is a phone technology that allows a person, typically a telephone caller, to select options from a voice menu and interact with the phone system. A pre-recorded voice prompt is played and the caller presses a number on a telephone keypad to select an option - i.e. "press 1 for yes, press 2 for no".In one particular case, it is reported that marketers use an Interactive Voice Response (IVR) system to enable them reporting their daily activities (Turban, 2006). Initially, marketers completed paper based survey for each store they visit. In evening, the marketers translated the data from the forms into answer that were entered to the IVR. The IVR asked marketer routine questions and he/she answered by pressing appropriate telephone keys.

However, this system had several drawbacks. Firstly, it was found that marketers were late in reporting frequently. Secondly, the information was inflexible due to IVR fixed-menu. And also, the reports from IVR sometimes reach the management days or weeks too late. The effect of this problem is the managers' difficulties to monitor and supervise their marketer performance. The managers' can not use the daily report that should be a tool to monitor the marketer work. Furthermore, as being said by Turban (2006), they might miss the important changes in market trends and the opportunities to act on the in time.

2.4.2 MEI Group Mobile System

MEI Group develop a mobile system that runs on handheld, pen based PDAs that powered by Microsoft's CE operating system (Turban, 2006). This mobile system was implemented in Merchandising Sales Portfolio (MSP) for Maybelline to help their marketer work. The mobile system enables marketer to enter report to the head quarter office in handwriting directly from the client's sites. From the handheld device, data can automatically be uploaded to a Microsoft SQL Server database at the corporate intranet via a secure internet connection. It also enables managers to send daily schedule or

other important information electronically to each marketer. In addition to routine information, MSP is used to support decision support. For some reason, managers need to know the sales of certain product in certain location. They need to know the conditions at retail stores that affect the sales of each product, and they need to know it in timely manner.

The features in MSP provide an interactive link to the mobile field force. The corporate planners and decision makers can respond much faster to the situation that needs attention. It also reduce the amount of after-hours marketer spend in headquarter for clerical work each day. Moreover, it reduces the data-entry errors.

Nevertheless, this mobile system might increase the cost for the company. In order to provide the marketer with this system, the company should equip each marketer with a PDA. Moreover, the marketer should activate the GPRS feature in their PDAs to connect to the corporate intranet databases. As for the company concerned, this two cost factor may increase the marketer expense. Hence, the company may need to find a better system which is cheaper but yet practical for the marketer.

2.5 SMS Gateway Advantages

SMS gateway technology would be an appropriate system that would support the monitoring system that will be developed in this project. The system will be able to be accessed by the agent daily from their mobile device. With a mobile phone on hand, the two way communication between the system and the agent will occur at anytime during the office hour. Furthermore, there is no internet connection needed.

From the economic perspective, there will be no new device needed by the marketing agent. Thus, there will no extra cost for new hardware. In addition, the cost of sending message will be claimed by the marketer along with the communication cost that the company often paid. However, the cost of sending message will probably as low as the GSM provider could offer. At last, there will not be any other cost for the internet service as well as it is a stand alone system.

Table 2: Comparison of existing monitoring system with MAMS

Point of Comparison	IVR System	MEI Group Monitoring System	MAMS
Supporting device	Phone	PDA	GSM mobile
Input method	telephone key	PDA handwriting	text message
Connection to database	direct	direct, GPRS	direct, GSM network
Period of information sent	daily	daily	daily
Operating System	no operating system needed	Microsoft CE	not supported

2.6 Application with SMS Gateway

2.6.1 Akademi Fantasia Voting System

Figure 2: Voting System in Akademi Fantasia

SMS Gateway was implemented to support the voting system in Akademi Fantasia (AF), the most popular reality TV show in Malaysia (akademifantasia.net). This system is open to all mobile phone users in Malaysia who wants to support their favorite AF contestant by sending SMS to the SMS center.

2.6.2 Court Information Mobile Service

Court Information Mobile Service is an integrated VisualGSM Software implement by VISUALtron Software Corporation with a newly designed OpenSQLServer SAPDB web-based data management system for case information, duty registrars, and duty judges (visualgsm.com). Lawyers can enquire using SMS the duty registrar on a particular day, or information on a particular court case. The information services implemented using VisualGSM is deployed with help features to assist users on the

correct enquiry format should they enter the wrong format. Court officers can also send broadcast notification to lawyers using the system.

Figure 3: Court Information Mobile Service

2.6.3 Sales Leads Recording For Exhibition Service

An Interactive Smart Message Service (I-SMS) service which aims to provide a smooth flow of information for exhibition leads management. The distinguishing feature of I-SMS is its ability to execute Sales Leads Recording (SLR), while providing information on promotions and other services. For example, exhibitors can obtain visitor information and sales leads at their booth while performing follow-up actions on their mobile phones at the same time. I-SMS announcements can also be sent to pre-registered visitors at any time. Users can download (the required information) from the Internet (via I-SMS) at any time of the day

Figure 4: I – SMS for Exhibition Service

CHAPTER 3
METHODOLOGY

3.1 Introduction

The completion of this project will be based on the waterfall model whereby the execution of each phase is cascaded from one to another (Sommerville, 2004). One of the advantages of this model is the ease of use and the documentation produced at each phases fits with other process models. However, its inflexible partitioning of the project into distinct stages becomes its major problem. Therefore, commitments should be made in the early stage in the process to avoid changes in the fundamental requirement. The phases and detail activity involves are:

3.2 Planning

The system is planned under several considerations as mentioned by Lee [2004], namely business consideration, social consideration, privacy and security consideration and environmental consideration.

In business consideration, there are several factors to be considered, namely the cost of hardware and software, the cost of communication, the cost of system development and deployment, and the disruption to existing service. For social, privacy, security and environmental considerations, the system are developed in order to satisfy both employee and employer. In addition, project timeline aligned with the final year project proposal are made. The project timeline can be seen in appendix A.

3.2.1 MAMS Server

Basically, the server component in MAMS is consisted of a personal computer and mobile phone or GSM modem.

a. Personal Computer

It will be used as a system platform, whereby the supporting software and database will be installed.

b. Mobile Phone

Sony Ericsson K500i hand phone will be used as both transmitter and receiver. This device should be able to work in AT command mode. It will be connected to personal computer by using DCU-11 data cable which is a USB converter based on chip pl2303, which is used to connect the phone through at115200 protocol.

3.2.2 SMS Messaging Command Line Tools

A command line tool is a tool for interacting with computers, often using a text terminal. By making use of these command lines, we do not need to program with AT command in order to control the mobile phone or GSM modem (developers.com). Thus, this command line is connecting the MAMS software with the AT command in personal computer. The list of mobile phone that can work in AT command mode and supported by the following command line can be found in Appendix A.

a. Gnokii and Gammu

Gnokii is a free and open source command line tool that can be used to send and receive SMS messages through a mobile phone or GSM modem (gnokii.org). It can also be used to read and write entries of the phone book and calendar, handle logos, load ring tones, etc. In addition, the Gnokii project contains a modem driver called gnokiid, which allows the use of mobile phone that do not support AT commands as ordinary AT-compatible modems.

According to the author, Wiącek (2007), Gammu (Gnu All Mobile Management Utilities) is a free and open source command line tool that has similar function like Gnokii. However, Gammu offer a better and up to date structure with easy API.

b. Kannel

Based on the official website (kannel.org), Kannel is a famous, powerful, open source and free SMS gateway and WAP gateway. The main use for Kannel is to link HTTP based services to various SMS centers using obscure protocols. However, we can use it to connect to a mobile operator's SMS center (SMSC), or using a GSM mobile phone or

GSM modem as a virtual SMS center. Kannel can handle multiple SMS centers and virtual SMS centers. We can specify the SMS center or virtual SMS center that an SMS message should be routed to. This feature is useful in situations such as when we have multiple SMS center/virtual SMS center connections and some of them are cheaper or faster to deliver SMS messages. In addition, Kannel has an HTTP / HTTPS interface that you can use to send and receive SMS messages.

3.2.3 Database

The database will be implemented by using Oracle or MySQL. Oracle provides an *object type model.* Object type model basically offer a similar benefit like class mechanism in Java programming. With the object features, we are allowed to model a complex real world business entity and the reusability of the object will make the application works faster and efficient (Connolly, 2005).

MySQL provides consistent fast performance, high reliability and ease of use. The selection of the database used will be based on its suitability with the command line function and the scripting language that we are using *i.e.* Java. Finally, the function of this database is to store SMS from marketing agent and SMS outline that will be periodically sent to marketing agent.

3.2.4 GSM Network

a. Maxis

Maxis Communications Berhad is a mobile phone service provider based in Malaysia. It uses the dialing prefix identifier of "012", "0142" and "017". They offer prepaid call plans, monthly subscription plans, global roaming, MMS, WAP (over both GSM and GPRS), Residential Fixed Line services, Broadband Internet plans, and as of early 2005, 3G services to both pre-paid and subscription customers (www.maxis.com.my).For business customers, Maxis offer VSAT services (satellite based communications) and Blackberry based mobile services besides regular services. Maxis most popular service is its prepaid Hotlink brand that currently serves 6.3 million customers in Malaysia.

b. Digi

DiGi Telecommunication is a mobile phone service provider in Malaysia using the dialing codes of "016, 014-32, 014-35, 014-30, 014-31 and 014-6". As of June 2006, Digi Prepaid brand has the most prepaid (pre-pay) mobile phone customers in Malaysia. DiGi Telecommunications Sdn. Bhd. provides a variety of mobile communication services. These services include voice under their prepaid plans & postpaid plans, SMS, data plans and services, international roaming, international calling card and WAP services.

c. Celcom

Celcom (Malaysia) Berhad is the largest and oldest mobile telecommunications company in Malaysia. It is one of two 3G service providers currently operating in Malaysia (the other being Maxis). As of 2006 Celcom is offering both 2.5G and 3G services on its Minutes postpaid and Xpax prepaid brands. Current customer base stood at 7 million as of early 2006. Celcom claimed 95% nationwide mobile service coverage with 3G availability in most of Klang Valley, Johor Bahru, Melaka, Kulim and Penang.

As for this project concern, we are choosing GSM network from a mobile telecommunication company with wider coverage and low SMS rate. The SMS rate for each prepaid company above can be found in Appendix B.

3.3 Analysis

A preliminary research has been investigated and it gives a better understanding on the problem faced and the technology that will be used in the monitoring system. Books, journals, and internet are the highly used reference on this stage. Moreover, few interviews with expert i.e. lecture, marketing agent, and people with marketing experience have been conducted by the writer during the early stage. The result in the early hours is discussed in chapter 4.

3.4 Design

These subtopics briefly enlighten the design of the monitoring system that we are going to implement. It will cover the monitoring system architecture and the unified modeling language (UML) diagrams. One of the diagrams (*i.e.* use case diagram) shows the action that can be performed by the users. The class diagram shows the relation between classes and the rest of the diagrams depicted the activity flows and the data processed by the system once a particular action triggered.

3.4.1 Marketing Agent Monitoring System (MAMS) System Architecture

Based on the component listed in the earlier section, we have come up with the system architecture for Marketing Agent Monitoring System (MAMS). Figure 5 illustrates the design of MAMS architecture.

Marketing Agent Monitoring System (MAMS) will automatically send SMS in periodically basis to marketing agent in order to know their activity within a day. The message will be send through a GSM network like a normal SMS. The message format that the system would handle is the standard SMS format which is supported by GSM mobile phone. The system will also enable managers to send important information to each marketer.

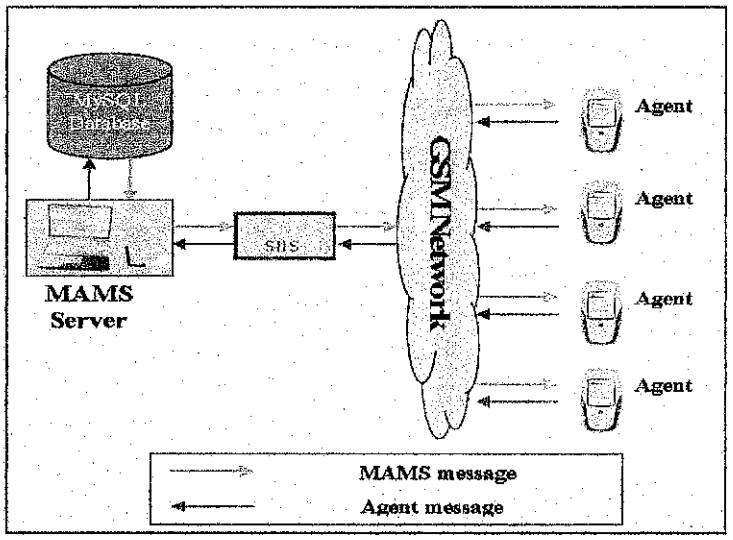


Figure 5: MAMS Architecture

3.4.2Activity Diagram

The following diagram shows the main activity that will be performed by the monitoring system which is to send the message and review it afterward. The system will automatically send message to the marketer by using the template provided. Meanwhile, the authorized user may create new message to be send to the user or simply using the template to inform the marketer on work related information.

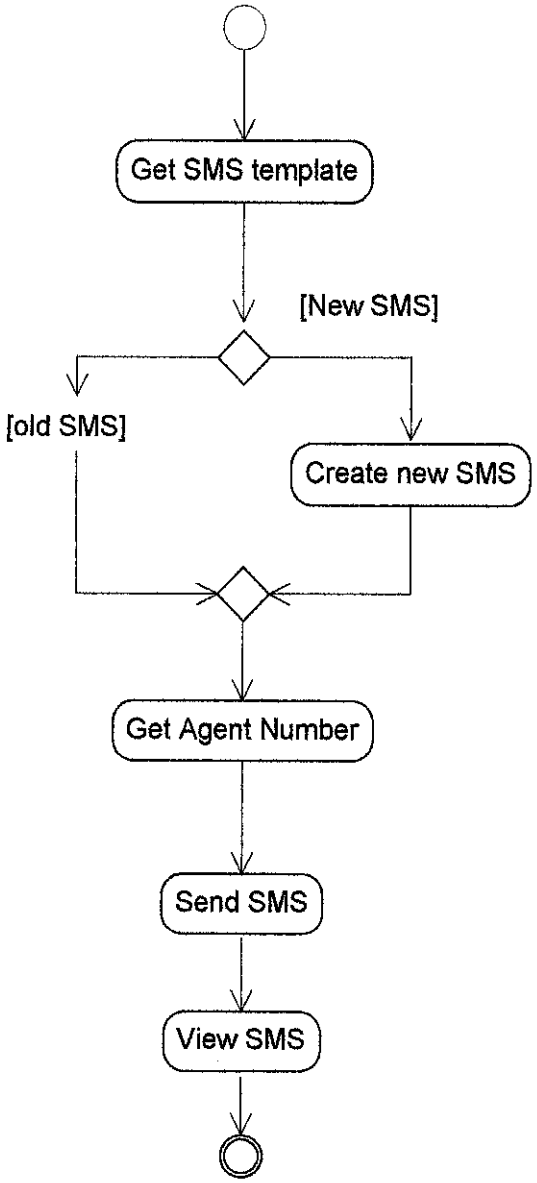


Figure 6: MAMS Activity Diagram

3.4.3 Use Case Diagram

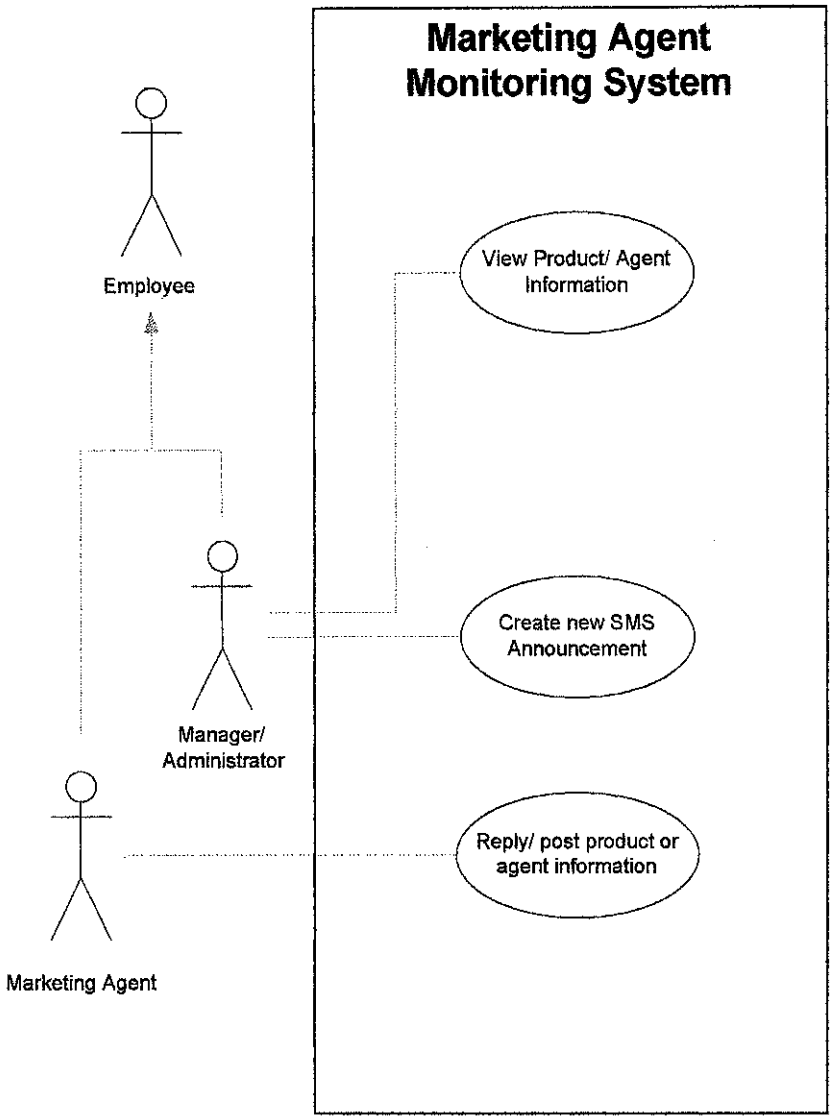


Figure 7: MAMS Use Case Diagram

In Marketing Agent Monitoring System (MAMS), managers can create a message to be sent to the agent. They can also view the message sent by the agent and or the message that they have created. Both activities is occurred consecutively, create message then view. However, managers can still view a message without creating message first. In another hand, a marketing agent can only post or reply the message to MAMS server.

3.4.4 Class Diagram

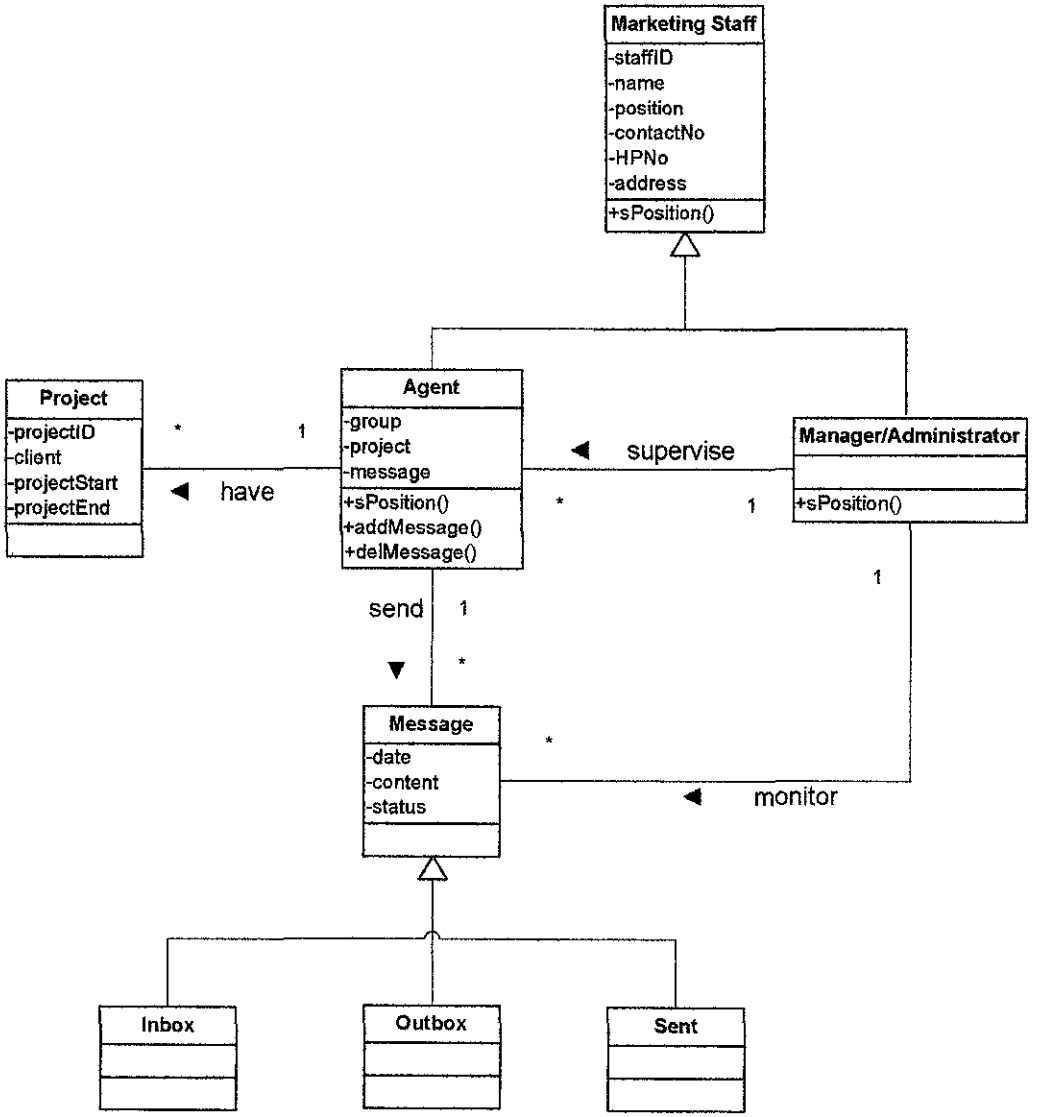


Figure 8: MAMS Database Class Diagram

3.4.5 Sequence Diagram

3.4. 5.1 Create Message

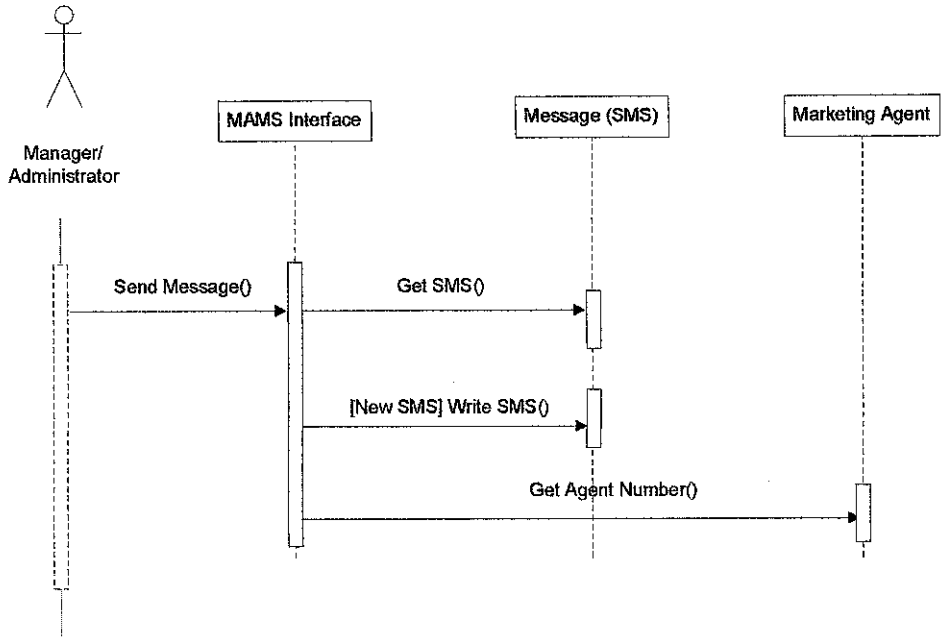


Figure 9: Create Message in MAMS

3.4.5.2 View Message

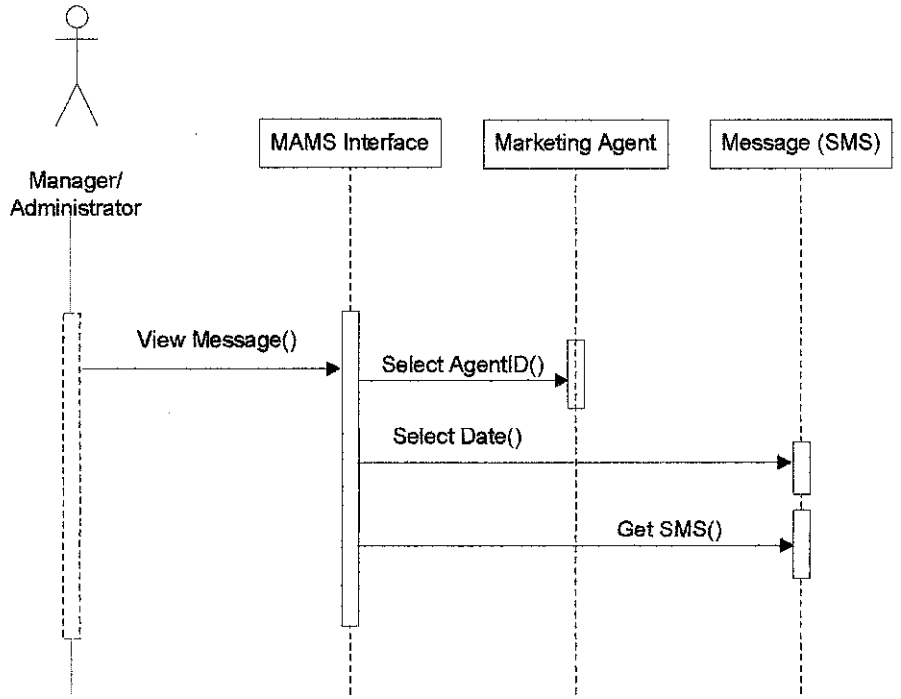


Figure 10: View Message in MAMS

3.4.5.3 Reply Message

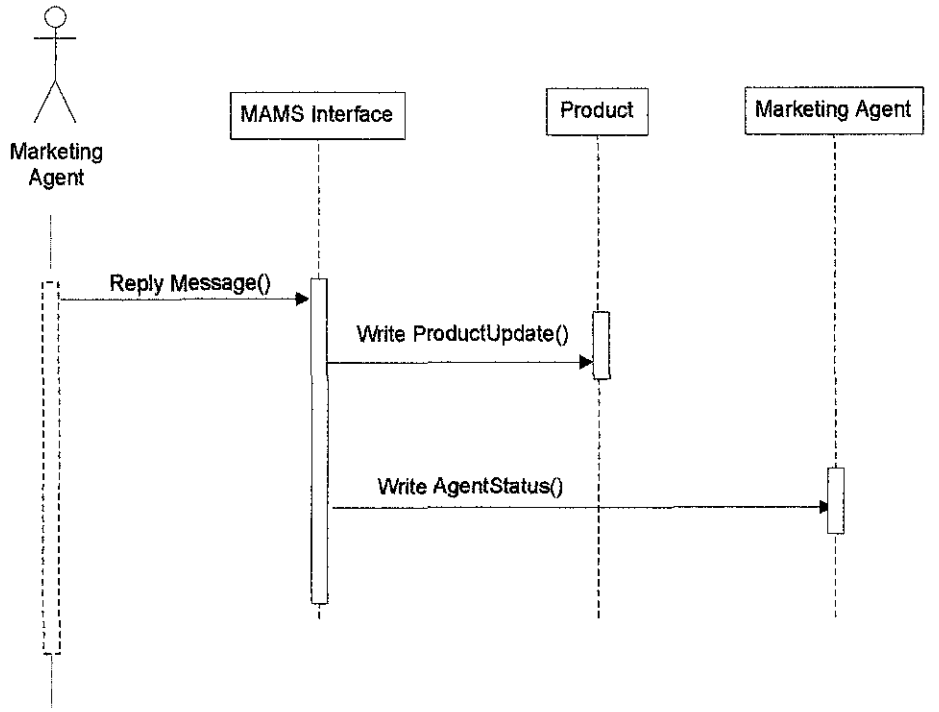


Figure 11: Reply Message in MAMS

3.5 Implementation

MAMS is implemented using Java programming. To be specific, writer uses NetBeans IDE 5.5.1 and JCreator LE 3.50 to implement the system. As mention earlier, the database is build using Oracle 92 or mySQL.

3.5.1 System Screen Shoot

The following figure is a recent design of the system interface. It might be altered through out the implementation in order to give the best interface to the user. The first figure is the opening page of MAMS. This system is only available for the authorized staff like managers or system administrator itself. The authorized staffs need to provide a valid used id and password in order to access this system.

Figure 12: Log in Page

After log in, they will be directed to the main page which provides them with the main feature of MAMS. The system connection with the mobile device is controlled by the menu file option. Meanwhile, the menu tools option handle the message related feature, like sending, displaying, and deleting message. Lastly, the menu help option provides information for message and MAMS detail.

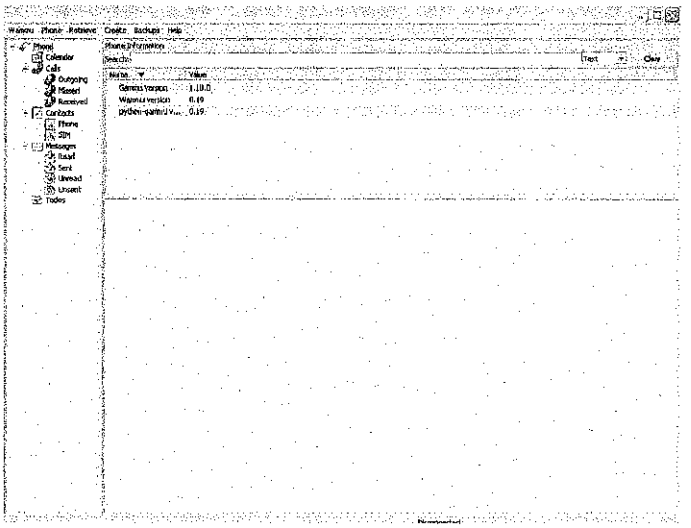
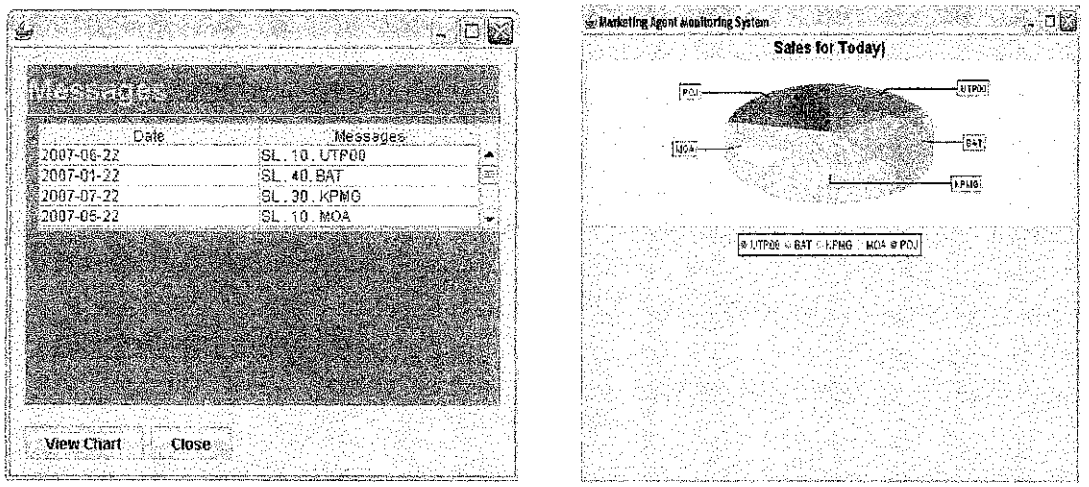


Figure 13: MAMS Main Window

The message sent by the agent which is will be display in the table of main window. We uses *gammu* command line to retrieved SMS from the phone like the following:

- **gammu –getallsms;** to get all possible SMS from phone and SIM
- **gammu –get eachsms;** to get all possible SMS from phone and SIM
- **gammu –getsms;** basic function to display message

Moreover, the system administrator or authorized manager can also retrieve the message saved in the database. The message display from the database will be look like figure 14a below. Figure 14b show the graph generated from the message retrieved from the database by the system administrator. This feature helps manager or system administrator to better understand the message information sent by the marketing agent.



(a) (b)

Figure 14: (a) Message display from database; (b) Graph of the message info

Figure 15 shows the message format that should be followed by the agent when they are sending message to the system. The dot sign (.) will be used as the separator. SL, C, ST which stand for Sales Report, Client Report, and Stock Availability respectively, are used to indicate which type of reporting the agent sent to the system. However, the message sent from the system to the agents will be in normal message format.

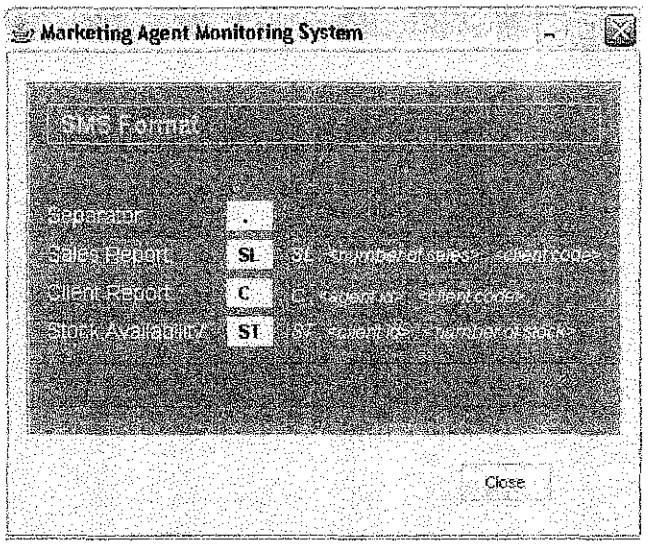


Figure 15: Message Format

Message sending feature will be look like something like Figure 15 below. Assuming the marketing agents are working in groups. Thus, sending message to Group1 means sending message to all in that particular group. It will be more efficient than sending the message one by one, to everyone under the manager supervision.

In order to perform this function, we are also utilizing *Runtime.getRuntime( ).exec( )* method in java. The parameter for this function is *gammu* SMS command for sending SMS like the following:

- **gammu –sendsms EMS** [destination number] [message format] [text]
- **echo [text] | gammu –sendsms** [message format] [destination number]
- **echo [text] | gammu --sendsmsdsms TEXT** [destination number] **MYSQL /etc/smsdrc**

Where:

[destination number] = recipient hand phone number

[message format] = text

[text] = sms message to be send

smsdrc = SMS daemon configuration file

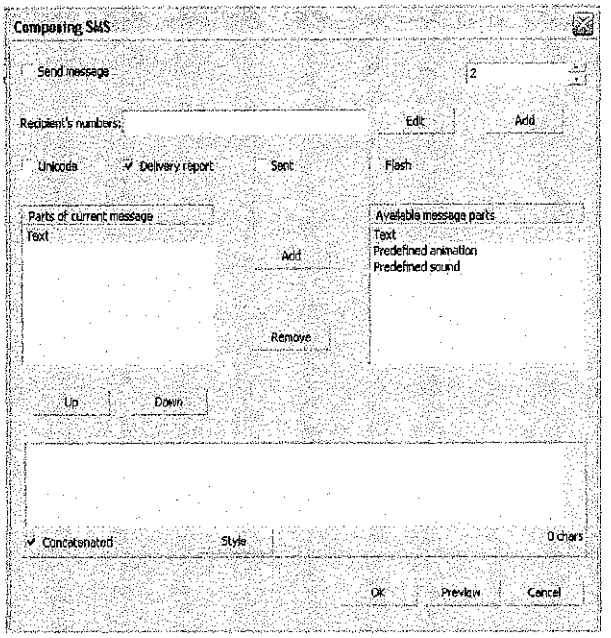


Figure 16: Send Message

3.6 Maintenance

The system will be installed and put into practical use. System testing will be conducted to integrate two or more components that implement MAMS functions or features and then testing this integrated system. Any undesired fault should be detected and fixed. The details on the system testing result will be explained in the following chapter.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Marketing and Sales Representatives Survey

A preliminary study has been performed in order to understand the distributed work performed by a number of marketing and sales employees in Malaysia. The information and data set has been collected through questionnaires and interview with expert in this field.

The number of marketer in education business sector that engages in distributed work area is loads. From the study of a group of marketing employees in Malaysia who sale education equipment i.e. text books, dictionary, *etc.*, it is found that 92% of them spends most of their time approaching potential customers. They will return to the office during the clarification process, which usually occurs at the end of the month. Another 8% works in office, but still commutes for quite a number of times in a month. The light blue and purple area in Figure 16 depicts the information mentioned above.

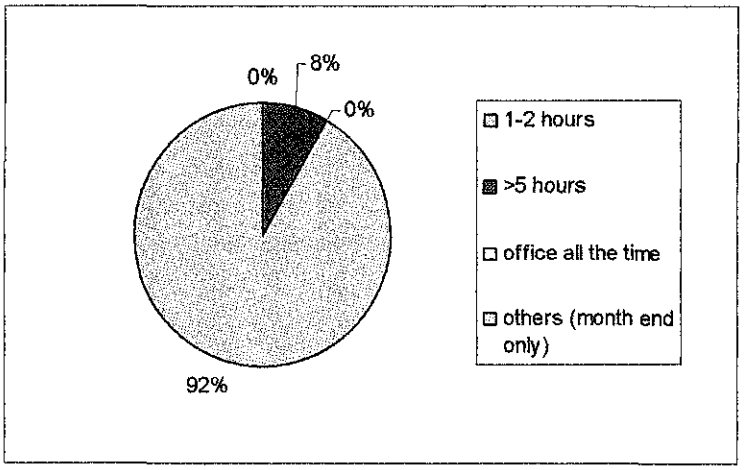


Figure 17: The percentage of time spend in the office per day

All marketer involved in this study are required to make a report on their activity periodically. Some of them need to submit the report on a weekly basis, and monthly on the other hand. It is actually depend on the criticality of the information. The information which they need to up date to the management is varied in each company. Nevertheless, there are some frequent information that they need to mention which are number of sales made (25%), time of work (23%), client's detail (23%), and the product sold (12%). Figure 12 below illustrate the information commonly updated by ten marketers who works in education sector. Most of them said that date/time of work and numbers of sales are the main information they need to up date followed by clients detail and other information that might be diverse for each company.

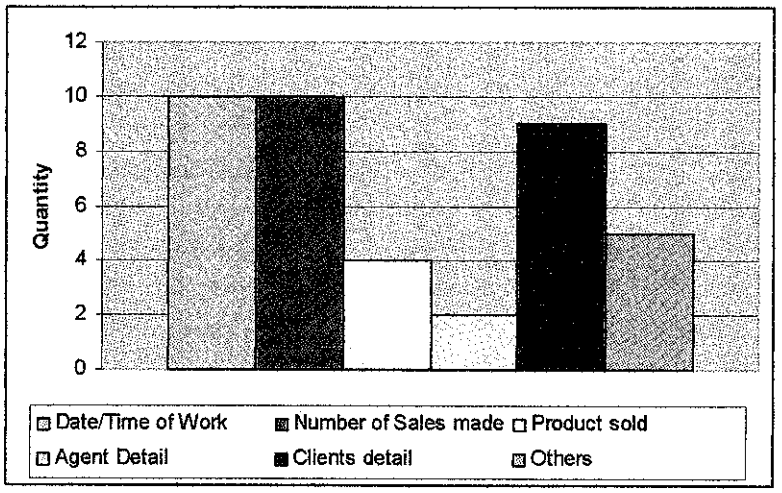


Figure 18: The common information updated by marketer

The fact that the information is critical to the management and/or decision maker, the systems that support this reporting activity is surprisingly very minim. The survey shows that the majority of the marketer is supported by a simple system only. They need to update their supervisor via a telephone call daily and submit a paper based report in the end of month. If there is a new system that can facilitate their reporting activity, a majority of 92% prefer to have a mobile application than others. Figure 18 shows the survey result. It is shown that MAMS can be potential as it is able to facilitate reporting activity using mobile application.

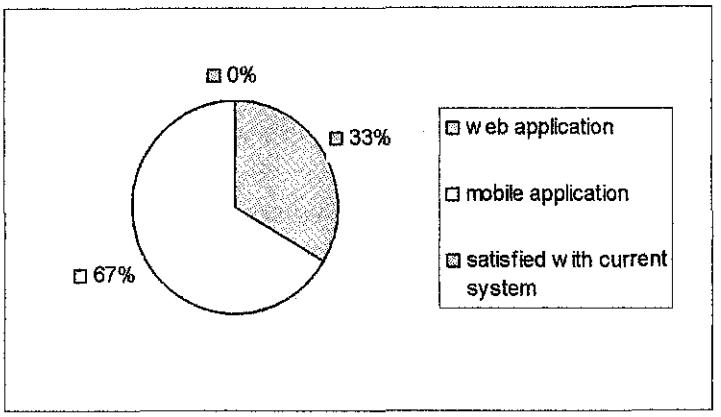


Figure 19: Preferred application type for new monitoring/reporting system

4.2 System Testing

MAMS testing involves integrating two or more components that implement MAMS fuctions or features and then testing this integrated system. For the purpose of MAMS testing, we are performing integration testing and functional testing. In integration testing, we manage to found few bug with Gammu which is Gammu geteachsms, Gammu getallsms, Gammu getsms, and other phone data retrieval command. The bug might be come up because of Gammu incompatibility with the mobile phone used, Sony Ericsson K500i and K750, because Gammu was initially built to work with Nokia phone. However, we manage to found the solution which is to use Phyton-Gammu 0.19.

In functional testing, we tried to measure the performance of MAMS main function, which is sending message. We are measuring the performance based on the number of SMS sent per minute. The system is considered to be good if it could send 6-10 SMS per minute. The following figure shows the result of MAMS performance to send message in the first four minutes. In the first minutes, MAMS can only send 4 messages. In second and third minutes, MAMS sent 1 SMS and 2 SMS respectively. However, MAMS manage to successfully send 6 SMS in minutes four.

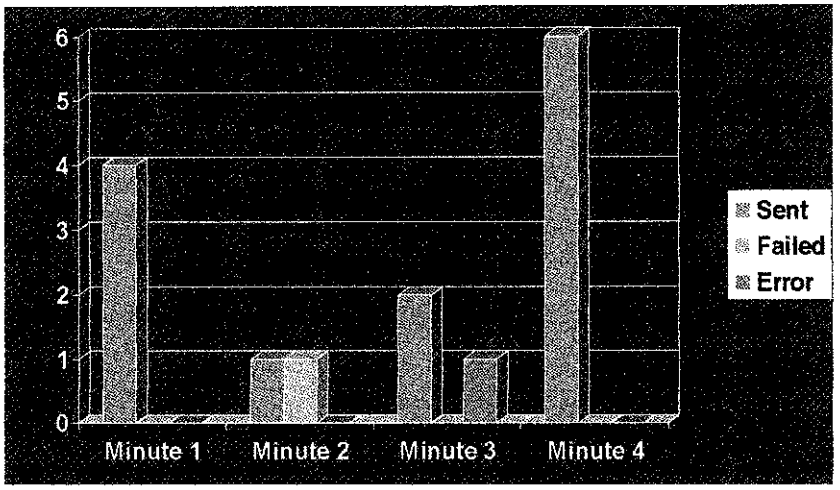


Figure 20: Number of message sent by MAMS

There are few system connection errors that we found during the system testing, which is personal computer (PC) to mobile phone connection error and database connection error. The possible reason behind the PC to mobile phone connection error is the incompatibility of the mobile phone with SMS gateway software used. Meanwhile the database error occurred because of the deliberate network connection from MAMS server to the database server.

CHAPTER 5

CONCLUSION AND RECOMENDATION

Few problems were found in recent monitoring system for distributed worker. It was found that it can not cater for late reporting by the marketer. The information key in process was seemed to be inflexible due to system fixed-menu and the reports from the system tend to be late reaching the managers.

Marketing Agent Monitoring System (MAMS) is a system that help distributed workers such as marketing and sales representative perform their daily reporting and provide the managers with the information needed for decision making.

From the preliminary study, it is found that majority of distributed worker spends most of their time working outside their office (Figure 16). During this time, they are required to report their activity. It is found that the information in the report can be very critical for the decision maker of the company. Surprisingly, the system that supports the reporting activity is very minim. The majority of the distributed workers are supported by a simple system only. Marketing Agent Monitoring System (MAMS) can be one of the industry choices in facilitating their distributed worker MAMS is able to facilitate the reporting activity to be performed in a real time. With sending and receiving message features, daily reporting will be easier. The decision maker of the company is also able to effectively analyze the critical information from the reports. An action can be performed accordingly without any delay.

The main contribution of this project is in the development of a system that enables distributed workers to report using mobile application. As a result, manager and decision maker of a company can make decisions and take actions effectively.

The data set used for the development of MAMS is small as there is some limitation to obtain the data. Due to the clash of the schedule, User Acceptance Test is not yet performed. To have further improvement of the system, a study is required.

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APPENDICES

Appendix A

No.	Detail/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Drafting basic interface															
2	Designing class diagram															
3	Constructing database															
4	Familiarizing with command line															
5	Configuring command line tool															
6	Submission of progress report 1															
7	Compiling command line tool															
8	Configuring database connection															
9	Database testing															
10	Java-Database configuration															
11	Java-Gammu(command line) configuration															
12	Submission of progress report 2 (final draft)															
13	Seminar 1															
14	Exhibition/ preEDX															
15	Submission of final report															
16	Oral presentation															
17	Submission of disertation															

Recent Work

Upcoming Work

Appendix B

List of the mobile phones and GSM modems supported by Gnokii, Gammu, and Kannel

1. Gnokii

Manufacturer	Type
Nokia	Nokia 6510 series,Nokia 7110 series,Nokia 6110 series,Nokia 3810 series,Nokia 2110 series

2. Gammu

Manufacturer	Mobile Phone Type
Alcatel	Alcatel One Touch 331, Alcatel One Touch 501, Alcatel One Touch 512, Alcatel One Touch 535,Alcatel One Touch 701l,Alcatel One Touch 715,Alcatel One Touch 735
BenQ-Siemens	BenQ-Siemens EF81
Falcom	Falcom Twist USB, Falcom wavecom
LG	LG U8210, LG U8330
Motorola	Motorola A1000, Motorola C390, Motorola C550, Motorola C650, Motorola e815,Motorola L6, Motorola SLVR 7, Motorola V150, Motorola V180, Motorola V180,Motorola V220, Motorola V3, Motorola V300/V400/V600, Motorola V360, Motorola V3i, Motorola V500, Motorola V501, Motorola V547, Motorola V551, Motorola v620, Motorola V80
Nokia	Nokia 1100, Nokia 6610, Nokia 6610i, Nokia 6630, Nokia 6670, Nokia 6680, Nokia 6680, Nokia 6680, Nokia 6681, Nokia 6681, Nokia 6810, Nokia 6820, Nokia 7110, Nokia 7110, Nokia 7210, Nokia 7250i, Nokia 7610,Nokia 8800, Nokia N30 M2M, Nokia N70
Sagem	Sagem myV-55, Sagem myX5-2, Sagem myX6-2, Sagem myZ-5 GPRS
Samsung	Samsung SGH-E330, Samsung SGH-Z400, Samsung V200, Samsung x100
Siemens	Siemens A56, Siemens A60, Siemens C45, Siemens C55, Siemens C60, lSiemens TC35, etc.
Sony Ericsson	Sony Ericsson D750i,Sony Ericsson K300i, Sony Ericsson K500i, Sony Ericsson K510i, Sony Ericsson K600i,Sony Ericsson K610i, Sony Ericsson K700i, lSony Ericsson K700i, Sony Ericsson K750i, etc

3. Kannel

WAP devices	**Phones that works as SMSC's**
• Nokia 6210 • Nokia 7110 • Nokia 9110i with WAP client • Siemens C35 • Siemens S35i • Ericsson R320 • Ericsson R380 • Motorola Timeport P7389 • Motorola TalkAbout T2288 • (E) Nokia WAP Toolkit 2.0 • (E) Nokia WAP Toolkit 1.2 & 1.3b • (E) Nokia SDK 2.1x • (E) Edge WAPman for both Windows and PalmOS • (E) Motorola ADK 1.1 • (E) Phone.com UP.SDK 4.0 • (E) AU Systems Browser on PalmOS • (E) Ericsson R380s Emulator 3.0 • (E) WinWAP 3.0 • Sony Z5 Alcatel OneTouch 501	• Nokia Premicell • Siemens M20 Wavecom WM02-G1800 modem

(E) = Emulator, Simulator, Toolkit, SDK.

Appendix C

Malaysia'a Main Mobile Communication Company SMS rate

1.Maxis

Total Plan		Easy Plan
	Voice Rates	
	Calls Within Operator	
39sen/min* RM1.20/min*	Local Calls Adjacent & Non-Adjacent	10sen/12sec 10sen/4sec
	Calls To Other Operators	
49sen/min RM1.20/min	Local Calls Adjacent & Non-Adjacent	10sen/12sec 10sen/4sec
	SMS Rates	
7sen/sms 15sen/sms	Within Operator Network Other Operators	7sen/sms 7sen/sms
	Add-Ons	
Peak: 20sen/min Off-peak: 10sen/min 1sen/sms	Calls SMS	NA NA NA
	Data Usage	
Peak: 1sen/kb Off-peak: 0.5sen/kb Within Operator Network: 25sen/MMS Other Operators: 50sen/MMS	GPRS MMS	Peak: 1sen/kB** Off-peak: 0.5sen/kB** Within Operator Network: 25sen/MMS** Other Operators: 50sen/MMS**
50% off All calls to any network	Special Call Rates	Reduced Call Rates
Daily Discount	**Calls Within Operator**	**(For Maxis-to-Maxis calls only)**
20sen/min 60sen/min	Local Calls Adjacent & Non-Adjacent	RM1.50/10min RM1.50/10min
Daily Discount	**Calls To Other Operators**	
25sen/min 60sen/min		

* Calls are charged at 30-second blocks.

** Available from 15 November 2006 onwards.

2. Digi

Postpaid Friends & Family	RM0.10/min	RM0.01/SMS	RM0.05/MMS
DIGi prepaid Fu-Yoh	RM0.48/SMS (all networks)	RM0.07/SMS (all networks) RM0.01/SMS (family and friends)	RM0.25/SMS (all networks) RM0.10/SMS (family and friends)

3.Celcom

SMS Rate	**Lite Plan**		
	Peak	**Off-Peak**	**Super Off-Peak**
a. Celcom to Celcom	**0.05**	**0.10**	**0.01**
b. Celcom to Other	**0.15**	**0.20**	**0.20**
SMS Rate	**Mid Plan**		
	Peak	**Off-Peak**	
a. Celcom to Celcom	**0.10**	**0.02**	
b. Celcom to Other	0.20	0.20	
SMS Rate	**Max Plan**		
	Peak	**Off-Peak**	
a. Celcom to Celcom	**0.10**	**0.02**	
b. Celcom to Other	0.20	0.20	
SMS Rate			
a. International	**0.50**		
b. Roaming Pre Set	0.50		
c. Roaming Standard	**2.00**		

Lite Plan
Peak - (6.00am - 5.59pm)
Off-Peak - (6.00pm - 11.59pm)
Super Off-Peak - (12.00am - 5.59am)

Mid/Max Plan
Peak - (6.00am - 11.59pm)
Off-Peak - (12.00am - 5.59am)