UTP CarPool System

by

Do Duc Kien

Dissertation submitted in partial fulfilment of
the requirements for the
BACHELOR OF TECHNOLOGY (Hons)
(Information and Communication Technology)

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Universiti Teknologi PETRONAS
Bandar Seri Iskandar
31750 Tronoh
Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

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Information and Communication Technology
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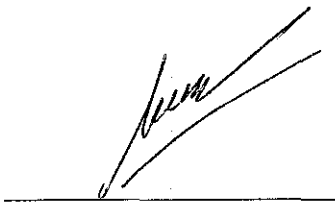
Approved by,

YEW KWANG HOOI

Universiti Teknologi PETRONAS
Bandar Seri Iskandar
31750 Tronoh
Perak Darul Ridzuan

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.



DO DUC KIEN

ABSTRACT

Transportation has been one of the main problems with students in university, especially for university in the remote area. Only a minor portion of students has their own transport, more over, the University Tecknologi Petronas is located far away from the city, students there have faced a lot of difficulties when they want to go out of the campus. UTP car pooling system has been developed with the purpose to overcome that problem. The system will let a student share his private vehicle with one or more people that have common or aligned destination. This concept has been familiar in the United State and many countries in Europe but not in Malaysia. UTP Car Pooling System is a web based system will be implemented by open source software, which will bring the flexibility and reusability to the system. Apache will be used as Web Server while MySql will be the backend Database. PHP will act as a middleware, to generate the dynamic content to display at the client side. Because of mobile blooming and characteristic of car pooling system, the system will take the advantage of wireless technology to provide service to mobile users via their hand phones. The system development will consist of three phases with three particular versions. During the first phase, the system will be set up on PC platform, so that user can access the service via their computers. After the second phase, a lot of enhancement will be made such as ability to notify users via email and SMS. The last phase will produce another version for micro browser, which is totally supported by every hand phone. At that time, UTP Car Pooling System will have ability to bring an alternative method of transportation to UTP student, which can help them to overcome one of their main problems. Mobility is the main characteristic that makes UTP car pool system different from others one. Most of the systems now, based on author's research does not support handphone as well as SMS notification, which are the most used in communication. Therefore, UTP CarPool System does not only promote this concept system in UTP as well as Malaysia, but also a deep enhancement of car pool system fields.

ACKNOWLEDGEMENT

I am indebted and grateful to everyone who has provided both direct and indirect assistance to the completion of this project.

First and foremost, I would like to dedicate my gratitude to my loving family for their continuous support and encouragement. Mom, Dad, you are my superheroes, thanks for being there for me all the time.

I am greatly indebted to my project supervisor, Mr Yew Kwang Hooi, who had continuously monitored my progress during the course of the project and never shows a sign of uninvited for my frequent show up in front of his office door. Without his constructive comments, advices and guidance this project will not be a success.

Last but not least, I would also like to thank all my friends for their invaluable advice, comments and support during development period.

LIST OF ABBREVIATION

GIS	Geographic Information System
GSM	Global System for Mobile communication
HTTP	Hypertext Transfer Protocol
SMS	Short Message Service
WAP	Wireless Application Protocol
WML	Wireless Markup Language
WSP	Wireless Session Protocol
UTP	Universiti Teknologi Petronas

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Chapter 1
INTRODUCTION

1.1 BACKGROUND OF STUDY

Nowadays, private transportation, especially car, plays an important role in human life. Most of the family own at least one car and it is their main mean of transport. Different studies show that building car pools is topically. However, it is obvious that car pooling is used very often in America, Europe countries, but it is not that popular in Malaysia. Building car pools can have different motivations for the participants: people who do not have a car can find a more comfortable way of transportation, sharing cars environment friendlier, both parties can save money for petrol, toll fee and time for searching parking space and a lot more. It was proven that another very important point in building car pools is to avoid traffic-jam: if every seventh driver joined a car pool or took public transportation, during peak time there would be almost no traffic-jam anymore.

In some of the universities, where public transports cannot cover, most of students and lecturers will depend on their own cars. However, there are a lot of students and lecturers facing difficulties since they do not have their own vehicle. Car pooling system can be built in this kind of university to over come that problem. People can share the trip, they still reach their desire destination but at less cost and safer.

As these examples show, there could be displayed many different situations where a car pooling system makes sense. There were numbers of projects and study on this topic at different level, from a master thesis to a state project. Most of them have been applied in the real life.

1.2 PROBLEM STATEMENT

Universiti Teknologi Petronas is located in a remote area and transportation has been a problem because most students do not have their own transport. Students often find the need to travel to the near cities such as Ipoh, Taman Maju or Tronoh and hence they have to call a taxi which is very expensive. On the other hand, there are students who have their own cars but often travel alone. This is not economical. It will be better for both students who need to travel but do not have their transport can easily seek for those who travel alone to Ipoh and vice-versa.

A survey was conducted before the implementation of the project, it shows that there are more than six thousand (6000) of students living inside the campus, but only twenty percent of them have their own vehicles. It is necessary and beneficially to bring the car pooling system to the student living.

Even car pool concept is not new in America and Europe, it is still relatively new in Malaysia especially in university. Based on the study, none of universities in Malaysia has implemented a proper car pooling system. The students somehow can practice this concept by posting the request to the intranet forum, bulletin or even mass emails, which are not effective and sometimes bring inconvenience to others. But due to the fact that there is a need for a proper carpool concept, we have not seen it in any university or even company. Looking at the existing carpool services around the world, one common thing they lack of is supporting mobile device such as handphone and sms functions.

Therefore, UTP Carpool System will be the enhancement of that concept, and bring another mean of transport to the students.

1.3 OBJECTIVE OF THE PROJECT

- To develop a web based system that promotes Carpooling in UTP. The system will be host in the UTP server so that it can be accessed by all students with less effort.
- To make the system to be able to perform the search-and-match calculation automatically.
- To build a web service module, that enables the website to send SMS and email to inform each party.

Car pooling system is built to match the students who have transports and students who would like to seek for a trip by providing the web based application system. The system allows users to post their requirements on their journey, and then it will do the search-and-match calculation and inform each party by email or SMS.

Besides introducing the concept of carpool, which helps the students to overcome their problems on transportation as discuss earlier, UTP Carpool System also brings new technology which has never been applied in this concept. It takes into account the mobility characteristic by providing service for mobile phone browser and embedded SMS functions. That will make the system available and accessible from anywhere and at anytime.

1.4 SCOPE OF STUDY

The project should study on the web service technology, especially client-server architecture and computer programming to develop a prototype. Components of a web service such as web server, database server, script to generate dynamic content should be covered and discuss thoroughly to choose the best suit one. They are the fundamental tools to build the system. However, the author also needs to study on the existing carpool system of other universities, organizations and even thesis around the world in order to find out the best model to be built in UTP. Combination with the real situation

in UTP, the author has come out with the system architecture as well as the development cycle for the most effective plan. The project will be implemented in 3 phases, which will be done in 3 particular versions:

- Phase 1: to set up the web platform for development.
- Phase 2: to research on public subscriber and create a subscribing module. To migrate this module into the system so the system can inform students via their email and SMS.
- Phase 3: to research on how to convert the system into the format that supported on the handphone micro browser.

The entire project should be successfully developed and implemented during the period of two semesters, which equals to ten months.

Chapter 2
LITERATURE REVIEW

2.1 REVIEW ON MOBILE APPLICATION DEVELOPMENT

2.1.1 Characteristics of Mobile Devices and Applications

One of the most important features of any application designed to run on a mobile device is the look and feel of the user interface. When designing user interfaces for mobile applications one has to be aware that mobile devices are radically different from desktop PC's. The primary differences are the smaller size of the screen and the way in which the user inputs information. Keyboards are not normally provided on mobile devices and users generally use some sort of stylus or mini-keypad to provide input. Interfaces which require the user to enter large amounts of data are therefore not suited to mobile device applications.

In addition to the characteristics mentioned above, mobile devices are also limited in the processing power and resources which they have available. When developing applications for these devices it is important to release the resources held by applications as soon as possible, particularly if the resources are scarce. This includes memory, which is often at a premium on mobile devices. Although mobile devices are limited in their computational power and resources, users still expect their applications to deliver a responsive, interactive experience. As a result developers often find themselves facing a tension between resource/memory usage and application performance when developing applications that are both efficient and meet the user's expectations.

Last but not least, if in PC platform there are only three major web browser, which are Microsoft Internet Explorer, Mozila (FireFox) and Nescape Navigator, in microbrowser platform, each company has different version of browser, even in different model. For example, the internet browser used in Nokia is different from the one used in Siemens or Motorola. The one used in Nokia 6111 is also different with the one used in Nokia 7610. And there is very little standard among these browser, therefore, it is a challenge for the developer to build a site that can be displayed properly in almost kinds of handphones in the market.

2.1.2 WAP and SMS

WAP (Wireless Application Protocol) defines a set of protocols intended to bring Internet content to mobile devices like cellular phones, pagers, and personal digital assistants (PDAs). It defines both an application environment and transport protocols. It uses existing Internet technologies and many of its components are based on these. The Wireless Application Protocol has become the standard for communication between server applications and its client so that a cellular phone can talk to a server among the cellular network that it belongs to. During the development, the WAP specification also takes in account of the limitation of mobile devices:

- Less powerful CPU
- Less memory
- Smaller display
- Different input methods
- Low bandwidth network connectivity

Because WAP has become so global, it no longer is bounded by the means of the cellular market. WAP has become the link of the Internet to the Mobile World, bridging a gap between two of the top industries of the world.

WAP Model

WAP model is quite similar to the WWW model but needs the existence of WAP Gateway. The architecture of how WAP working is shown in the figures below. One of main component of the architecture is WAP Gateway, which acts like a proxy server

between origin server and the mobile clients. Whenever a mobile client make e request, the WAP Gateway will encode the request from WSP request to HTTP request and send to the origin server. Once the WAP Gateway receives the response from the origin server, it will decode the content back to compatible with the micro browser. Further more, WAP Gateway also plays an important part as protocol translation between WML, a standard for mobile device, and HTML, a standard for World Wide Web.

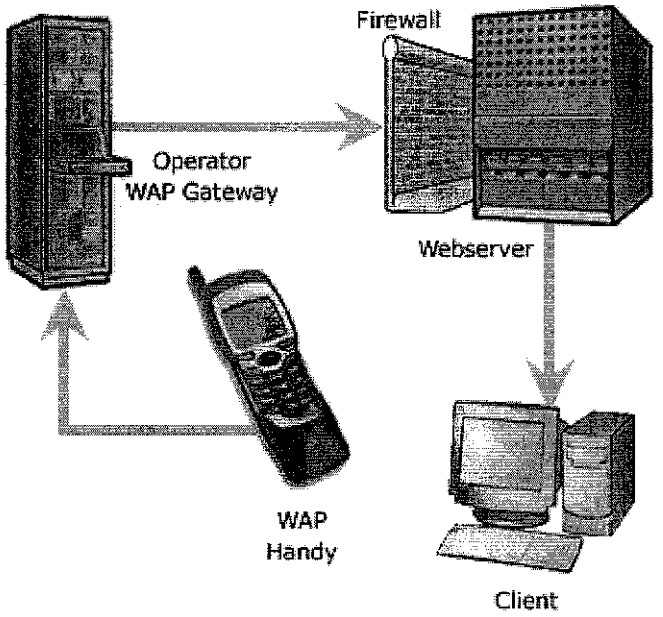

Figure 1: WAP Model – Physical Architecture

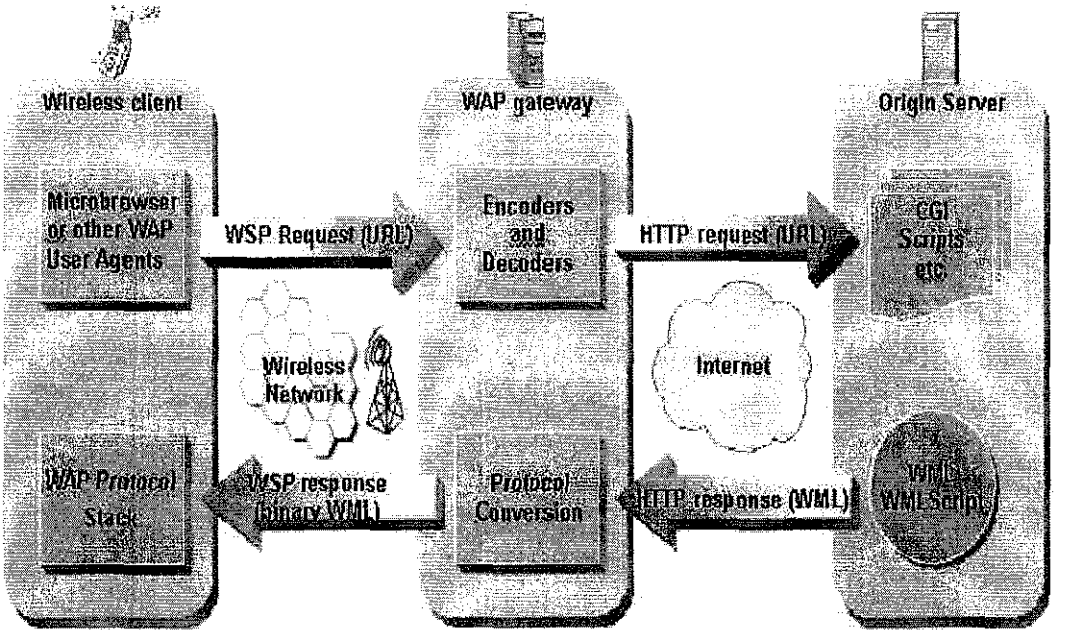

Figure 2: WAP Model – Logical Architecture

WAP architecture is divided into several layers, which is often called "Stack". Each stack has its own function and responsibility. Every layer depends on the layers beneath it and each of them is accessible by the layers above.

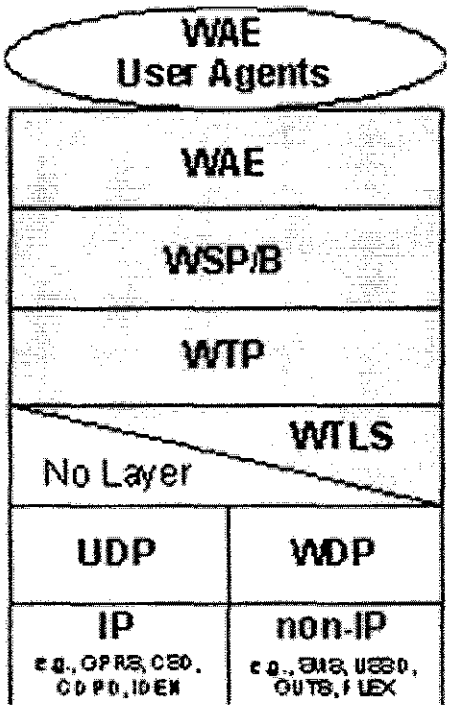

Figure 3. OSI Model for Wireless Communication

Wireless Application Environment (WAE)

The goal of WAE is to establish an environment that allows users to build applications that can be used over a wide variety of wireless systems that can be implemented efficiently. WAE is able to be used with Phone.com's HDML, the World Wide Web's HTML, and should work with other technologies of the web, such as Uniform Resource Locator (URL) and Hyper Text Transfer Protocols (HTTP), and other modern technologies that are found within a mobile network.

In the WAP model, WAE would be the application environments that sends and receives requests from the Clients to the Gateway to the Origin Server. WAE relies heavily on URL and HTTP ideals by assuming the existence of a gateway server and support from the WAP gateway in the network.

WAE is composed of user agents such as browsers, text editors, date book or phonebook. WAE is also composed of scripting, higher-lever programming languages and image formats. WAE uses languages such as WMLScript (similar to JavaScript) and WML (similar to HTML).

Wireless Session Protocol (WSP)

The Wireless Session Protocol is the layer that deals with communication between client and proxy or server. The WSP provides dialog between client and server. WSP provides the following services:

1. Opens a session of communication between client and server.
2. Establishes a protocol and negotiation between client and server.
3. Exchanges encoded data between client and server.
4. Exchanges request and replies between client and server.
5. Supports several asynchronous transmissions of data.

Wireless Transaction Protocol (WTP)

The specifications for the transfer layer are in the Wireless Transaction Protocol (WTP). Like the User Datagramm Protocol (UDP), the WTP runs at the head of the datagram service. Both the UDP and the WTP are a part of the standard application from the TCP/IP to make the simplified protocol compatible to mobile terminals. WTP supports chaining together protocol data and the delayed response to reduce the number of transmissions. The protocol tries to optimize user interaction in order that information can be received when needed.

This particular protocol has a separate interface that manages and referees the WTP layer and the settings of the handheld device. This management application is known as the WTP Management Entity. For WTP to work, the following factors are important:

1. The handheld device is within coverage area of base agent.
2. The handheld device is turned on and has a power and is reliable.
3. Resources are adequate especially with the CPU and memory.
4. WTP settings are correctly inputted.

The WTP Management Entity makes sure the above factors are valid during the transaction session. Of course, it is assumed that the user wants to receive and transmit data.

Wireless Transport Layer Security (WTLS)

The Wireless Transport Layer Security is the layer that handles security of data and validity of data between two communicating to manage, start, and finish security issues between two portable devices.

To transport data, WTLS needs: the source address and port number to identify the message creator, and from where the message is being sent, the destination address and port number to which data is being sent, and of course, the data itself. WTLS has a connection interface which provides a connection protocol between client and server.

Wireless Data Protocol (WDP)

The Wireless Data Protocol acts as the communication layer between the upper level protocols (WTLS, WTP, and WSP), and the bearer services. WDP allows the upper layers to function independently from the wireless network at hand, as long as the WTP layer is specifically set to the settings of the bearer settings.

The function of the WDP is to provide a stable environment so that any of the underlying bearers can operate using WAP. WDP can be adapted to different bearers with different services however the services offered by WDP remains constant thus providing a continuous interface to the upper layers of the WAP stack.

Bearers

The bearers of WAP are the products or other types of medium that implements WAP in their network and in their technology, such as CDPD, Mobitex, and GSM.

2.1.3 Short message service (SMS) technology

The SMS is a service that enables mobile phone to send and receive text message. SMS was developed when it was incorporated into the Global System for Mobile (GSM) digital mobile phone standard.

However, with the development of technology, the term SMS has broadened its scope. SMS now is a globally accepted as a wireless service that enables the transmission of alphanumeric messages between mobile subscribers and external systems such as electronic mail, paging, and voice-mail systems.

Due to the scope, this report only focuses on how to send a SMS from a web site to mobile phone subscribers. Basically, there are two ways to send a SMS from web service to a mobile phone, either using GSM Modem (hardware) or using SMS Gateway (software). SMS Gateway is more familiar because of its advantages:

- Lower installation cost
- Easy to implement

- Support sending bulk SMS (which can not be done by GSM Modem)
- Flexibility

The architecture of system sending SMS from web service to mobile phone is shown in the diagram below. The web service will get the information from user, via form, and then use "Push" technology to transfer to SMS Gateway. The SMS Gateway will encode and/or reformat the package then send to SMS Center (SMSC). SMSC acts as a store-and-forward system, will forward the SMS to the mobile phone via Mobile Switching Center (MSC).

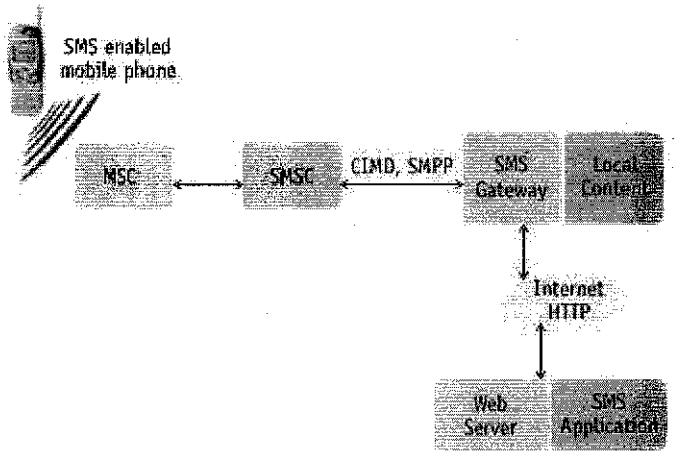

Figure 4: Web-to-SMS architecture

2.1.4 Dynamic website with WML, PHP and MySQL

In the initial stage, most of the WAP sites are only statistic with basic WML codes. However, due to the fact that it is requirement for data to be updated frequently, the site must have interaction with user, and provide more entertainment and value added service, WAP sites become more dynamic.

There are several technologies to build a dynamic WAP sites. In this report, due to time and scope constraints, the author will only focus on the technique of combination of server script and WML.

The core of a WAP sites, whether it is dynamic or static, is WML. As discuss earlier, it is the markup language, to build the interface of the page. It is very similar to HTML but provide fewer controls.

Behind of WML, is of course, the script language. There are some script languages which are normally used. The one used most is Microsoft Active Server Page (ASP). ASP is normally chosen because it runs effectively in IIS, and the most important is IIS support WAP natively without any configuration. That the reason why a lot of developer want to use ASP as the method to build their dynamic WAP websites.

Another two server scripts are PHP and JSP. Both of them, in order to corporate with WML, require developer to do some configuration with the server. In this project, the author uses PHP as scripts language and MySql as the server as both of them are purely open-source and suitable for academic project.

In order to embed PHP code in WML file to generate dynamic date, there are some configurations needed to the server so that the server will understand the PHP code and pass it back for parsing instead of treating it as content of the WML file. There are two types for configuration: direct and indirect. If the developers have full access to the configuration files on the server, they can modify the MIME setting in .htacess in Apache server. However, since most of the developers do not have the right to access and modify the core configuration settings, one thing they can do is create another .htacess file with the updated MIME and put it in the same folder that contains their WAP site. By this way, each time a WAP page is loaded, the server will read the .htaccess file and override its current setting.

However, as discuss earlier, there is a challenge for every developer to develop WAP sites since there is WML offer fewer controls compared to HTML, for example, there is no FORM control in WML. Besides that, each handphone with its own browser has its way to parse the code and display the content differently such as most of the old handphone does not support the Drop down list box, if we put the code of Drop down list box, it will display all as list of check boxes. However, in the new Symbian based

smartphone, the browser can display Drop down list box seamlessly. Therefore, it is a need to consider doing testing with as many kinds of hand phones as possible to increase the compatibility of the code.

2.2 PREVIOUS STUDY AND IMPLEMENTATION OF CAR POOLING

2.2.1 Car Pooling with GIS Map Server and Web Services

Car Polling with GIS Map Server and Web Service is a master thesis of Mr. Muzaffer Dogru (Sclieren, Switzerland).

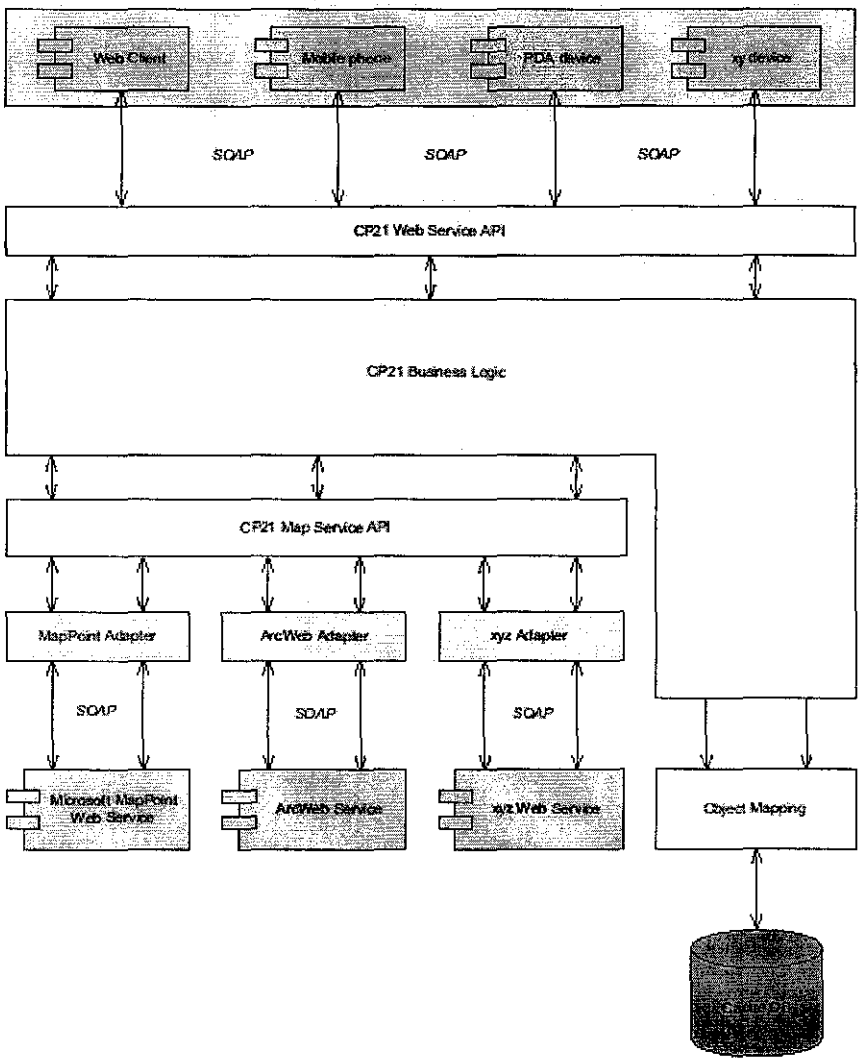

Figure 5: CP21 Application Architecture

The main architecture of CP21 is three-tier architect, which is intended to allow any of the 3 tiers to be upgraded or replaced independently as requirement or technology change. Three main tiers are: Client tier, Business tier and Data tier. However, in contrast with ordinary three-tier architectures, the business tier of CP21 is tiered itself. It consists of three different tiers:

- Business logic tier: this is the most important tier of business tier, where the complete functionality of the application is defined.
- Object mapping: this tier manages the object mapping of business objects to data objects.
- Map tier: this last tier is responsible for geographical data management and consists of internal and external components. The external components are web service of any providers.

The most noticeable in his thesis is the implementation of the MAP server. There are some requirements a map server has to fulfill that it can be used with CP21.

First of all, a map server has to be able to represent geographical locations as coordinates. Since a matching cannot be performed on the base of the name of the location, all locations are mapped to the corresponding coordinates. The coordinates have to consist of a longitude value and a latitude value.

Then, since each map service supports different countries, the map service should return all its supported countries. Otherwise, the implementation of the client cannot be optimized concerning the returned locations. In the worst case it will even be impossible to find any location at all. This is the case when a client offers a choice of countries containing only unsupported countries.

A matching of sub routes is only possible if the start date and time is defined for each via location separately. It cannot be the task of the user to enter this information. The

map server has to have the capacity to calculate the time difference of two consecutive locations.

Finally, a map service should be able to return a map for an entered route with a route description. A map service that does not return an image or a route description is still applicable with CP21, because the core functionality of the system is not affected by this feature. The consequence would only be that this function is missing. Last but not least, the ability of marking points of interests on the returned map is a nice feature, which is necessary to make CP21 integrate-able with E-Parking, the parking monitor system that had been successfully implemented.

There are several top notch technologies have been used to implement this system such as:

- Caché Database
- Java
- Web service: XML, SOAP, WSDL, UDDI
- AXIS
- PHP

2.2.2 Another carpool service

There are several universities and organizations have implemented their carpool system such as University Monash (Australia), York University (USA), Harvard University (USA), etc. The author has surf and tried to use their service as well as found any documentation or guideline on how to develop the system as well as how the system operates. Some of the systems provide comprehensive function such as map service, auto pay, etc, but none of them consider the mobility characteristic. So in order to access the service, the user must have a pc connect to internet or intranet at least, and then all the communication will be done via emails, which can lead the some delay or miss of the trip due to the fact that not everyone checks his or her email every hour. It would be an advantage if UTP Carpool System can be accessed via handphone, which

is the most common gadget nowadays, and alert will be notified via sms, which can make a real time communication.

Chapter 3
METHODOLOGY

3.1 PROCEDURE IDENTIFICATION

At the beginning phase, a survey will be conducted to study about the though and reaction of students with that potential system. The project will be carried on with some researches from the existing implementation of the same concept (same context and related context). The data is gathered, tools/techniques are identified together with analysis from the current environment (constraints, limitation...) to form the method in order to implement the project. The system is also planed to provide information to customers through mobile SMS as an enhanced module.

3.2 INITIATING AND PROJECT PLANNING

3.2.1 Initiating

Initiating is the process where the author recognizing and starting the project. It involves committing the next phase of the project. The output of initiation process is the key document for formally recognizing the existence and providing a broad overview of this project. The following method has been chosen in accomplishing the initiation phase.

- **Observation** – Observation has been done to see the status of transportation system in UTP as well as how student behaved.
- **Interview** – Interview with Mr Azhar, University Technology Petronas Security Officer has been done to get information related to number of vehicles that students own.

- **Questionnaire Survey** - A survey has been done to confirm the result came from Observation phase. It also gathered information on how students think about the transportation system in UTP, what problem they were facing and how they think about the car pooling system concept.
- **Problem identification** – After several methods were done to gather significant information, the next step is to determine the real problem in transportation that students facing so far. Some ideas of how to help students to overcome that problem were also generated at the end of this phase.

3.2.2 Project planning

Project planning includes devising and maintaining a workable scheme to accomplish the objective of the project. There are some factors need to be considered during this phase:

- **Scope planning** – Scope planning involves developing documents to provide the basic for the future decision including the objective of the project. Therefore, through the scope planning, the problem statement, objective and especially the scope of the project must be stated properly. Within 2 semesters, the author will concentrate on the fundamental functions of the car pooling system such as posting requirements, searching function, matching algorithm, public subscriber, etc and some enhancement such as support hand-phone microbrowser.
- **Time planning** – Time planning was done to ensure the project would be done in the right time track. Therefore, through the time planning, Gantt chart has been created to make sure the tasks and project activities are performed within the specific time given.
- **Cost planning** – Cost planning involves the project's budgeting is derived from the hardware, software or service has been used during the time to develop the project. Cost planning was used to estimate the cost of GSM modem, SMS Gateway service, air-time credit of Hotlink Prepaid, etc.

3.3 SYSTEM DESIGN AND DEVELOPMENT

3.3.1 Use Case and flow of the system

- **Search Use Case :**

  The system involves two types of users, one offering trip and one seeking trip. The users access the service via web interface. They can search for available trip offered or people seeking for trip with specific destination and time.

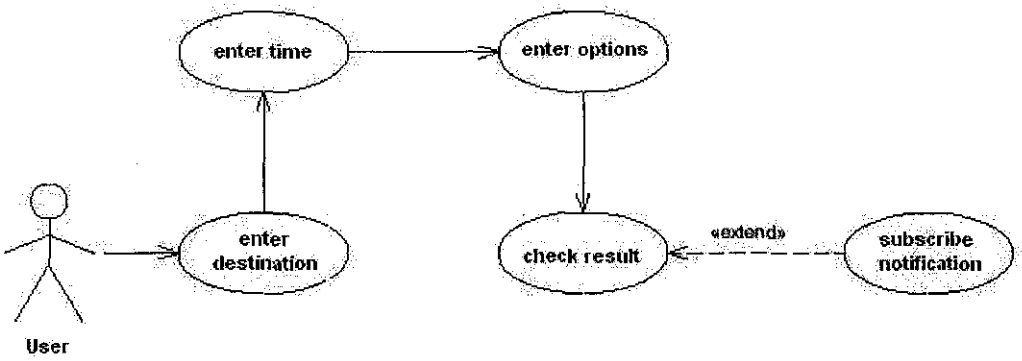

Figure 6. Search Use Case

- **Add Carpool Use Case**

  Every user can add carpool into the system. The information includes type of carpool (offer or seek trip), destination, time, date and other options.

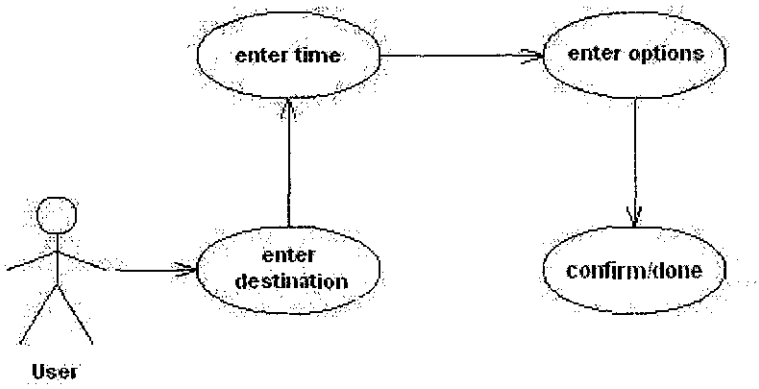

Figure 7. Add Carpool Use Case

- **Notification system**

  If the users subscribed with the system, when there is a posting that matches his or her requirement, the system will automatically send emails and SMS to both parties to inform them about the result.

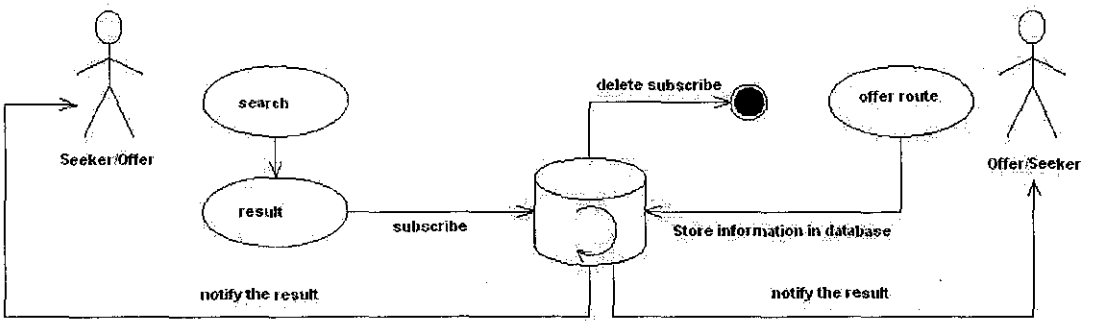

Figure 8. Notification Use Case

- **Data flow of the system**

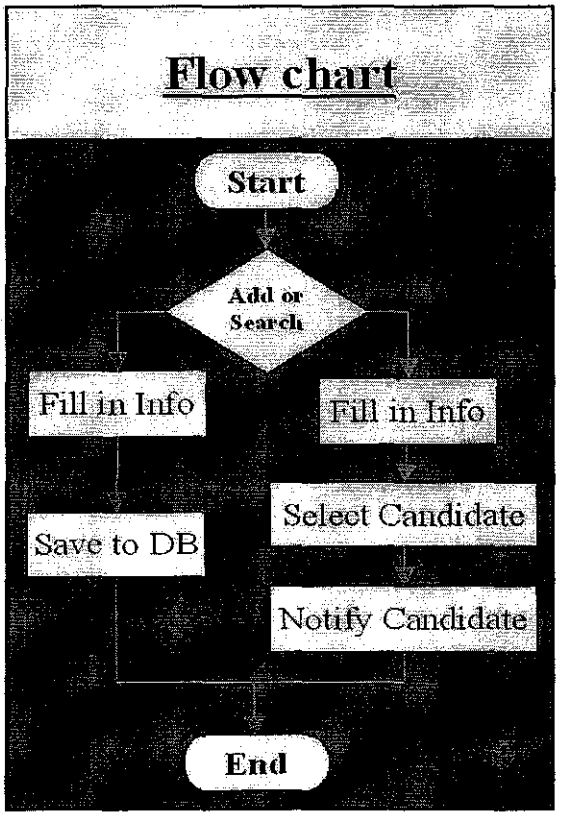

Figure 9. Flow chart

- **Database design**

The database will consist of two tables, since it does not need to maintain the record of each successful carpool. There are two tables, one is Offertrip, which contains all information related to user who offer trip, and table Seektrip containing information of user looking for trip.

Table 1. Offer trip database table

	Field	Type	Attributes	Null	Default	Extra	Action
☐	oDestination	text		No			
☐	oDate	date		No	0000-00-00		
☐	oTime	text		No			
☐	oGender	text		No			
☐	oEmail	text		No			
☐	oHp	text		No			

Table 2. Seeking trip database table

	Field	Type	Attributes	Null	Default	Extra	Action
☐	sDestination	text		No			
☐	sDate	date		No	0000-00-00		
☐	sTime	text		No			
☐	sGender	text		No			
☐	sEmail	text		No			
☐	sHp	text		No			

In both tables, the Destination, Date, Time, Gender, Email and Hp are used to store respectively data of user. Then this information will be used to perform the search and match calculation.

3.3.2 System architecture design

The proposed architecture for the system is tiered server-client architecture. The server would be running on Apache with SQL server as backend database. There are some tiers in the server side.

The Database Management Service (DBMS) will handle all requests to query the database.

The Business Logic Layer will take PHP into account to perform all the necessary functions of the system and generate the dynamic contents for clients.

The Client consists of Web Client (PC users), Mobile phone and PDA. They will access the service via appropriate Web Service API.

The Business Logic tier also connects with SMS service via its SMS Service Adapter. The SMS service will get the "push" data from the system then send SMS to the Client mobile phone.

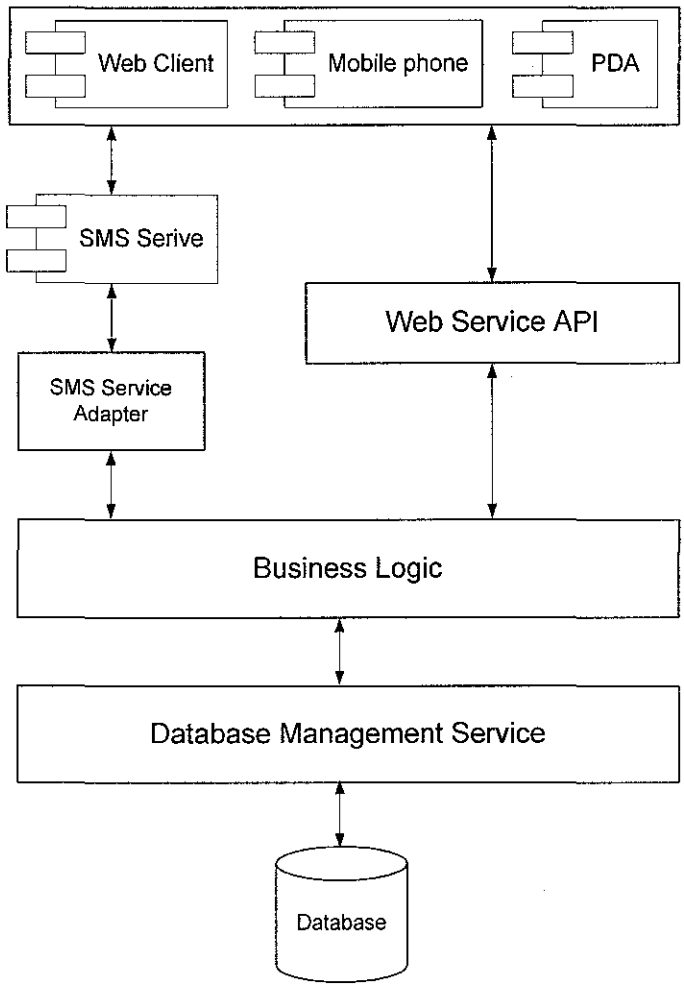

Figure 10: Car Pooling System Logical Architecture

In the physical architecture layout, the clients who uses PC platform can access directly to the service at the server. Mobile users, which use laptop, pda or cell phone, can access the service via Wireless Lan or GSM/GPRS/3G network.

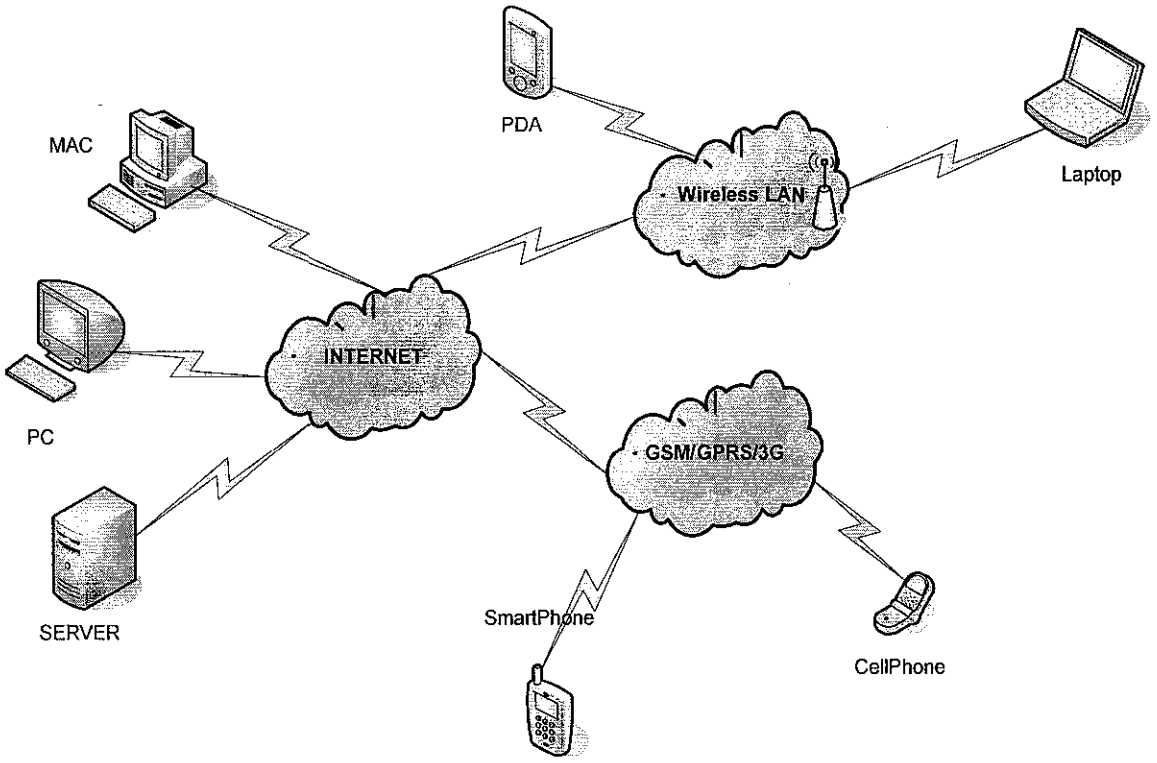

Figure 11: System Physical Architecture

3.3.3 Methodology

The methodology which is applied during the project development is the Spiral model. Using this methodology, the project will be divided into several phase with particular deliverables. In each phase, it can be seen a full project life cycle with the review of the previous prototype.

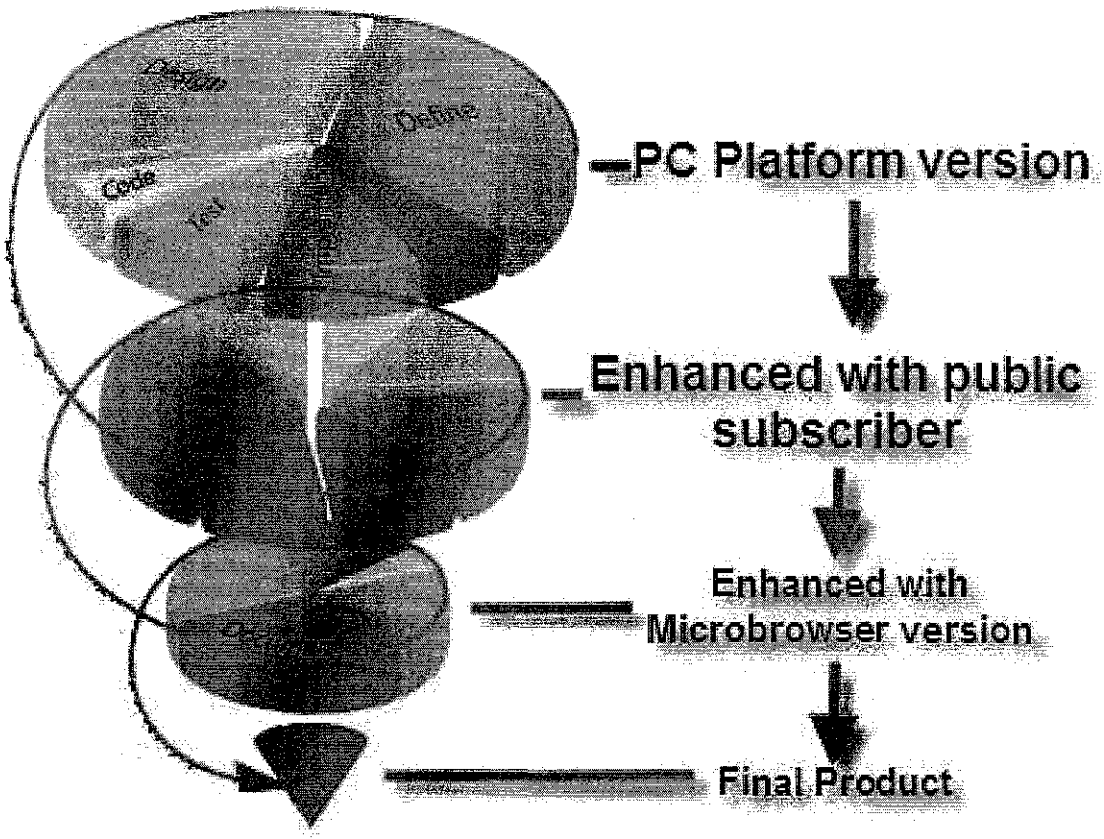

Figure 12: Spiral Methodology

There will be three main phases during the development:

Phase one: the main task in the phase one is set up a platform for that web based system. At the end of that phase, the system would be ready to perform fundamental functions in Pc platform. That phase should take one semester.

The main tasks in this phase include:

- Task 1: Set up the server environment. The package is Microsoft Window XP, Apache Server 2.2.4, PHP 5.2.1, MySql 5.0 and PHPMyAdmin 2.9. The environment should be configured formally and tested before proceed.

- Task 2: Design the system. The deliverables of this task should be the architecture of the system, the use case diagram and all supporting documents.
- Task 3: Design the web site interface
- Task 4: Design the appropriate database
- Task 5: Create PHP code that handles the system functions
- Task 6: Integration and testing

Phase two: during this phase, a study on public subscriber function will be conducted. At the end, the result will be a module which can send the information to each party via email or SMS integrated in the existing system. The second phase should take 2 to 3 months.

- Task 1: Review the previous prototype
- Task 2: Study on public subscriber
- Task 3: Create a module to send email to students to notify them
- Task 4: Study on SMS communication architecture
- Task 5: Create a module to send SMS to students' hand phone
- Task 5: Integration and Testing

Phase three: the task of this phase is to make the system to be compatible with handphone's microbrowser. There should be a study on technology such as WAP, WML, and WML gateway in order to fulfill the requirement.

- Task 1: Review the previous prototype
- Task 2: Study on WAP, WML technology
- Task 3: Convert the system to compatible with hand phone using WML
- Task 4: Integration and Testing

3.3.4 Test plan

The author has designed a test plan for the system testing phase. Basically, there are two parts of testing is Performance Test and Acceptance Test.

- Performance Test: this test will be done by the author, who developed the system. The test will cover the functional test, non-functional test as well as the integrity testing.
- Acceptance Test: this is users testing. The system will be used and tested by real users to decide whether it meets the user expectation or not. This test will be done as soon as the system is finished.

3.4 TOOLS TO BE USED

The following are the tools suggest to be used in the development of the project:

Hardware/Components	Specification/ Model	Reason of Usage
Desktop/Notebook	IBM R52 Notebook	The workstation is needed to develop the system prototype. It is recommended to be a high processing computer to handle the mobile development prototype efficiently.
Database Server	MySQL	To implement the database structure of the prototype. Database server is used to separate database from application interface to improve the security and better data management issues of the system.
Web Server	Apache	To implement the Web service of the system. The Web service is registered in the Apache Web server that acts as the "middle man" among the client devices and MySQL.

Mobile Phone	Any mobile phone with GPRS enabled.	To implement the prototype in the form of normal mobile phone. The phone is required to have GPRS enabled in order to browse the Web service.

Software	Reason of Usage
Microsoft Windows XP Professional	Most stable Windows series with performance and security enhancements through service pack.
PHP web service	Powerful server script that can generate dynamic content for the system as well as perform fundamental functions.

Chapter 4
RESULT AND DISCUSSION

4.1 RESULT

4.1.1 Survey result

The objective of distributing questionnaire is to get information about the transportation system in UTP and how the students think about the car pooling concept.

The questionnaire is divided into four sections which has different purpose. Section A contains all general questions about students and their habit of transport. The first question is asking about the year of the student. It acts like a filter to let the author to choose equally feedback from every segment in order to have a fairer view.

For Question Two, most of the answer is "NO" when they were asked about the sufficiency of the allowance. Since most of UTP students are scholars, they receive RM500 each month for allowance. At another survey conducted by International Student Committee 1 year ago, more than 90% of students consider RM500 is not enough for their lives in UTP.

Question 3 and 4 ask student about their habit of transport. All of the students have gone out of UTP at least one time. The detail result of the survey is shown below:

Table 3. Details of Results of Question A4

Frequency	No. of persons	Percentage
Once a month	0	0%
Twice a month	9	30%
Every week	18	60%
Twice a week	3	10%

The purpose of section B is studying about the transportation system in UTP, how students often go outside. There are only 13.3% of the students, who participated in the survey have their own cars or motorbike. The main transportation which majority of students use is bus and following up is taxi. The table below contains more detail information about how students often go outside.

Table 4. Details of Results of Question B2

Transport	No. of persons	Percentage
Own car	4	13.3%
Go with friends	5	16.7%
By bus	12	40%
By taxi	9	30%

Questions 3 and 4 of Section B gather information of transportation cost and its convenience. From the result, more than 76% of students spend average amount and above for their transportation fee and nearly all students consider the quality of transportation system is below average.

Table 5. Transportation fee spent by UTP student

Transport	No. of persons	Percentage
Not much	5	16.6%
Acceptable	10	33.2%
A lot	13	43.4%
Out of control	2	6.8%

Table 6. Transportation quality rated by UTP students

Transport	No. of persons	Percentage
Too bad	23	76.6%
Not good	6	20%
Acceptable	1	3.4%
Good	0	0%

In Section C, three questions study on how student are familiar with the car pooling concept and its necessity. Half of the students know about this concept, however, all of them give the positive feed back for "implementation of a service to let them share the trip", in another words of car pooling systems.

From the survey above, it has been shown that transportation is one of the main problems that UTP students facing now. It is necessary to implement a car pooling system, which is supported by students.

4.1.2 System development result

At the moment this report was written, the author has finished the UTP CarPool System in both PC and Microbrowser versions.

Apache, MySQL and PHP were setup and configured successfully in a local server. Author use PHPMyAdmin to manage the database and has been created a database for UTP Car Pooling System with two data table: OfferTrip and SeekingTrip. The server also was configured to support WML in order to run the dynamic WAP site.

At this moment, all of the core modules are totally finished such as the code to connect the presentation level with MySQL server. It was successfully tested to run SQL queries such as Insert, Select with dynamic parameters from the web interface. The Searching algorithm also has been done, which allow users to search for available trips which fulfill their requirement about the destination, date, time of destination and other

options. The result will be displayed in form of table, which show details about each trip and then user can choose the one he or she likes to go to with most to inform by email and sms.

About the notification module, the author has chosen ClickATell as third-party SMS service provider and successfully integrated the SMS module into the system.

Running the system in the local host inside the campus, the author have faced some problem with SMTP as UTP firewall block port 25, which is the default port for SMTP service. However, the author has requested to host the system in the UTP server in order to solve that problem.

An alternative choice which was chosen to be implemented is using the existing mail server of UTP since this system is only focus to serve UTP students who has all UTP emails.

One problem left is the host for WAP service. The system can run on the localhost, a web browser can access the system at localhost but the handphone with its microbrowser cannot. It is a requirement that the system must be hosted in one internet site that can be accessed by handphone via GPRS. It will be done during the Acceptance Testing.

Screenshot of the system

Users enter the main page, where they can search for available carpools based on their specific requirements.

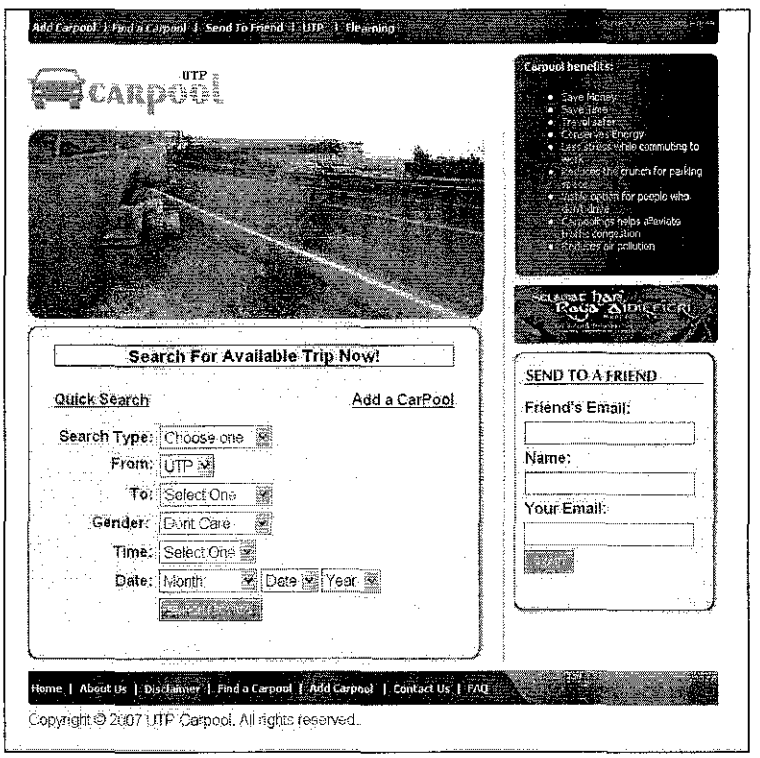

Figure 13. Main screen of the system

After sending the query, list of available trips will appear and users can choose to see details of each trip before deciding to join them.

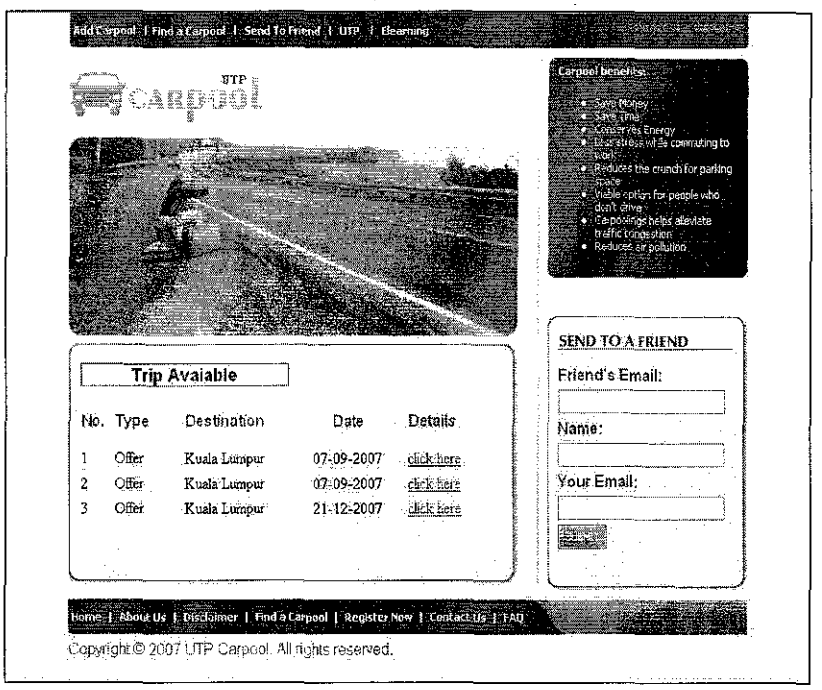

Figure 14. Result Page

In the details page, if user want to join the trip, user will fill in his/her name, handphone number and email in the form on the right and submit. The system will notify the poster via email and sms with user's information so they can contact each other.

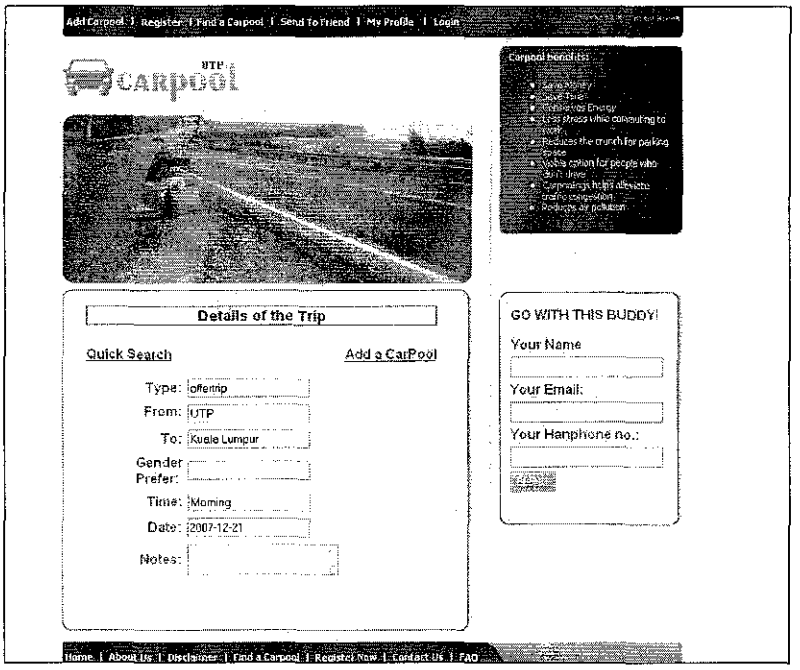

Figure 15. Details of the trip and form to send information

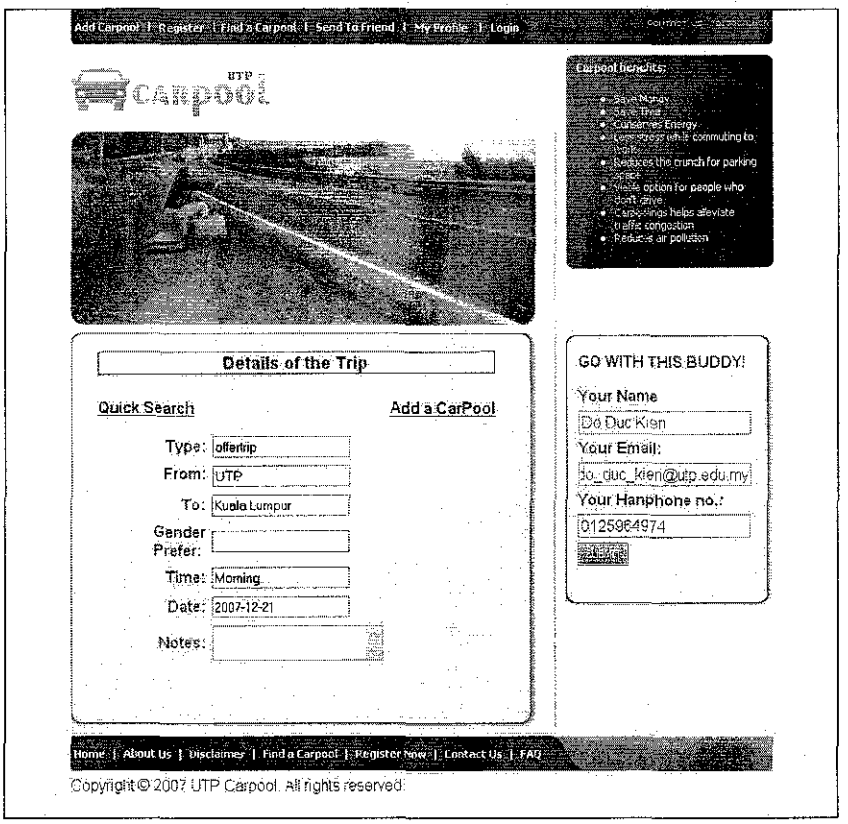

Figure 16. Fill in the form with user's information

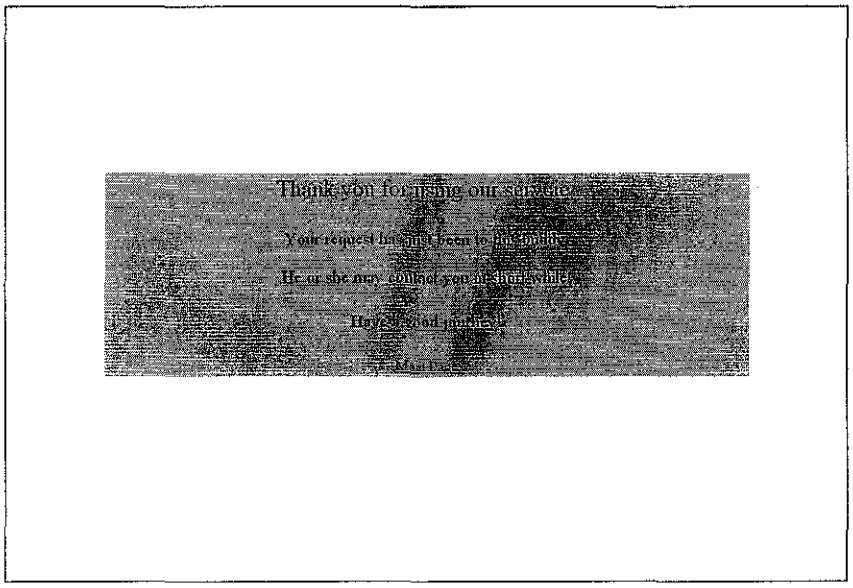

Figure 17. Successfully notify the poster

If user cannot find a suitable carpool, they can add their carpool into the system

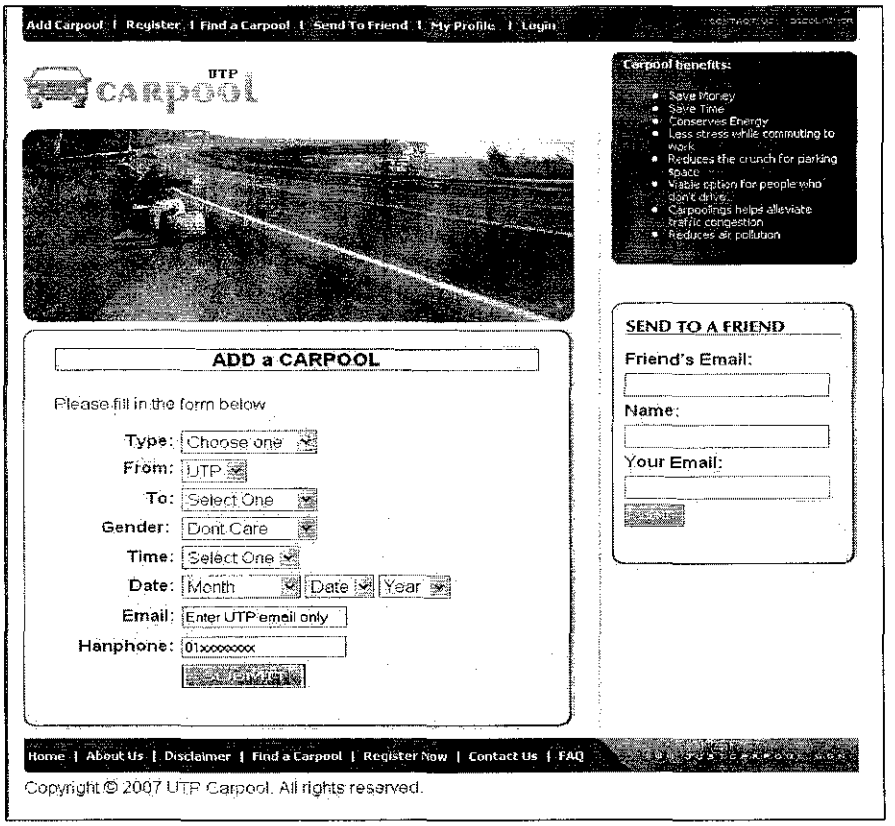

Figure 18. Add carpool page

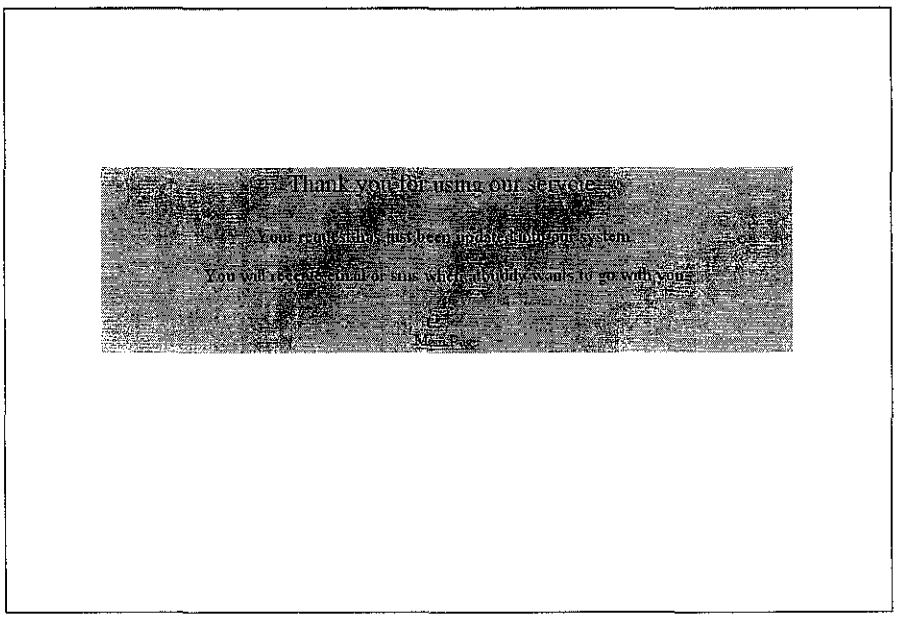

Figure 19. Successful add a carpool

Mobile Microbrowser screenshot

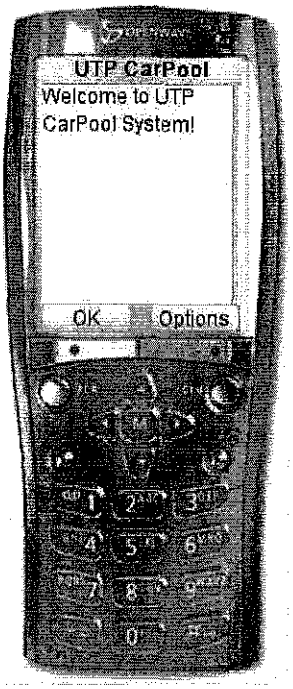

Figure 20. Splash Screen

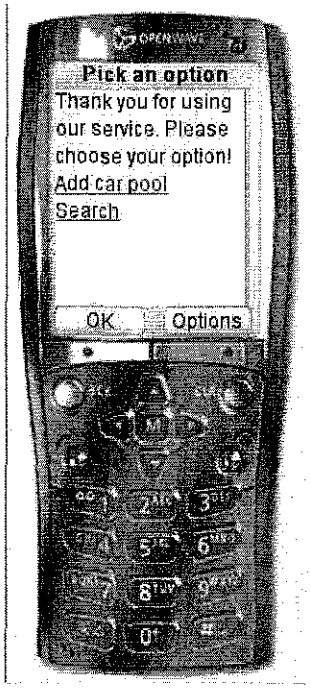

Figure 21. Main Page

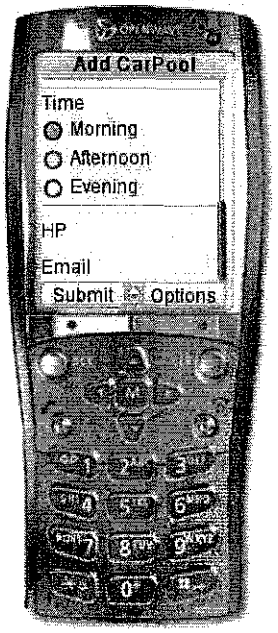

Figure 22. Add Carpool Page

Figure 23. Successfull Added Carpool

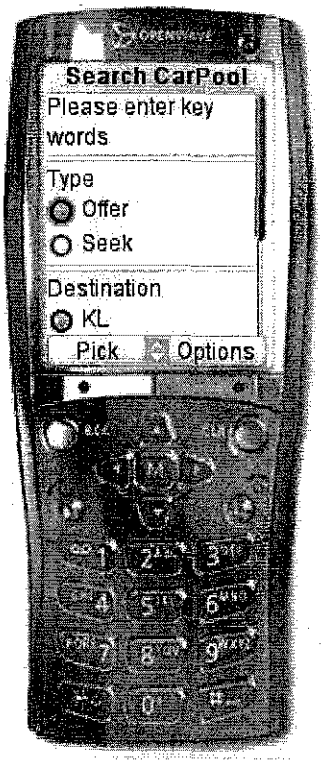

Figure 24. Search Carpool Page

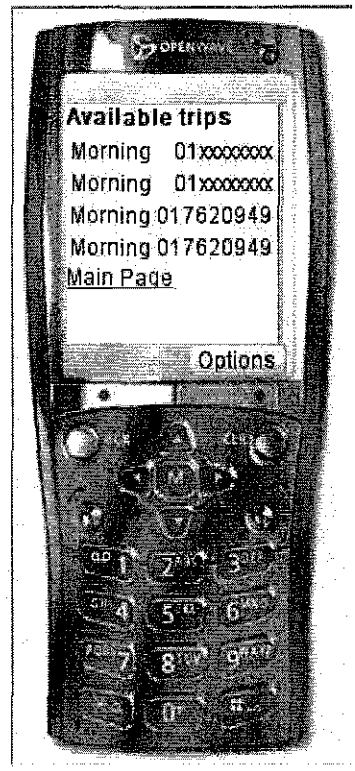

Figure 25. Search Result Page

4.1.3 Testing Result

a) Testing Method

There are two kind of testing methods that were used by the author in the development life cycle: Performance Testing and Acceptance Testing.

b) Performance Testing

The aim of this testing is to make sure the system will work as it is expected before uploading to public server for users to test. During this phase, the author has to divide into two parts: units testing and system testing (integration testing). In the unit testing, the author has carefully checked all the functions and modules of the system with all predefined data. Most of the functions and modules such as notification module (by SMS and email), searching module, display module, etc are tested in isolation environment to eliminate any effect from others components. During the unit testing

phase, there are only one module that was failed at the first attempt which SMS notify function. The problem is the system cannot connect to the SMS Gateway because UTP firewall has blocked this address. The problem was solved immediately when author switched to another dedicated line, which is not affected from UTP firewall.

After passing the Unit testing, the system was checked for its integration during the system testing. Its mainly purpose is to make sure that all the module are workable with each other, data can be sent and received correctly between functions. There are some challenges during this phase as expected however, the system would pass and work flawlessly during Seminar and Oral Presentation as well as during Engineering Design Exhibition.

Right after the system was successfully implemented; it was put on the server for students to test. At the first phase, there are only around 100 students can access the server and use it as a prototype. During 2 weeks running, there was a lot of good feedback and also recommendation, and proudly to say, all of them are positive. At ths moment this report is written, the author and his supervisor are discussing with the UTP management board in order to put the system in UTP server to serve students, which is the main goal of this project.

4.2 DISCUSSION

The system was successfully implemented and met all the objectives. There is something that needs to discussed more; one of them is security aspect. Frankly, it is the most important factor that can eliminate or affect the habit of using carpool. Everybody wants to be safe, so they always want to know more information about their journey partners. However, some of the users do not want to put a lot of personal information on the site, since it's very confidential for them. That may raise the conflict of interest, which can reduce the success of carpool concept. In this case, since UTP CarPool System is mainly developed for UTP students, therefore, natively, the security level is considered acceptable since only UTP students, who live inside the campus can access

the server via LAN. However, other people also may access the server, even it's not promoted outside UTP, via GPRS compatible handphone since the server supports it. Once again, we can see the contradiction of technology. It can bring more convenience as well as security threats to users. In order to enhance the security level, the system can be enhanced to migrate with UTP database server, which contains information of students such as student name, ID, course, picture, etc. So students can access the system using their own ID and Password which was assigned uniquely at the first semester. It will make the system to be a component of UTP portal and only be used by UTP students.

The second thing that needs to be considered is the SMS function. It brings a lot of effectiveness and convenience to users at no doubt. However, at this moment, the administrator of the system has to pay the bill for all the SMS that are generated and sent by the system. It is unfeasible if the system will be put on use, since there are thousands of students may access and a lot of sms must be sent which cost a huge of money for the administrator. The administrator may consider buying a SMS modem to follow the hardware approach which can save a lot of money in long term operation. In the worst case, due to financial barrier, the administrator can easily disable the SMS notification and only use the email notification, which does not cost an extra cent.

Chapter 5
CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

This report introduced the background of car pooling system, a web based service to provide another mean of transport. Several researches on system characteristics and web service have been conducted to assist author in the first stage of developing and implementing the system. The case study on CP21 and other existing carpool systems have been analyzed to provide the understanding and ideas to enhance the UTP Carpool System.

Finally, the author has successfully developed the UTP Carpool systems within the time and cost frame. The system is considered successful since it can provide all the needed functions and operate smoothly without any error occurred. The system also meets the entire objectives that were stated on the beginning of the report which are:

- To develop a web based system that promotes Carpooling in UTP.
- To make the system to be able to perform the search-and-match calculation automatically.
- To build a web service module, that enables the website to send SMS and email to inform each party.

In conclusion, the UTP Carpool System not only pass all the requirements for a final year project but it also has a big potential to be implemented and used inside the campus as well as be commercialized.

5.2 RECOMMENDATION

During the system development process, there are several ideas that were generated but could not be implemented due to the time constraint. However, it will make the system better with some enhancements:

- Integrate Map Service into the system: for example, if a user search for trip to Tronoh, since Tronoh is on the way to Ipoh, the system should be "smart" enough to list down the trips to Ipoh as well.
- Create API to interact with UTP Database Center for students' authorization: UTP Database Center contains information of all students such as name, id, birthday, and picture. By interact with UTP Database Center, the system can make sure to authorize the user who wants to add carpool and enhance the personal security.
- Add counter for each carpool to maximize the performance: since most of car offered for carpool is more than 2 seats available, it will be more effective if the system can manage how many seats available for each trip.

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APPENDIXES

APPENDIX 1

FYP Questionnaire
PROVISION OF CAR POOLING SYSTEM

I am an IT Final Year student, doing my Final Year Project. This questionnaire is to help me in getting some information as well as responds from the users towards the acceptance of Car Pooling System concept in UTP. Please take a moment to fill in the questionnaire. Thank you.

SECTION A: GENERAL

1. What year are you in?
   1st year ☐ 2nd year ☐ 3rd year ☐ 4th year ☐
2. Is the allowance of 500rm sufficient for you?
   Yes ☐ No ☐
3. Have you ever go out of UTP?
   Yes ☐ No ☐
4. How often you go out of UTP?
   Once a month ☐ Twice a month ☐ Every week ☐ More than 2 times per week ☐

SECTION B: TRANSPORTATION

1. Do you have your own vehicle?
   Yes ☐ No ☐
2. How do you go outside UTP?
   By own car ☐ Go with friends ☐ By bus ☐ By taxi ☐
3. How much do you spend in transportation?
   Not much ☐ Acceptable ☐ A lot ☐ Out of control ☐

4. How do you think about the transportation in and around UTP?

Too bad ☐ Not good ☐ Acceptable ☐ Good ☐

SECTION C: CAR POOLING SYSTEM

1. Have you ever heard of Car Pooling concept?

   Yes ☐ No ☐

2. If "Yes", do you think it will be applicable in UTP?

   Yes ☐ No ☐

3. If "No", do you want a service that allows you can share the trip with other friends?

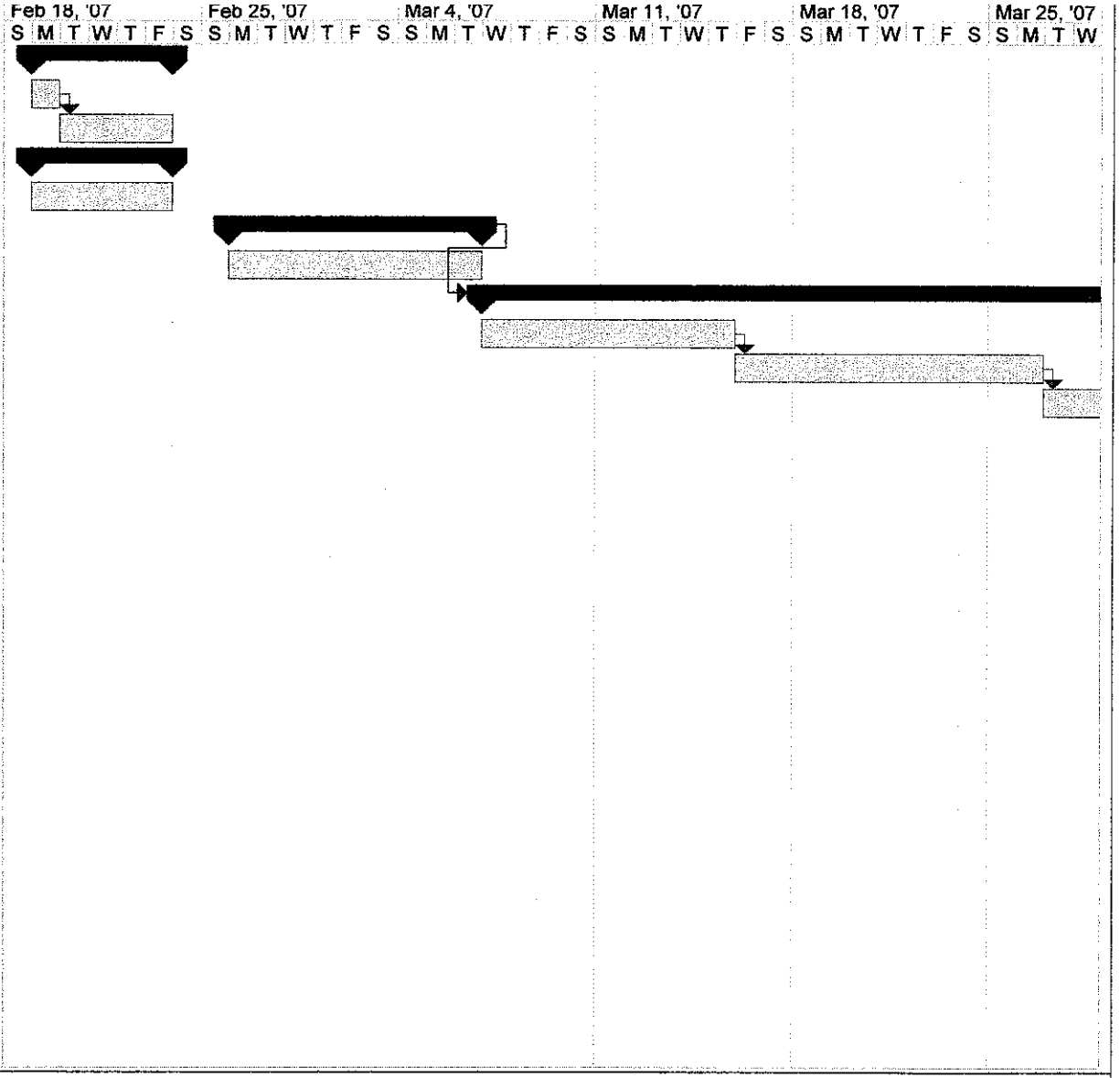
   Yes ☐ No ☐

SECTION D: RECOMMENDATION

Please tell us what you expect if there will be a car pooling system implemented in UTP.

APPENDIX 2: Gantt Chart

D	Task Name	Duration	Start	Finish
1	**Survey Phase**	**5 days?**	**Mon 2/19/07**	**Fri 2/23/07**
2	Prepare the survey form	1 day?	Mon 2/19/07	Mon 2/19/07
3	Conduct the survey	4 days?	Tue 2/20/07	Fri 2/23/07
4	**System analysis**	**5 days?**	**Mon 2/19/07**	**Fri 2/23/07**
5	Literature review	5 days?	Mon 2/19/07	Fri 2/23/07
6	**System design**	**7 days**	**Mon 2/26/07**	**Tue 3/6/07**
7	Architecture design	7 days	Mon 2/26/07	Tue 3/6/07
8	**Implementation phase 1**	**51 days?**	**Wed 3/7/07**	**Wed 5/16/07**
9	Set up and config	7 days	Wed 3/7/07	Thu 3/15/07
10	Design the GUI	7 days?	Fri 3/16/07	Mon 3/26/07
11	Create a database	4 days?	Tue 3/27/07	Fri 3/30/07
12	Create PHP script	33 days?	Mon 4/2/07	Wed 5/16/07
13	**Testing phase 1**	**2 days?**	**Thu 5/17/07**	**Fri 5/18/07**
14	Module testing	1 day?	Thu 5/17/07	Thu 5/17/07
15	Intergration testing	1 day?	Fri 5/18/07	Fri 5/18/07
16	**Analysis phase 2**	**8 days?**	**Mon 5/21/07**	**Wed 5/30/07**
17	review the system	7 days	Mon 5/21/07	Tue 5/29/07
18	study on public subcriber	1 day?	Wed 5/30/07	Wed 5/30/07
19	**Implementation phase 2**	**16 days?**	**Thu 5/31/07**	**Thu 6/21/07**
20	Building public subcriber m	16 days?	Thu 5/31/07	Thu 6/21/07
21	**Intergration**	10 days?	Fri 6/22/07	Thu 7/5/07
22	**Testing**	6 days	Fri 7/6/07	Fri 7/13/07
23	**Analysis phase 3**	**44 days**	**Mon 7/16/07**	**Thu 9/13/07**
24	review the system	14 days	Mon 7/16/07	Thu 8/2/07
25	study on WML	30 days	Fri 8/3/07	Thu 9/13/07
26	**Implementation phase 2**	**21 days**	**Fri 9/14/07**	**Fri 10/12/07**
27	Convert the system to WM	21 days	Fri 9/14/07	Fri 10/12/07
28	**Intergration**	3 days	Mon 10/15/07	Wed 10/17/07
29	**Testing**	7 days	Thu 10/18/07	Fri 10/26/07
30	**Writing final report**	16 days	Fri 10/5/07	Fri 10/26/07



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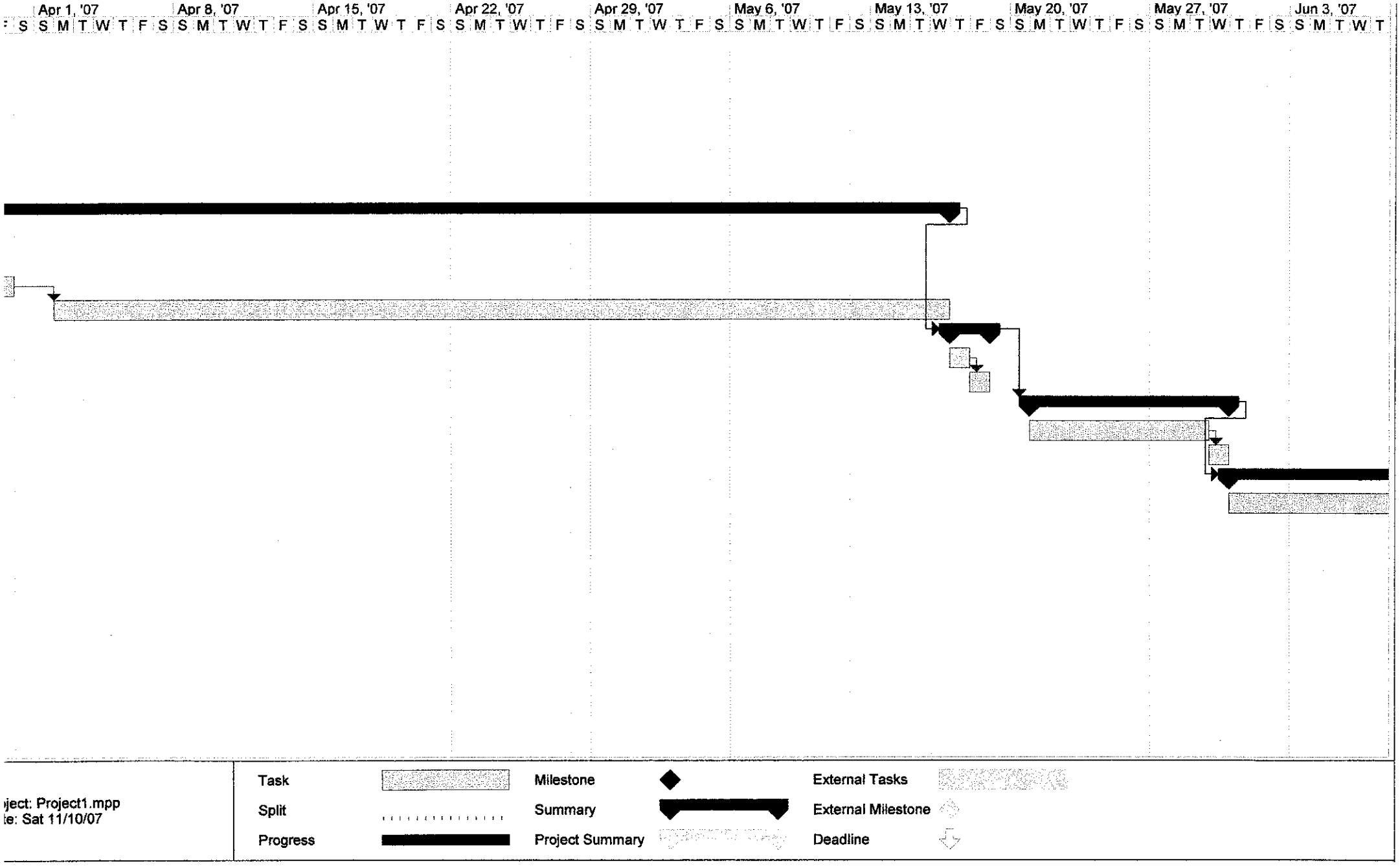
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Jun 3, '07
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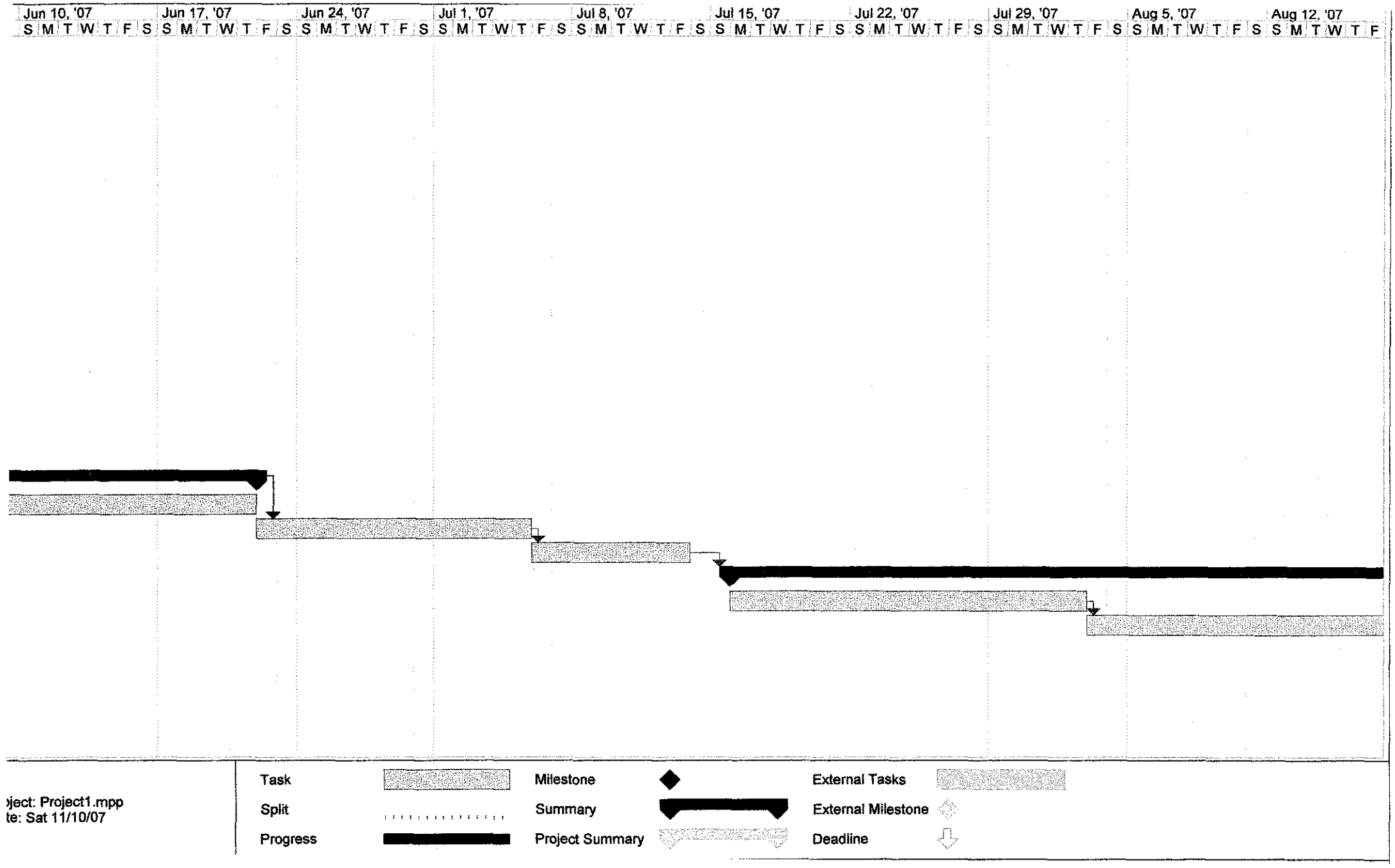
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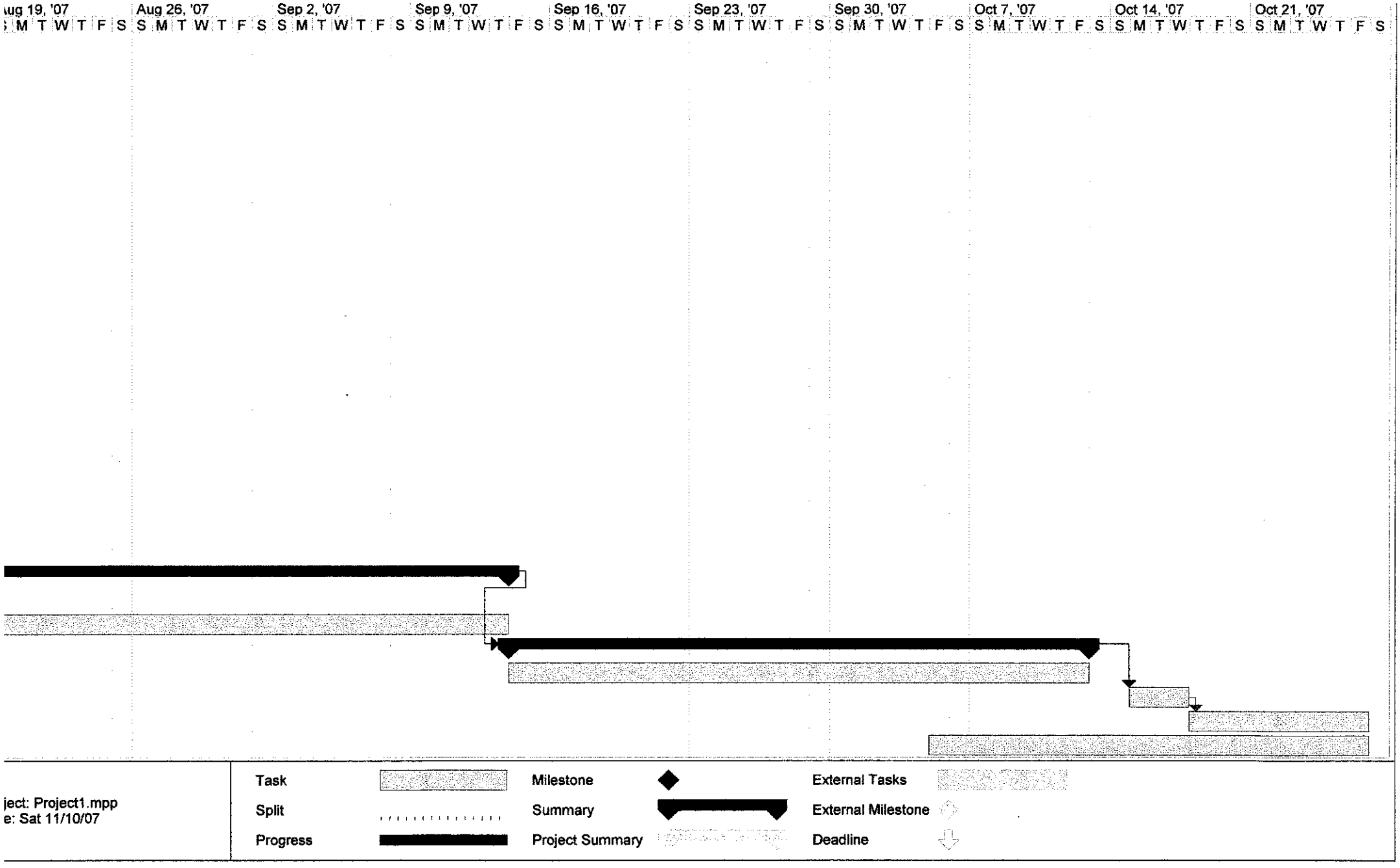
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Oct 21, '07
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