Housing Estate Portal Based On
Internal Value Chain (IVC) Approach

Yeo Suat Hui WET990052

Under Supervision
Puan Miss Laiha

Moderator
Mr. Ibrahim Abu Bakar

Faculty of Computer Science and Information Technology

University of Malaya

Acknowledgement

First of all, I will like to express my gratitude to my supervisor for this thesis, Pn. Miss Laiha for her support, guidance and advice from the beginning until this research paper is produced. Then, I will like to convey my thanks to my moderator, Mr. Ibrahim for contributing helpful insights, suggestions and support.

Next, I will like to extend my appreciation to my brother, Hansen Yeo for his useful suggestion and guidance for this project. Without him, I wouldn't have this special idea and concept to propose as my thesis title. I will also like to convey my heartfelt thanks to my father, for willingly to spend time giving me some important guideline for this project about housing development. And also thanks to my dear mom, who has giving me the full support and confidence in achieving the success of this thesis. Not to forget, my sister that give me the fully cooperation when I needed.

Lastly, I will like to say thank you to all my friends, especially those who has help me when I faced difficulties and problems in producing this research paper and developing the system. And also thanks to Mr. Patrick Chung, my industrial training supervisor, for his advice and help whenever I needed.

Table of Contents

List of Figures

List of Tables

Abstract

Internal Value Chain (IVC) is a well known marketing concept, proposed by Michael Porter of Harvard University, as a tool to identifying ways to create value. This concept has brought me the idea together with my knowledge of software development to develop a housing estate portal with IVC as the backbone to deliver customer value and satisfaction as well as supplier. Housing estate portal based on IVC approach will provide the basic features and functions liked others existing housing estate portal but will have some additional new features and functions that make the different between this portal and the existing portal. This is because all the features and functions and chose based on IVC that can add value to all the users.

This research paper will includes the explanation of the system that introduces the four main modules of this system, including public module, virtual community module, developer module and supplier module, the objectives, scope and constraints of the project from the very first stage of system analysis, system design, development and integration till the testing phase, completing the software development life cycle. Reviews on various existing housing estate portal on the Internet and interview with the housing developer and supplier will also be available in this research paper.

This report also discusses the tools that I am going to use to develop the housing estate portal. TimeCity Housing Estate Portal will be developed using Active Server Page with HTML and VBscript as the languages, and Microsoft SQL 2000 as the database server and Microsoft IISv5.0 as the web server running on Microsoft Window Server 2000 as the operating system platform, together with Three-Tier architecture design. It is hoped and believed that this system would be beneficial to all the users including the public, the developer and the supplier.

Chapter One: Introduction

1.1 Title Definition

Internal Value Chain (IVC), a well known marketing concept that I have learned during my second year in Marketing Management, one of the management subject provided in Information Technology course, has brings me the idea to implement the concept, together with my knowledge of software development, to develop a housing estate portal that can deliver customer value and satisfaction as well as supplier.

1.1.1 What is Internal Value Chain?

This concept was proposed by Michael Porter of Harvard University, as a tool for identifying ways to create more value. Every firm is a collection of activities that are performed to design, produce, market, deliver, and support its product. The value chain identifies nine strategically relevant activities that create value and cost in a specific business. These nine value-creating activities consist of five primary activities and four support activities.

The primary activities represent the sequence of bringing materials into business (inbound logistics), converting them into final products (operations), shipping out final products (outbound logistics), marketing them (marketing and sales), and servicing them (service). The support activities-procurement, technology development, human resource management, and firm infrastructure, handled in certain specialized departments.

The firm success depends not only on how well each department performs its work but also on how well the various departmental activities are coordinated. Too often, company departments act to maximize their interest rather than company's and customer's interest. This has erected walls that slow down the delivery of quality customer service.

To be successful, the firm also needs to look for competitive advantages beyond its own operations, into the value chains of its suppliers, distributions, and customer. Many companies today have partnered with specific supplier and distributors to create a

superior value-delivery network, also called a supply chain. Example of company that have applied this concept successfully are Bailey Controls, an Ohio-headquartered $300 million a year manufacturer of control system for big factories and Betz Laboratories, a Pennsylvania-based maker of industrial water-treatment chemicals [2].

1.1.2 Problem Definition

Many companies today, whether it is an company that provides online business, such as e-shop, e-restaurant, e-hotel, multinational company, local company and so on facing difficulties in their business especially in attracting customer, maintaining existing customer and building a good relationship with their supplier. An online company, even though running a portal with the best technology and the most expensive tools will face the same problem if they run their business online just to follow the trend without any further study or research.

Another serious problem that most of the company faced is the important of understanding their customer need and want. According to the world fastest company, Nokia has said "while technologies are advancing rapidly, they have no value in themselves. They only attain value in the context of fulfilling human needs. People must gain real benefits from them. That is what our challenge is all about: understanding people's needs and using our technology competencies to come up with applications that make their lives better…in the near future this trend towards more numerous personalization possibilities will multiply…that's why we are continually deepening our understanding of the consumer (by Frank Nuovo, chief designer of Nokia Mobile Phones)" [1].

1.1.3 Solution Definition

Together with internet and World Wide Web, a business portal that implements this value-added concept, Internal Value Chain, is the solution for all the business to deliver quality customer value as well as adding value to the supplier in the fastest and cheapest way. This business portal by adding value to customer and supplier will help to solve company's problem to attract new customer and maintain existing customer and build a

good relationship with supplier. With the win-win situation, it will add value to the company by generate the victory of getting a high revenue.

This business portal will include most of the nine value-creating activities from Internal Value Chain concept as their functionality to create value for the customer and supplier.

To demonstrate on how the Internal Value Chain concept in the business portal, I have chose to develop a business portal for housing estate developer, that provides the end user and supplier functionality that can add value to them and at the same time, to the developer himself.

1.1.4 Housing Estate Portal based on Internal Value Chain Approach

In general, housing estate portal is a business portal or website developed by housing estate developer to provide information about housing property developed by the developer to the public by using the internet. This included the housing properties in their latest launch and their incoming projects. Additional to this information, the portal will also include company profile feature and functionality for users to give their feedback and comments by sending email or contact the developer. Others useful functions and features will be added to come out with a fully integrated system for housing estate portal.

Housing estate portal which based on Internal Value Chain will be slightly different and greater from the usual housing estate portal that you can browse on the internet. This portal will include some basic features liked the other but at the same time, it will include some extra features and functions that can add value to all the users including the customer and supplier, as well as to the developer. In this context, value can be business, wealth, information, features, functions, and so on. To the customer, the portal adds value to them by providing them with the latest information related to the developer's housing property and company profile; to the existing customer, it provides the virtual community site for them and this will also help to maintain existing customer for the developer; and to the supplier, we provide the online sending quotation functionality for

them to get to know what developer wants and generates the business opportunity to them in the cheapest and fastest way and too, helping in keeping the relationship between both the supplier and developer. Also, the portal will help the developer to understand what current customer wants about their dream house by providing a form for users to tell developer what they want and suggestion about their dream house. By providing this functionality, it actually helps in adding value to the customer and to the developer, so the developer will develop houses not only according to what they plan and want, but matching with what the customer wants.

1.2 Objectives

Realizing the important of the Internal Value Chain concept in developing a business portal that can add value to end user and supplier, the objectives of the housing estate portal are listed below:-

a) Marketing the housing estate company on a wider scale and enabling it to reach a larger international audience. It is also strategic marketing for the company to against as edge over competitors, as it is supposed to highlight the high-tech approach to business employed by company, and there fore elevate the company's image in the eyes of the public and competitors.

b) To apply my knowledge that I gained from management subjects, a compulsory subjects for IT majoring in management students, play my role as a management student to implement business concept into my thesis, together with my knowledge in Information Technology.

c) Allowing easy and instant access to information at any time and any place for users, including customer, supplier and company employee. This allows the developer who wants the quotation from the supplier and the supplier who provides the quotation to work flexible irregardless of the location, so long as he is able to hook up to the internet. This can reduce traveling expenses and encourage productivity.

d) Provides a channel of communication between customer and developer as well as between supplier and developer. With this portal, developer will be able to reach the consumer or potential customer and knew what they want and what they think. This in turn helps the developer to make decision on designing the house that customer wants the most.

e) Cultivates a paperless working environment with the purpose of speeding up the business turnaround, which in turn, increases work efficiency and productivity, and also decreases stationery expenses.

f) Providing the latest and most up to date information for user regarding company information, housing property information for potential customer and community information for existing customer through the virtual community site.

g) To ensure secure and reliable communication between developer and consumer, developer and supplier through open internet standards.

h) To provide a user friendly interface website for all the users and implement "three clicks search" concept, meaning that information that user search can be found not more than three clicks.

1.3 Goals

To combine the business concept, Internal Value Chain together with software development skill to develop a value-added business portal that can be used in all field of business to add value to end user, company, supplier, distributor and so on.

1.4 Project Scope

1.4.1 Project Functionalities

The housing estate portal that I have developed is a fully integrated system for a housing estate developer company. It is a system that integrates the front-end system (Web pages) with the back-end system (information processing). It is also a system that can caters to a multitude group of users. The portal contains four separate modules according to the four different groups of system's users include potential customer, existing customer, supplier and developer. Following are the functionalities provided by the portal:-

a) Virtual Community

Virtual community is a web site provided by the developer to each and every housing area that he has developed. This web site provided the functionality on providing useful information regarding the community to the community members, meaning the owner of the property or the residents of the housing area. The information included business directory, helpline, tips, home makers and repairs information and useful link to healthcare website. This in turn helps to add value to the existing customer.

b) Sending Quotation from Supplier

Supplier site is a page that I have developed specially for the supplier. The suppliers will get the user ID and password manually from the developer after the developer authenticates them for security purpose. Only authorized suppliers can reach this page. This site provides the supplier with information regarding to what material that the developer required for the housing project that is going on. The suppliers can then submit the quotation to the developer and inform him the price they can quote. This will help the developer to get the information quickly and comparison can make before he makes decision on which suppliers to choose. For the suppliers, this will generate business opportunity to them wherever they are, thus adding value to them.

c) Developer Required for Quotation

This module provides the functionality for the developer to log in the page with the user ID and password, and then he can add in the request for quotation and send to list of

suppliers and at the same time, allows him to check for the quotations that the suppliers had sent to him. With this function, developer at the project site can get the information he wants quickly and allows the request for quotation to be done online.

d) Property Information Search Function

User accessing the portal can view property information extracted from the listing database. Their search can be further defined by stating their preference for the type of property, its location, its range of price and so on. This group of users is also known as the potential customer for the housing estate company.

e) Gather Information from Potential Customer

In business world, to understand what customer want and need is the key for the success of the whole business. This module provides the feature of a very simple form for user or potential customer to fill in their information, and answer questions that will tell developer what they want for their dream house and submit the form. This database will help the developer to make a right decision to develop property that the customers want and this help to add value to the customer as well as the developer.

1.4.2   User Characteristic

As described, the housing estate portal consists of four separates modules for its four groups of user:-

a) Potential Customer

People who intended to buy a house and are looking for their dream house or they are property seeker. They will visit the web site to get information regarding the developer, housing project, specific property using the search function provided by the portal. They will also make fully use of the function provided by portal that allow them to communicate what they want or need for a dream house to developer.

b) Existing Customer

People who already own a house from the housing estate company and are now be a part of one of the community. As usual, they will visit their virtual community site to get the information regarding to their community such as business directory, helpline and so on.

c) Supplier

People who supply the materials and equipments that the developer needs for project development in building the houses and shops in the specific project.

d) Developer

People who are the key person in housing estate company, involved in the housing development project and are the one who can make decision on request the quotation from the supplier when the project required building material.

1.4.3   Project Constraints

The initial study and design of the housing estate portal have identified several constraints on the system. These constraints dictate the method and environment under where the system will be developed.

1) The system will have to developed, tested and delivered by early Jan 2002.
2) They system will be running on Window 2000 platform.
3) The backend database server should have the capacity to store at least 1GB of records.
4) The web pages should take less than 30 seconds to load.
5) The functionality of the portal is limited to certain functions and users because of time constraint.

1.4.4   Assumptions

1) The information that the system will gather from the user will be analysis by an external application that will help the developer to understand what the user want.

2) Every supplier and developer of the company has been given a user ID and password manually from the company for security reason.

1.5 Expected Outcome

My expected outcome for this project is a simple and attractive housing estate portal, with the business concept, Internal Value Chain as the backbone of the portal, adding value to public, potential customer, existing customer, supplier and developer by providing the functions and information that they need in helping them to get their dream house or business in the easiest, cheapest and fastest way.

1.6 Report Overview

The following chapters in this report have been arranged systematically to present a thorough perspective of the system for readers. This part briefly outlines what is to be covered in the following chapters of this report.

Chapter Two presents readers with the research on some of the literatures regarding housing estate portal as well as issues to be considered.

Chapter Three explains the method employed in the course of building the Timecity housing estate portal from the system analysis and design phase until the testing and integration of the entire system.

Chapter Four promotes a better understanding to the system supported by diagrams about system design.

Chapter Five explains the implementation of the entire system in detail.

Chapter Six presents the testing phase of the system after the system had been developed and implemented.

Chapter Seven presents the evaluation done for this system including the problems faced during the development stage, the strengths and limitations of the system and also the future enhancements for the system.

1.7 Summary

This chapter presented the introduction and overview of the system, Timecity Housing Estate Portal together with the objectives, goal, scope, constraints and expected outcome of this project. Incoming chapter will present a more detail explanation of the whole system.

Chapter Two: Literature Review

This chapter will present the outcome of further research undertaken regarding the project to be developed and it related topics. The issues covered here will be the definitions of some key terms, concept, the approach to undertaking the research and the analysis on the existing systems that are related to my system.

2.1 Definition on Literature Review

Literature review is a background study of the related knowledge and information collected to develop a project. The purpose of this study is to get a better understanding the topic of the project and the requirement for the development. Review on the related articles such as journal or printed version of the project's topic and existing similar system can gave a good idea and better view of the project.

2.2 Approach to Research

Various approaches have been undertaken in researching various literatures with the aim of learning new thing and to find more supporting facts in designing the portal. The information found through this process will be implemented in the development of the portal.

2.2.1 Books

Books regarding to the marketing concept, internal value chain have been reviewed with the objective of going an insight into what is this concept and how can I implement this concept into the development of the housing estate portal. Also, reference books concerning issues like systems architecture, analysis and design were also referred in the process of designing the structure of the portal.

2.2.2 Search Engines

Search engine have been used to facilitate the searching of the information for review purpose. Among the search engine that has been used are Altavista, Yahoo and Catcha

and also metasearch such as Metacrawler and Mamma. The search engine has help me to get a lot of information and knowledge for review.

2.2.3 Existing Web Site

The existing similar web site on the internet always provides the most useful review for the project before the development of the system start. For housing estate portal, such as www.ioigroup.com, www.propertyzoom.com are the existing website that provide certain functionality similar to the "virtual community" in the housing estate portal; www.sunway.com/suncity, www.mayland.com.my and www.bukit-rimau.com for others features similar to the features that I have proposed for my housing estate portal, www.Timecity.com.my. Aside from local web sites, searching with various internets search engines had revealed several foreign web sites which were also explored to gain better understanding of what is to be included in the portal.

2.2.4 Online Tutorial and Resource

Aside from information related to the portal, housing estate and the marketing concept, internet also provided the information related to web-based systems and web programming. Web sites offering online tutorial in ASP such as from www.webmonkey.com and www.microsoft.com and information related to system development architecture which is needed for the project.

2.2.5 Existing Thesis

In Faculty Science Computer and Information Technology, provided the documentation room were all the theses were keep. The thesis prepared by the senior and lecturer are a very useful resource in getting the information we want by referring to the analysis or thesis with the similar system.

2.2.6 Interview

I have done some informal interview with housing project developer and supplier. For example, Timeway Building Product Sdn. Bhd. . From the interview, I get a lot of

information about the quotation process flow, type of pricing, type of payments and others useful information regarding to quotation.

2.3 Review and Analysis on Existing Website

2.3.1   Review on www.ioigroup.com

This is the main website that I have chosen for analysis and review before I designed my system. This website is said to have developed based on the Internal Value Chain concept, which is the concept I tried to implement in my website. The IOIGroup portal is designed to be the all in, one step site to variety of users. It provides a full range of information from corporate information, business segment, business opportunity, career opportunity and hotlink. For this review, we will focus on the business segment site.

In this business segment, all viewers will be presented with five sections of information, which are plantation, property development, property investment, manufacturing and leisure section. Under property development section, user will find details of all the development projects undertaken by the IOIGroup. One of the functionality that I have review and taken as a reference for my project is the simple search function which provided the functionality for user to obtain property information related to IOIGroup by query the database using keywords such as location and property type.

Another functionality that I have reviewed and decided to implement it into the project is the community site, MyIOI site. This is a special feature offered by the IOIGroup which provides a relatively detailed description of the Puchong area. The descriptions include Puchong area business directory, tips such as furnishing tips and health tips, help-line, home makers and repairs information and useful links to website for the purpose of health care live chat and online booking for tickets and so on. Besides, the main page also allow the user to obtain latest news and community updates such as sales, fairs and occasion that are going on in that housing area. One constraint for this function is that it only limited to Puchong Area only. It should actually provide the same functionality to all the

housing area so that all the customers can enjoy the service equally. Although this site provides variety of information and functionality, certain function such as chat room can be omitted because it doesn't add value to customer since not many user using it and waste of money for maintenance the function.

Next, the feedback site which provide the functionality for user to key in their data and submit their comment or opinion to IOIGroup. This function have been reviewed and will use as a reference for customer point of view module in my project. Some improvement will be making to the form to modify it into a form with questions for user to answer and more users friendly. This will help in collecting the data and turn it into useful information for the developer's review on customer point of view, thus get to know what customer think and what customer want for their dream house.

Overall, IOIGroup features simple UI design but interesting and attracting MyIOI site. MyIOI is a convenient site offering multitude of services. Some services will be followed in the virtual community module. From the extensive features provided by the entire site, it can be concluded that a lot of effort and cost went into developing the system. This entire site basically develops using HTML language. Page loading time for this portal is quite reasonable.

Figure 2.1: www.ioigroup.com Virtual Community Site
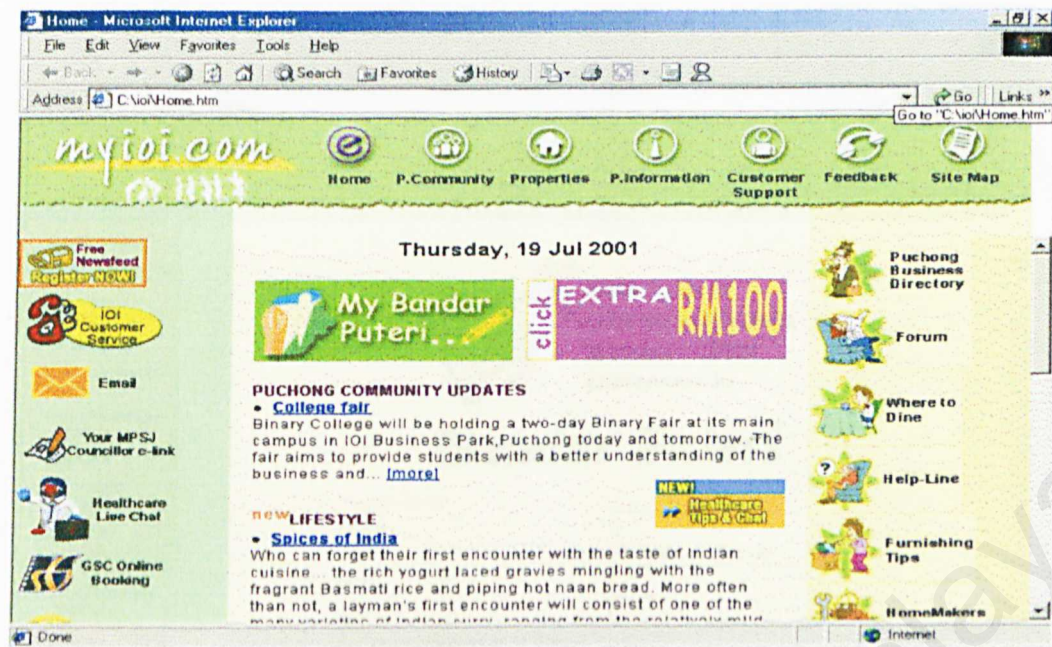
Figure 2.2: www.ioigroup.com Property Search and Listing Site
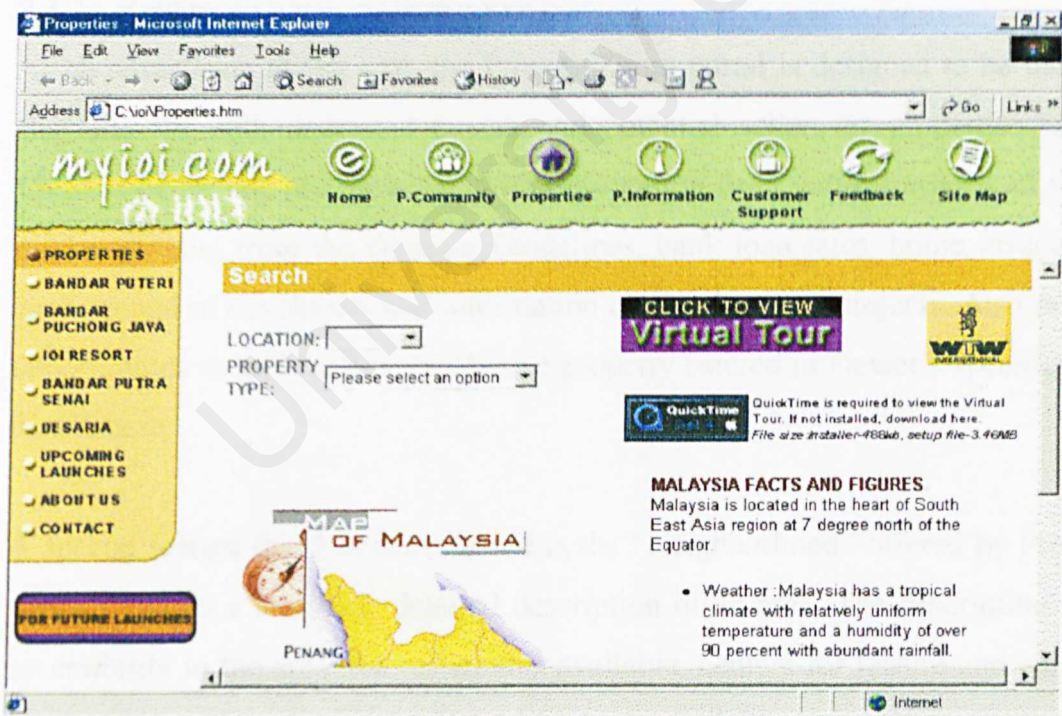
Figure 2.3: www.ioigroup.com Bandar Puteri Comment Site
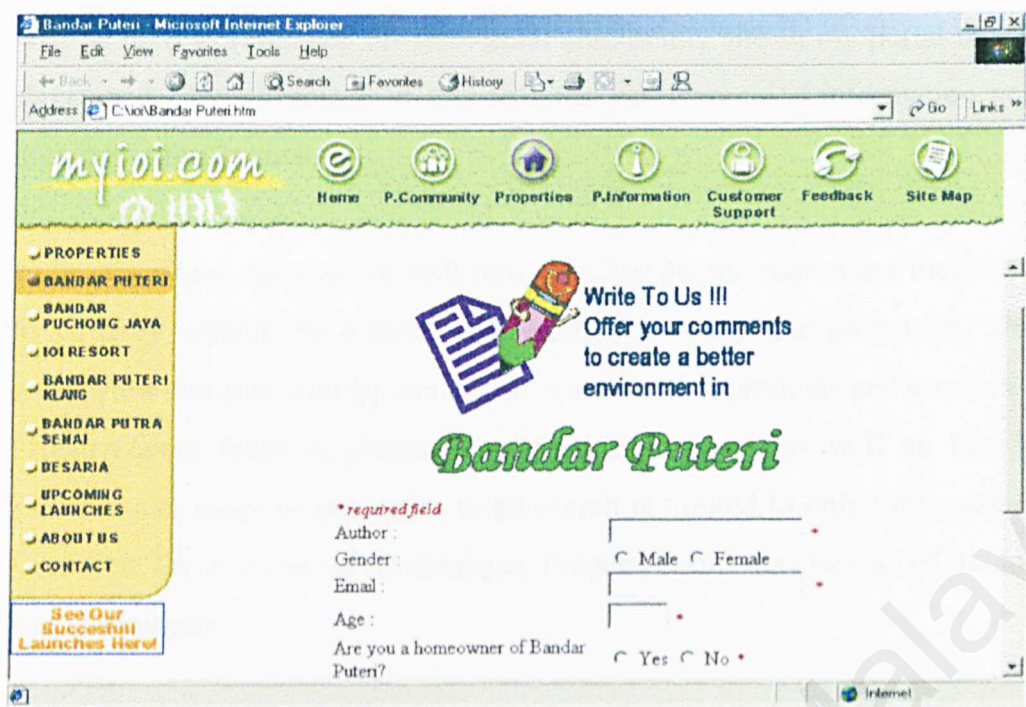
2.3.2   Review on www.propertyzoom.com

As an advertising media tool, the PropertyZoom portal is designed to be the all-in, one step site for both interested buyers and potential sellers or properties in Malaysia. Viewers of the site are presented with information from various aspects of the property market ranging from the Housing Guidelines, bank loan rates, home insurance advice, back ground of developers and information on development projects. Also presented are opportunities to seek, sell or purchase a property catered to viewer's specifications from its database.

A special feature that I have reviewed is the "Neighborhood" offered by PropertyZoom which provides a relatively detailed description of an area. The description include the accessibility to the area, the restaurants available, centers for leisure and entertainment, shopping arcades and other facilities which are available around the neighborhood. This section also provides an e-map of the area. Another unique feature of the PropertyZoom

is the e-retailer section which allows the user to search for retailers of special products or services such as air cleaning, caterers, burglar alarm and so on. These two unique features will be used as reference for the virtual community site in my portal that I am going to developed. One advantage of this features are it provided information not only to one area but multiple areas.

In its new phase, the web site will provide a 360 degree zoom view that allows net surfers to virtually inspect the external and internal views of the properties. The 360 degree zoom view can also used by retailers to promote their products and services.

PropertyZoom features pleasant user interface design as well as fast loading time. However, its range of properties to be search is limited to only three states in Malaysia. Give time for it to extend its database, PropertyZoom may be one of the top real estates site in Malaysia.

Figure 2.4: www.propertyzoom.com Neighborhood Site
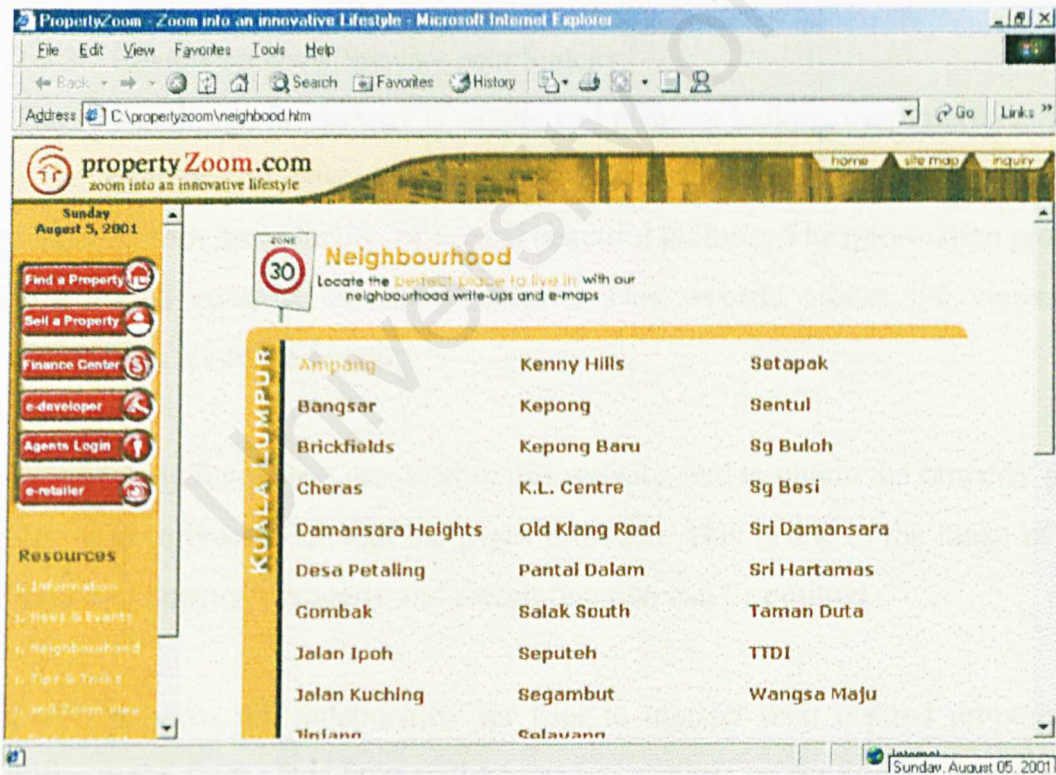
Figure 2.5: www.propertyzoom.com Neighborhood Site in Details
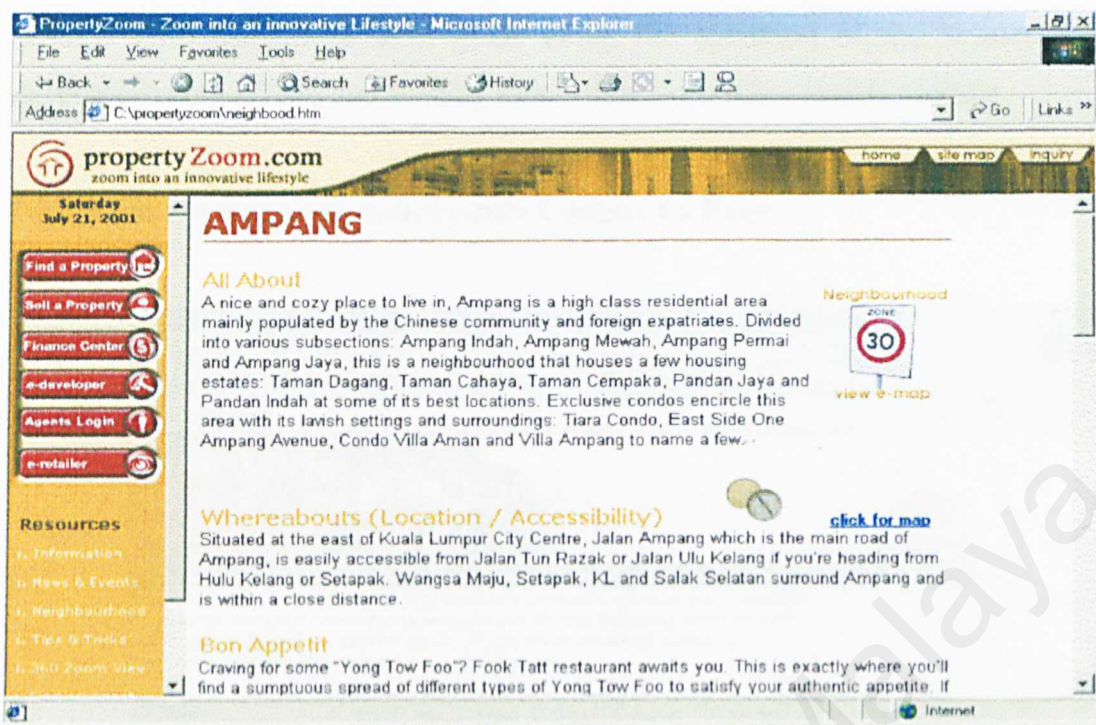
2.3.3   Review on www.Sunway.com/Suncity

The screen design for Suncity is simple and pleasant looking user interface. This is what to be reference in developing a website, simple and pleasant. The web pages are enhanced with the induction of several beautiful pictures. The information provided is not so crowded compare to others website. This website allows the viewer to obtain information related to Suncity.

No searching function is provided in this website, and to obtain the property information, user need to browse through the pages provided. This is due to the range of property is limited to Suncity's property and search function can be omitted.

It also provides the functionality for user to register their desired property online by filling in the form. This form will be used as a guide on for system design and analysis for the customer point of view module in my system.

One advantages of this site is that it is very user friendly and not confusing. User will be prompt with instructions as a guide along the operation of the system. Suncity is developed using HTML and loading time is fast since it is a simple website.

Figure2.6: www.sunway/suncity.com Contact Us Page
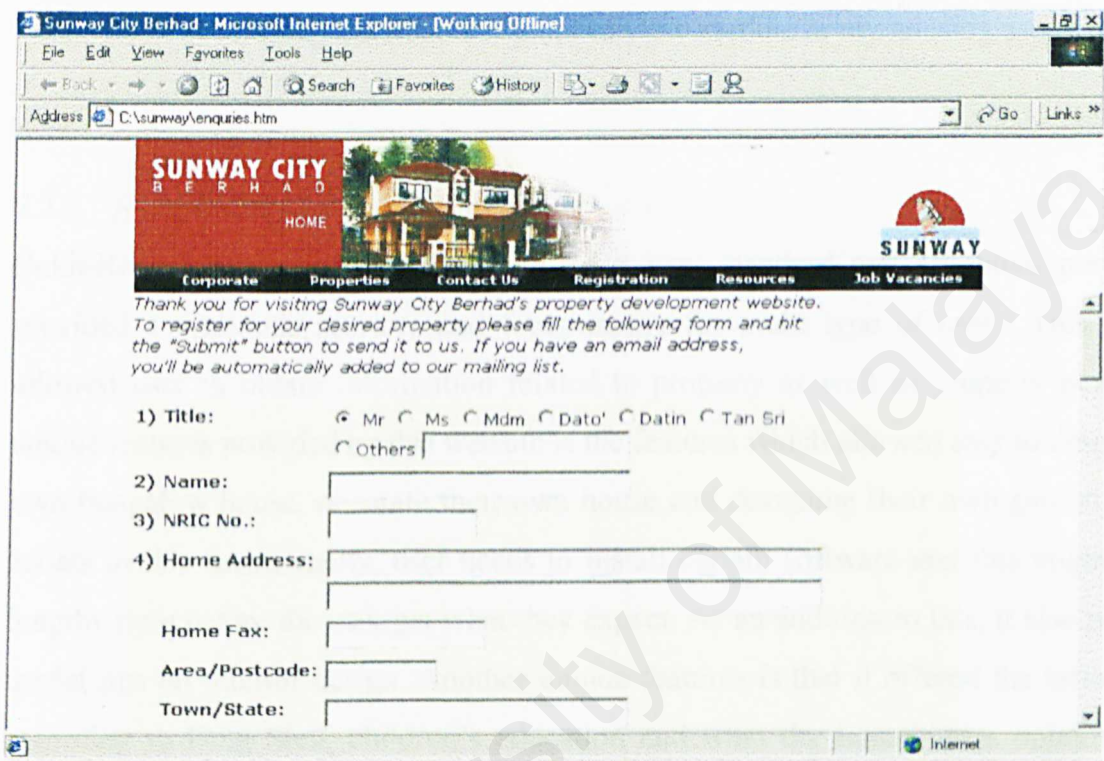
2.3.4   Review on www.mayland.com.my

Mayland, or Malaysia Land Properties Sdn Bhd is one of the leading housing developers. This website consists of simple and classic type of user interface design. This website presented to user property information related to Mayland, as well as hotels and service apartments information at the navigation bar area.

No search function is provided in this website, but it provides with a very unique features in introducing and promoting the property. When you browse through the property site and click on details, it will prompt out a large scale image together with the functionality

to get the location map, site layout and virtual tour. This allowed viewer to get a better understanding regarding to the property.

One disadvantage of this website is the location of the customer service and online registration link which are located at the bottom end of the pages. Viewer wouldn't know existing of this feature if they didn't scroll down the pages. The customer service and online registration features have been reviewed and will be consider as a reference to guide me in developing the customer point of view module in my housing estate portal.

2.3.5   Review on www.Bukit-Rimau.com

Bukit-Rimau website is considered to be a very standard and attractive portal that provided a multitude services and functionality for multi type of users. This website allowed user to obtain information related to property as well as property news. One unique features provided by this website is the features which allowed user to design their own bungalow house, decorate their own house and designing their own garden. But to access to this functionality, user needs to install certain software and this might take a lengthy time before the user get what they expect. As an addition to this, it also provided useful tips on interior design. Another unique features is that it offered the information regarding to Feng Shui, children's education and what the homebuyers opinion about Bukit-Rimau.

Figure 2.7: www.bukit-rimau.com Home and Garden Site
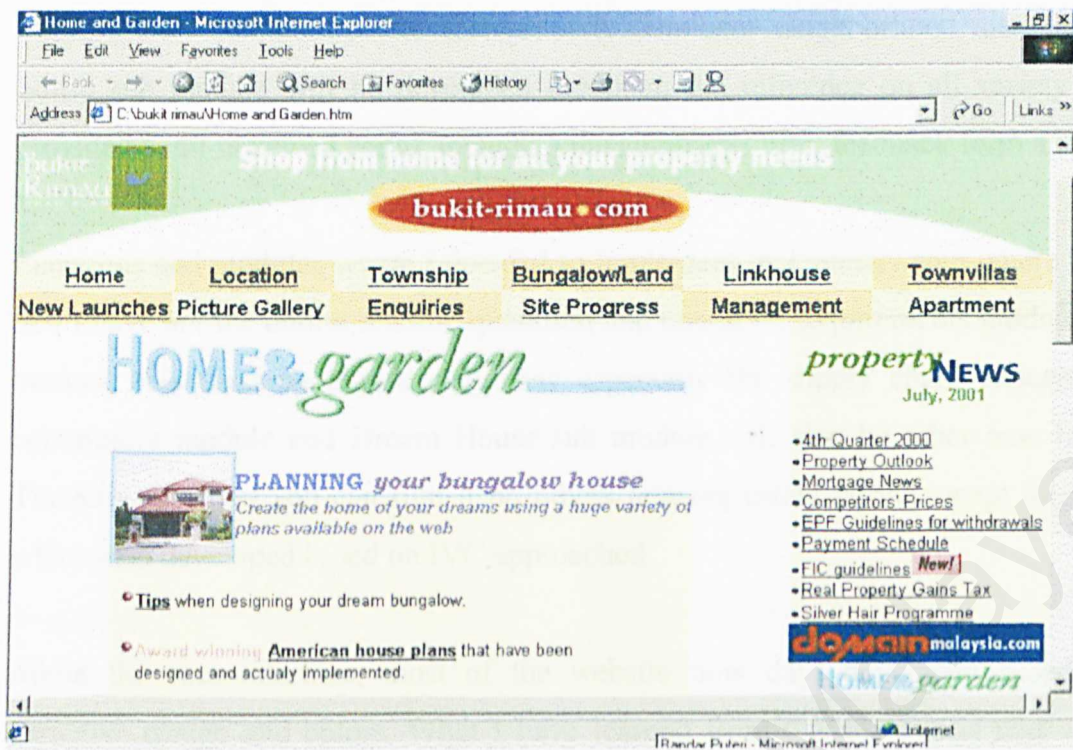
2.3.6   Summary on the Analysis on Existing Website

After reviewed on existing similar housing estate portal, which are www.ioigroup.com, www.propertyzoom.com, www.sunway.com/suncity, www.mayland.com.my and www.bukit-rimau.com and so on, I discovered that none of the existing website exactly provided the similar features and functions that I have included in my housing estate portal, www.Timecity.com.my. Most of the website I have reviewed provided certain functions and features that similar to Timecity.com but not all. This is because the functions and modules included in the Timecity.com and chose based on the IVC approached, which mean I only included those functions which can add value to the users.

All portals that I have reviewed basically provided the property search function that I am going to implement it in Timecity.com to provide useful property information to my customer. The basic features such as Contact Us and Company Profile which can be

found in all reviewed website will also be included in Timecity.com under the Public module. Timecity.com virtual community module will be implemented based on the ioigroup.com community site and propertyzoom.com neighborhood site. The dream house sub module will be developed based on the reference on all variety of forms provided in all reviewed portal, including the comment form, feedback form and others.

Functions and modules where I decided to implement in Timecity.com where the others don't have are the online sending quotation and quotation requirements modules. This is because this function is still very new especially the supply chain concept. Virtual community module and Dream House sub module will also be other new features in Timecity.com that you can find it on others housing estate portal accept ioigroup.com which also developed based on IVC approached.

About the user interface, most of the website now days developed based on very attractive design and colors. What I have learned from the analysis is that we should develop a simple and user friendly website, but not a complicated website. The website colors should follow the company official colors, and since this is a business website, it should be more formal but not too dull, since most of our users are our customers that we plan to attract. The design also must be consistent.

Finally, that are something that I should not followed from the existing website which are, certain website provided too many functions and features that can't add value to the users but to make the users confuse and hided the main features in the website. This will also wasted the developer's money in maintaining the features such as Chat Room feature in ioigroup.com where I found out that not many users are using the function. Besides, certain website provided too many information to the users regardless the information are relevant or not.

2.4 Findings

This section elaborates on the findings of the system including the system architecture and software tools required for this system.

2.4.1 Client/Server Computing

2.4.1.1 What is Client/Server?

The client/server model is an approach to software in which one application (the client) asks for and receives services from another application (the server). Another definition for client/server is "a software partitioning paradigm in which a distributed system is split between one or more server tasks which accept requests, according to some protocol, from (distributed) client tasks, asking for information or action."

Essentially, client/server computing is a software-based architecture that enables distributed computing resources on a network to share common resources any groups of users at intelligent workstations. There may be either one centralized server or several distributed ones. This model allows clients and servers to be placed independently on nodes in a network.

The key to comprehending the concept of client/server is in realizing that it is a logical concept. The client and server components do not have to exist on distinct physical hardware. Client/server technology is a model for the interaction between concurrently executing software processes. It is important to understand that the relationship between client and server is a command control relationship. In any given exchange, the client initiate the request and the server responds accordingly. A server cannot initiate dialog with clients, the interaction between the client and server processes is a cooperative, transactional exchange in which the client is proactive and the server is reactive. This is the main differentiation between client/server and other, less constrained, paradigms. The simplicity of client/server model makes it very powerful.

2.4.1.2   Type of Client/Server Architecture

Though client/server architecture can be very complex, there are generally three kinds of client/server infrastructures to choose from, which are two-, three-, multi-tier architectures.

a)   Two-Tier Architecture

The two-tier architecture contains two computers- a client, and a server, with areas of logic combined on the client. The three components of an application- presentation, processing, and data, are divided among two software, entities or tiers: client application cods and database server. A robust client application development language and a versatile mechanism for transmitting direct requests to the server essential for a two-tier implementation.

Presentation is handled exclusively by the client, processing is split between client and server, and data is stored on and accessed through the server. The client assumes the bulk of responsibility for application (functionality) logic with respect to the processing component, while the database engine, with its attendant integrity checks, query capabilities, and central repository functions, handles data intensive tasks.

Two tier architecture works well in relatively homogenous environments with fairly static business rules. However, it is less suitable for dispersed, heterogeneous environment with rapid hanging rules. This is because a change in business rules would require a change to the client logic in each application. This is extremely time consumes, inefficient, prone to error and costly.

Figure 2.8: Two-Tier Architecture
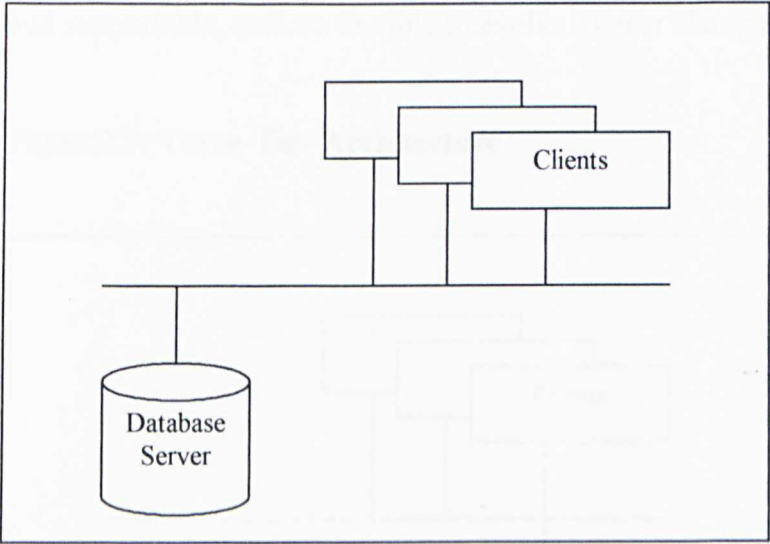
b) Three-Tier Architecture

The components of three-tier architecture are divided into 3 layers: a presentation layer, a functionality layer, and the data layer. Each of these layers must be logically separated. The attempt is to overcome some of the limitations of the two-tier scheme by separating presentation, processing and data into separate destruct entities.

The same type of tools can be used for presentation as were used in a two-tier environment. However the tools are now dedicated to handling just the presentation. When calculations or data accesses are required by the presentation   client, a call is made to a middle tier functionality server.

This tier performs calculations or makes requests as a client to the database server. Middle tier functionality servers may be multi threaded and can be accesses by multiple clients, even those from separate applications.

One of the advantages of this architecture is that any of the tiers can be enhanced or replaced without affecting the other tiers. Nowadays, three-tier client/server solutions are recognized as being the ideal choice for the enterprise since they are move maintainable and supportable, and are flexible to evolve to ever changing business requirements.

Figure2.9: Three-Tier Architecture
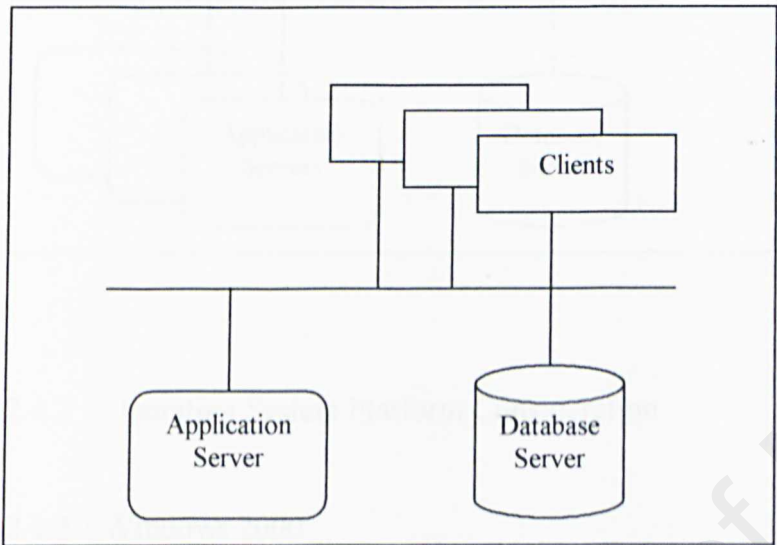
c) Multi-tier architecture

In a multi-tier architecture, the business logic is partitioned and distributed over several machines. As requirements change during a systems lifetime, this partitioning and deployment can be reviewed and emended with minimal impact. Furthermore, additional tiers architecture included to support multiple databases and other services such as message switches, legacy system, data warehouses, communication channels and so on [11].

Figure 2.10: Multi-Tier Architecture
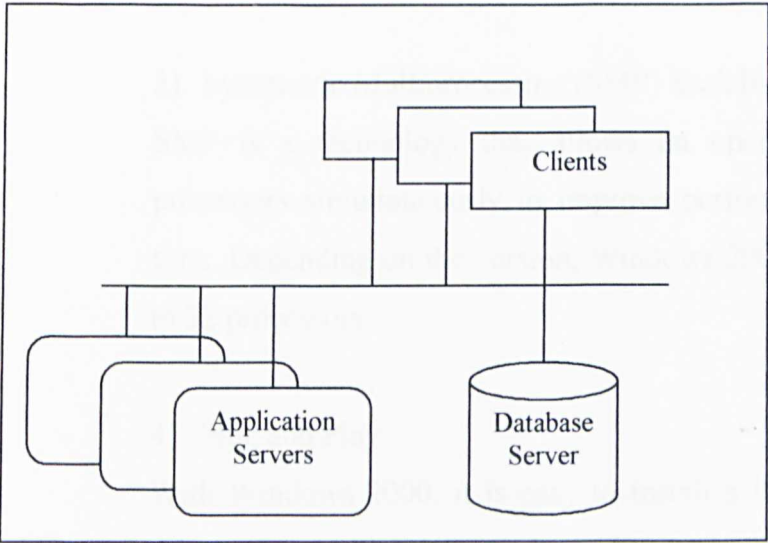
2.4.2   Operating System Platform Consideration

2.4.2.1 Windows 2000

2.4.2.1.1   Features of Windows 2000

The Windows 2000 operating system provides many enhanced features for its same users. These features include multitasking, memory support, symmetric multiprocessing, plug and play, clustering, NTFS, Quality of Service, Terminal Services and Remote Installation Services.

1) Multitasking

Multitasking enables users to run multiple applications simultaneously on the same system. The number of applications that a user can run simultaneously and the system performance when running them depends on tha amount of memory in the system.

2) Memory support

To function, each application that runs on Windows 2000 requires a certain amount of memory. In order to support multiple applications running

simultaneously (multitasking) and applications with large requirements for memory, Windows 2000 provides support for up to 64 GB of memory.

3) Symmetric Multiprocessing (SMP) Scalability

SMP is a technology that allows an operating system to use multiple processors simultaneously to improve performance by reducing transaction time. Depending on the version, Windows 2000 provides SMP support for up to 32 processors.

4) Plug and Play

With Windows 2000, it is easy to install a Plug and Play device. This is a device that you plug in and use immediately without having to perform a complicated setup process. After you plug in such a device, Windows 2000 automatically identifies the added component and completes the configuration.

5) Clustering

Windows 2000 provides the ability to group independent computers together to run a common set of applications. This grouping appears as a single system to the client and application. Such a grouping is called clustering, and the groups of computers are called clusters. This arrangement of computers avoids a single point of failure. If one computer fails, another computer in the cluster provides the same services in its place.

6) File System Features

The NTFS file system is recommended file system for use with Windows 2000. Windows 2000 provides the following features through NTFS support:

- File system recovery
- Large partition size
- Security
- Disk quotas

- Compression

7) Quality of Service (QoS)

In Windows 2000, Quality of Service (QoS) is a set of service requirements that the network must need to ensure an adequate service level for data transmission. Using QoS provides a guaranteed, end-to-end, express delivery system information across the network.

8) Terminal Services

Terminal Services provides remote access to a server desktop through a terminal emulator. A terminal emulator is an application that lets you access a remote computer as though you were physically located at it. Using Terminal Services, you can run client applications on the server so that client computers function as terminals rather than as independent systems.

By using Terminal Services, you can reduce the total cost of operation of your network. You can distribute Windows-based applications to client computers that might not normally be able to run Windows. You can also use Terminal Services to administer your server from anywhere on the network.

9) Remote Installation Services

Remote Installation Services (RIS) enables an administrator to deploy an operating system throughout the organization, without needing to physically visit each client computer. RIS is an optional component that is available as part of Microsoft Windows 2000 Server operating system.

2.4.2.1.2   Versions of Windows 2000

Windows 2000 consists of four operating system: Windows 2000 Professional, Windows 2000 Server, Windows 2000 Advanced Server, and Windows 2000 Datacenter Server.

1) Windows 2000 Professional

Windows 2000 Professional is a desktop operating system that incorporates the best business features of Microsoft Windows NT version 4.0. Windows 2000 Professional

includes a simplified user interface, improved Plug and Play functionality, power management, and support for a broad range of hardware devices. It supports SMP systems with two processors and 4 GB of physical memory.

2) Windows 2000 Server

Windows 2000 Server is the standard edition of the Windows 2000 server family. It contains all the features of Windows 200 Professional and is deal for small to medium-sized organizations. This version of Windows 2000 works well for file and print servers, Web servers, and workgroups. Windows 2000 Server supports SMP system with four processors and 4 GB of physical memory.

3) Windows 2000 Advanced Server

Windows 2000 advanced Server contains all of the functionality of Windows 2000 Server, plus increased scalability and system availability. Scalability is the ability to increase processing power incrementally to meet increased network demands. This functionality is provided through clusters of multiple servers. These servers provide additional processing power, thereby increasing system availability. This way, if one server becomes unavailable, the other servers in the cluster provided the requested service. Windows 2000 Advanced Server is designed for servers that are used in large scale networks and for database-intensive work. Windows 2000 Advanced Server support SMP systems with eight processors and 8 GB of physical memory.

4) Windows 2000 Datacenter Server

Windows 2000 Datacenter Server contains all of the functionality of Windows 2000 Advanced Server, plus support for additional memory and CPUs per computer. It is designed for large data warehouses, online transaction processing, and large-scale simulations. It can also support more than 10000 simultaneous users in certain workloads. Windows 2000 Datacenter Server supports SMP systems with 32 [10].

2.4.2.2 Unix System

UNIX is an multi-tasking multi-user operating system. It developed at AT&T Bell Laboratories. It is a powerful and mature operating system and network-based platform. Besides, UNIX is an ideal platform for running mail servers, networked file systems and so on. UNIX users normally share processing time on a central computer, or cluster of computers.

UNIX is an increasingly popularly operating system. Traditionally used on minicomputers and workstations in the academic community, UNIX is now available on personal computers and the business community has started to choose UNIX for operating system openness.

UNIX, like other operating systems, is a layer between the hardware and the applications that run on the computer. It has functions that manage the hardware and functions that manage the executives of applications. UNIX includes the traditional operating system. In addition, a standard UNIX system includes a set of libraries and a set of applications. It includes the file system and process control and a set of libraries [12].

2.4.3 Web Server Consideration

2.4.3.1 Microsoft Internet Information Server 5.0

As the Internet becomes more woven into mainstream businesses, so grows the need to have Web services interwoven with mainstream business computing. To address that need, Microsoft® Windows® 2000 Server includes an updated version of Internet Information Services (IIS), called IIS 5.0. Internet Information Services runs as an enterprise service within Windows 2000. It uses other services provided by Windows 2000, such as security and the Active Directory™ directory service.

Features and functionality contained within IIS 5.0

- Support for Web Distributed Authoring and Versioning (WebDAV)

WebDAV is an Internet standard that lets multiple people collaborate on a document using an Internet-based shared file system. It addresses issues such as file access permissions, offline editing, file integrity, and conflict resolution when competing changes are made to a document. WebDAV expands an organization's infrastructure by using the Internet as the central location for storing shared files.

- Web Folders

Support for Web Folders lets users navigate to a WebDAV-compliant server and view the content as if it were part of the same namespace as the local system. Users can drag and drop files, retrieve or modify file property information, and perform other file system-related tasks. Web Folders let users maintain a consistent look and feel between navigating the local file system, a networked drive, and an Internet Web site.

- Support for FrontPage Server Extensions

Windows 2000 Server lets administrators use Microsoft FrontPage® Web authoring and management features to deploy and manage Web sites. With FrontPage Server Extensions, administrators can view and manage a Web site in a graphical interface, so creating Web sites with the FrontPage Web site creation and management tool is as easy as clicking a check box on a property page for the Web site. In addition, authors can create, edit, and post Web pages to IIS remotely.

- Support for Latest Internet Standards

Using the integrated Web services in Windows 2000 Server, organizations can take advantage of the latest Internet standards to publish and share information over the Web. Microsoft Internet Information Services (IIS) 5.0 complies with the HTTP 1.1 standard, including features such as PUT and DELETE, the ability to customize HTTP error messages, and support for custom HTTP headers. Support for the latest protocols provides optimum performance for Web server connections.

- Support for Multiple Sites with One IP Address

With support for host headers, an organization can host multiple Web sites on a single computer running Microsoft Windows 2000 Server with only one Internet Protocol (IP) address. This lets Internet service providers (ISPs) and corporate intranets host multiple Web sites on a single server while offering separate user domains for each site.

- News and Mail

Administrators can use Simple Mail Transfer Protocol (SMTP) and Network News Transport Protocol (NNTP) Services to set up intranet mail and news services that work in conjunction with IIS. SMTP is a commonly used protocol for sending e-mail messages between servers; NNTP is the protocol used to post, distribute, and retrieve USENET messages.

- PICS Ratings

Administrators can apply Platform for Internet Content Selection (PICS) ratings to sites that contain content for mature audiences. This lets them host a variety of sites and provide information about suitability for particular audiences.

- HTTP Compression

HTTP compression allows faster transmission of pages between the Web server and compression-enabled clients. This is useful in situations where bandwidth is limited.

- File Transfer Protocol (FTP) and FTP Restart

The File Transfer Protocol (FTP) service, used to publish information to a Web server, is integrated into Windows 2000 Server. FTP Restart provides a faster, smoother way to download information from the Internet. Now, if an interruption occurs during data transfer from an FTP site, a download can be resumed without having to download the entire file over again [13].

2.4.3.2 Apache Server

The Apache httpd server is a powerful, flexible, HTTP/1.1 compliant web server that implements the latest protocols, including HTTP/1.1 (RFC2616). It is also a highly configurable and extensible with third-party modules. Apache can be customized by writing 'modules' using the Apache module API. Apache also provides full source code and comes with an unrestrictive license. Basically, Apache Server runs on Windows NT/9x, Netware 5.x, OS/2, and most versions of Unix, as well as several other operating systems. Besides, Apache is actively being developed and encourages user feedback through new ideas, bug reports and patches.

Apache Server implements many frequently requested features, including:

- DBM databases for authentication

  allows you to easily set up password-protected pages with enormous numbers of authorized users, without bogging down the server.

- Customized responses to errors and problems

  Allows you to set up files, or even CGI scripts, which are returned by the server in response to errors and problems, e.g. setup a script to intercept **500 Server Errors** and perform on-the-fly diagnostics for both users and yourself.

- Multiple DirectoryIndex directives

  Allows you to say DirectoryIndex index.html index.cgi, which instructs the server to either send back index.html or run index.cgi when a directory URL is requested, whichever it finds in the directory.

- Unlimited flexible URL rewriting and aliasing

  Apache has no fixed limit on the numbers of Aliases and Redirects which may be declared in the config files. In addition, a powerful rewriting engine can be used to solve most URL manipulation problems.

- Content negotiation

  i.e. the ability to automatically serve clients of varying sophistication and HTML level compliance, with documents which offer the best representation of information that the client is capable of accepting.

- Virtual Hosts

2.4.4   Database Server Consideration

2.4.4.1 Microsoft Access 2000

Microsoft offers a full family of database tools for the desktop, the server, and for open connectivity. For the desktop Microsoft offers Microsoft Access 97/2000. The Microsoft Access 97/2000 is a full-featured multi-user relational database management system that designed for the Microsoft Windows operating systems (such as Windows 9x, Windows NT, Windows 2000). Access 97/2000 is extremely visually oriented and easy to use. It makes extensive use of drag-and-drop and visual design for queries, forms, and reports.

Access 97/2000 comes with an integrated development environment (IDE), including incremental compilation, a fully interactive visual debugger, breakpoints, and single step-through. These capabilities combine to make Microsoft Access an extremely powerful platform for developing client-server database solutions.

2.4.4.2 Microsoft SQL 2000

SQL Server 2000 is a complete database and analysis package, with features that make every aspect of building and maintaining a data warehouse easier and more affordable. With SQL Server 2000, a robust set of tools help you to leverage the most value out of the data you collect and store. Additional features include:

- Office Integration 2000

Tight integration with Microsoft Office 2000 means that users can perform sophisticated analysis on large data sets using familiar tools. This important upgrade puts the power of analysis in the hands of more people than ever. Microsoft Excel 2000 in particular provides rich access to SQL Server 2000 data, allowing workers to create dynamic views of OLAP cubes using Microsoft PivotTable® functionality. Excel 2000 also makes it easy for any user to save a spreadsheet, chart, or PivotTable as a Web page, enabling other users to access and analyze SQL Server data.

- English Query

This powerful natural language functionality makes it possible to run complex analyses of large data sets simply by asking questions in plain English. Now users without an extensive background in SQL programming will be able to access the power of SQL Server in free-form queries. With the proliferation of Web applications, this is rapidly becoming a critical feature for all kinds of e-business operations.

- Microsoft Visual Studio® Database Tools

SQL Server 2000 now includes graphical tools that can manage all of the important tasks associated with building and maintaining a data warehouse, including schema design and query and code generation [13].

2.4.5   Web Technology Consideration

2.4.5.1 Active Server Page (ASP)

ASP is actually an extension to your web server that allows server-side scripting. At the same time it also provides a compendium of objects and components, which manage interaction between the web server and the browser. The objects can be manipulating by using the scripting.

Active Server Pages (ASP) is a very powerful and yet easy-to-learn server-side scripting environment. ASP comes with Internet Information server for Windows NT Server, and with Personal Web Server for Windows NT Workstation and Windows 98.

This environment enables user to create a Web site that is dynamic, fast, and interactive without requiring user to worry about the capabilities of the clients' browsers, which the user must do it if the user rely on client side scripting like client-side JavaScript or client-side Visual Basic Script (VBScript).

There are several ways an ASP application can get user input : message boxes, input boxes, ActiveX controls, and HTML form fields. Depending on the application and circumstances, the user has to select the best methods. It is important to understand that nearly all user input occurs on the client-side. One of the key features of using ASP is that your ASP files can determine what is sent to the clients' browser. To take advantage of this feature, you should be aware of the limitations of certain web browsers. For example, if a web browser does not support VBScript, you can't use the InputBox() and MsgBox() functions. Additionally, not all browsers support technologies such as ActiveX controls or VBScript.

Even if most of your users don't use a web browser that supports ActiveX or VBScript, your ASP applications can still interact with users. Using ASP, you can send them animated images or Java applets instead.

2.4.5.2 Cold Fusion

ColdFusion also enable servers to access data as the server builds an HTML page. Like ASP, ColdFusion pages are readable by any browser. However, ColdFusion utilizes a proprietary set of tags which are processed by the Cold Fusion Server software. This server software can run on multiple platforms, including Microsoft IIs, Netscape Enteprise Server, and Unix/Apache. The major difference is the ASP-ADO solutions are built primarily with VBScript and objects, however it sports its own set of solutions to common problems, including access to ADO functionality.

2.4.5.3 Java Server Page

Java Server Pages (JSP) is a new technology that allows you to combine markup (HTML or XML) with Java code to dynamically generate web-pages. The JSP specification is implemented by several web servers, and plug ins are available which allow u to use JSP with IIS4.0. One of the main advantages of JSP is the portability of code between different servers [8].

2.4.6   Programming Language Consideration

2.4.6.1 Hypertext Markup Language

HTML (Hypertext Markup Language) is the set of markup symbols or codes inserted in a file intended for display on a World Wide Web browser page. The markup tells the Web browser how to display a Web page's words and images for the user. Each individual markup code is referred to as an element (but many people also refer to it as a tag). Some elements come in pairs that indicate when some display effect is to begin and when it is to end.

HTML is a formal Recommendation by the World Wide Web Consortium (W3C) and is generally adhered to by the major browsers, Microsoft's Internet Explorer and Netscape's Navigator, which also provide some additional non-standard codes. The current version of HTML is HTML 4.0. However, both Internet Explorer and Netscape implement some features differently and provide non-standard extensions. Web developers using the more advanced features of HTML 4 may have to design pages for both browsers and send out the appropriate version to a user. Significant features in HTML 4 are sometimes described in general as dynamic HTML. What is sometimes referred to as HTML 5 is an extensible form of HTML called Extensible Hypertext Markup Language (XHTML) [14].

2.4.7   Scripting Language Consideration

2.4.7.1   What is Scripting Language?

A scripting language is very similar to a programming language. The difference is that the scripting language has been scaled down and trimmed up so that it only has the bare essentials. Instead of having a vocabulary of hundreds of commands, a scripting language may have several dozen. But the ones that are left are the key commands that use everyday. Scripting languages are, in general, computer languages that are handled by an interpreter rather than compiled directly into an executable program by a compiler [15].

Common scripting languages include Perl, JavaScript, VBScript, Tcl, and REXX.

2.4.7.2 Perl

Perl was invented by Larry Wall, a UNIX guru. The name is an acronym for Practical Extraction and Report Language. (It was humorously referred to in a definitive Perl textbook as Pathologically Eclectic Rubbish Lister.Perl is probably the most common language used for CGI scripts. Its syntax is similar to C. Variables used in Perl are not as strongly typed as in traditional languages; the type of a Perl variable is dependent on context. Perl is an excellent text manipulation language and is especially proficient at parsing delimited text files.Versions are available for UNIX, 32-bit Windows platforms, and Mac. Perl applications process e-mail, create databases, and perform other complicated tasks. The language has object-oriented extensions, and there is a wealth of extant routines available for Perl.

2.4.7.3 JavaScript

JavaScript is an object-oriented scripting language that was originally developed by Netscape to be small and lightweight. According to Netscape, it was designed specifically for embedding in other applications, especially for use with Web browsers. The language is designed to work with a core set of objects, known as Core JavaScript, and is commonly extended by supplementing it with additional objects, most commonly Client-side JavaScript and Server-side JavaScript. Client-side JavaScript consists of objects specifically designed to control a Web browser and its Document Object Model (DOM). Client-side extensions might be employed to add functionality to an HTML form and react to associated events, such as mouse clicks, form inputs, and page navigations. Server-side JavaScript extends the language to perform server-executed functions, such as a database search. JavaScript resembles Java in that they largely share the same syntax. Again, like Perl, JavaScript is not a strongly typed language; variable types are dynamic rather than static. While it is object-oriented, it is not class-based, and inheritance varies with the object in question and is not hierarchical in nature. Unlike Java, JavaScript does not create applets, but it's generally interpreted by Web browsers. JavaScript can be used to tie Java applets to HTML code. Netscape has been working with ECMA (European

Computer Manufacturers Association) to develop a standardized version of JavaScript, known as ECMAScript.

2.4.7.4 VBScript

VBScript is a subset of Visual Basic specifically designed to be lean and mean enough for application in the Web-centric world. It's engineered to be cross-platform and interacts with ActiveX Controls and Java Applets. Like JavaScript, VBScript, officially known as Microsoft Visual Basic Scripting Edition, can run client-side on a Web browser, especially Internet Explorer, and server-side on the Web server, especially Microsoft Internet Information Server (IIS). VBScript does not strongly type its variables; the interpreter recognizes the context of variables and deals with them appropriately. It is object-oriented, supporting a limited amount of Internet-related objects and any objects provided on a particular Web site [15].

2.4.8   Development Tools Consideration

2.4.8.1 Microsoft Visual Interdev

Microsoft Visual InterDev is a development environment in which developer can create, edit, deploy, and manages ASP. Visual InterDev combines a rich set of database connectivity tools, wizards, and design time controls to increase the functionality and decrease the development time to build Active Server Application.

The functionality of Visual Interdev can be categorized into four sections:

- File and source code management
- Database connectivity and design time access
- ASP functionality
- Client-side functionality

2.5 Summary

This chapter presented the literature review for this project including research and analysis on existing housing estate portal on the internet and findings on the system architecture and software tools. Incoming chapter will explain in detail system analysis for Timecity Housing Estate Portal..

Chapter Three: Methodology and System Analysis

3.1 Process Model

3.1.1   What is Process?

Process - a series of steps involving activities, constraints, and resources that produce an intended output of some kind. Software development includes several stages and every stage is itself a process, or a collection of processes that can be described as asset of activities and each activity involves constraints, output, and resources. There are many ways to address each stage of development; each configuration of activities, resources, and outputs constitutes a process, and a collection of processes describes what happens at each stage. Building a process model and discussing its sub processes help the team understand this gap between what should be and what is. The process model that I have chosen for this system is the Waterfall plus Prototype Model [9].

3.1.2 Waterfall with Prototype Model

The development strategy or methodology used in the project is Waterfall model with prototyping. The reason for choosing this model compare to other models such as Waterfall model, V model and so on is because the strength of both Waterfall model and Prototype model can be combined to reduce the risk of uncertainty and instability in development by clarifying user requirements for the system design before the coding stage.

Waterfall model is one of the first models to be proposed, where the stages are depicted as cascading from one to another. In the other words, one development stage should be completed before the next begins. The advantages of Waterfall model is it helps developer lay out what they need to do and makes it easy to explain to customers who are not familiar with software development. It also makes explicit which intermediate products are necessary in order to begin the next stage of development.

The biggest problem with the Waterfall model is that it does not reflect the way code is really developed. The actual software development process, if uncontrolled, developers may thrash from one activity to the next and back again, as they strive to gather knowledge about the problem and how the proposed solution addresses it. The software development process can help to control the thrashing by including activities and sub processes that enhance understanding, such as prototyping.

Prototype is a partially developed product that enables customers and developers to examine some aspect of the proposed system and decide if it is suitable or appropriate for the finished product. Design prototyping helps developer assess alternative design strategies and decide which is the best properties. Often, user interface is built and tested as a prototype, so the users understand what the new system will be liked, and the designers get a better sense of how the users like to interact with the system.

Figure 3.1: Waterfall with Prototype Model
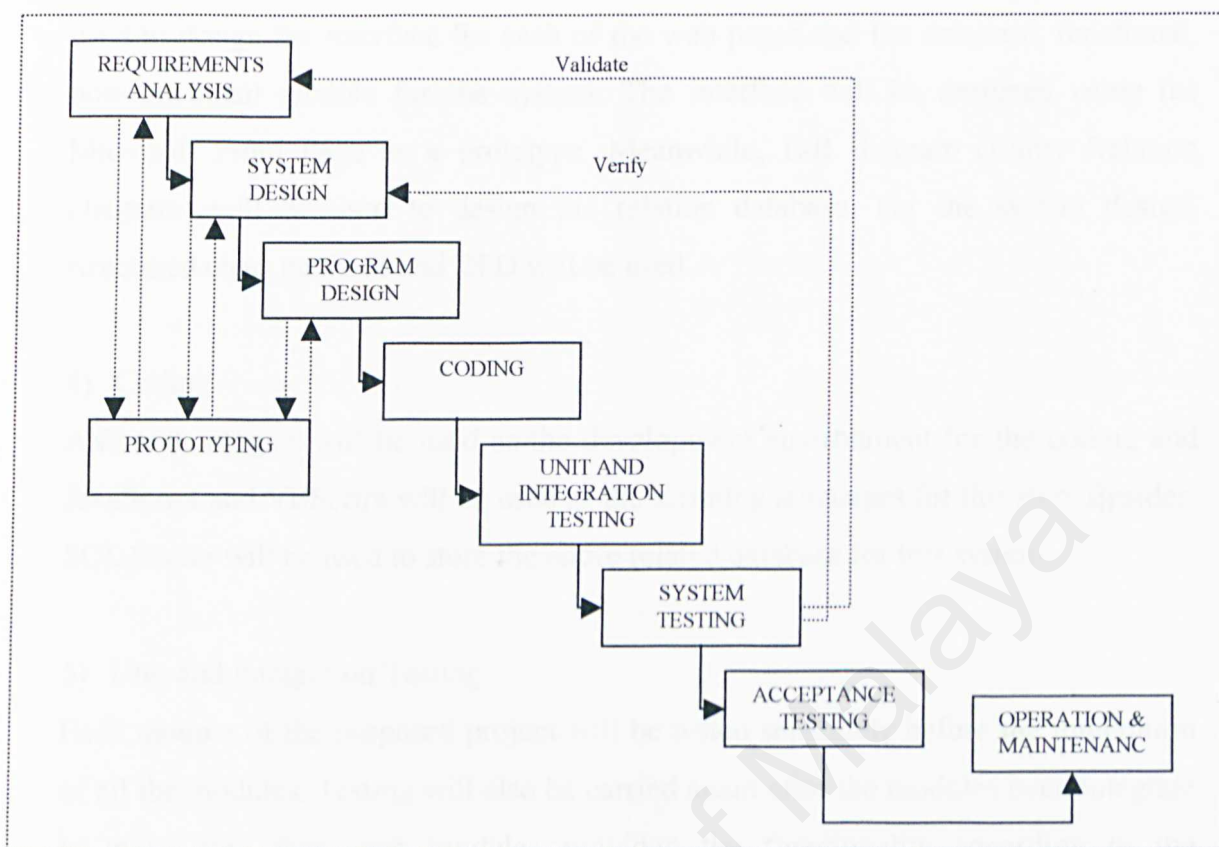
Steps on Waterfall Model with Prototyping

1) Requirement Analysis

Relevant information will be gathered from several of resource such as Internet, books and so on to determine the requirement such as user requirement, functional and non-functional, hardware and software requirement. After the analysis, meaning by the end of this phase, the system methodology has to be determined.

2) System Analysis and Design

Feasibility study and investigations can conn out the research. In this phase, the system development tool has to be determined. Data Flow Diagram are user to structured out the flow of each module and functionality in this project including the input, output and the processes in a structured graphical form.

3) Program Design

There will be two levels of design. The top level and the detail level design will be used to design the interface for each of the web pages and the database, functional, non-functional module for the system. The interface will be designed using the Microsoft Front Page as a prototype. Meanwhile, E-R diagram (Entity Relation Diagram) will be used to design the relation database. For the system design, structured chart methods and DFD will be used.

4) Coding

ASP technologies will be used as the development environment for the coding and JavaScript and VBScript will be used as the scripting languages for this step. Besides, SQL Server will be used to store the entire related database for this system.

5) Unit and Integration Testing

Each module of the proposed project will be tested separately before the integration of all the modules. Testing will also be carried again after the modules been integrate to make sure that each modules provided the functionality according to the requirement stated.

6) System and Acceptance Testing

Three types of testing will be used- modular testing, integration testing, and the whole system testing. Modification will be done if needed for the faulty occurrence

7) Operation and Maintenance

After the project has been tested, maintenance will be carried out. Modification will be made if faulty occurs. The proposed project will be kept up to date as well.

8) Validation

Validation ensures that the system has implemented all of the requirements, so that each system function can be traced back to a particular requirement in the specification.

9) Verification

Verification ensures that each function works correctly. That is, verification ensures that the developer is building the right product (according to the specification), and checks the quality of the implementation.

Advantages of the model are:-

1) It is easy to allocate each milestone with its deliverable.
2) Lay out tasks need to be done.
3) User involvement in early stage ensures the system is developed more closely to user's need.
4) It provides opportunity to explore alternative strategies and relations.
5) Emphasizes completion of one phase before moving on.
6) Emphasizes early planning, customer input and design.
7) Emphasizes testing as an integrated part of the life cycle.
8) Provides quality gates at each life cycle phase.

3.2 Project Planning

3.2.1 System Module

Module 1: Public Module

Module Public provides 4 functions for user. Users for this module basically are the public, meaning including the potential and existing customer. Below are the descriptions for every function in this module:

1. Property Search

This function allowed user to search the properties of Timecity of their preferences. A form requesting the user to enter their preferences will be displayed before the searching process begins. The user selects their choice from the combo box such as location and type of properties. By clicking the search icon, the result of the property searching will display either the property

information requested by the user or if there are no matching, the message showing the search result is zero will be displayed to user. User may then view the details of each property listing.

2. Company Profile

This function is an information providing function. It provides user with information related to Timecity Housing Estate Company. This gives the user a sense of confidence in the integrity of the company.

3. Contact Us

This function plays a role as a communication tool between the developer and public. User will be displayed with Timecity contact number and address as well as a form for user to type their comments to send it to developer email. User is allowed to choose whether to contact developer manually using the phone number, mail to developer using snail mail or electronic mail.

4. Dream House

Dream House is a new function that also provided the functionality as a communication tool. But, it is different from Contact Us function where it is more specific in asking questions and getting information from user about their opinion and suggestion for their dream house. This will be a great function in helping developer to get to know what their customer wants and needs through the useful information that the form will collect. User will be prompt with a very user friendly form, asking them to input their own information and also make some choice form their dream house, such as what type of dream house, how much their budget and where they want their dream house to locate and suggestion they might want to tell the developer.

Module 2: Virtual Community Module

Module Virtual Community provides an information site to the existing customer, meaning the home owner of the specific housing estate developed by Timecity. Below listed the functionalities provided by this module:

1. News

This function will be located on the main page of Virtual Community site. It will display latest news related to the housing estate, such as events and promotions that are going on in the housing estate and so on.

2. Business Directory

This function will provide user with business directory information of the specific housing estate. User can view information about every shops located in their housing estate. This information including the type of shops, shops address and contact number, as well as the products and services provided by the particular shop. This function ease user in getting the information related to their housing estate when they need it.

3. Furnishing Tips

Furnishing tips function consists of displaying useful furnishing tips to all the users. This information including interior design tips and suggestions, house decorating point of view and so on.

4. Health Tips

To make the Virtual Community more complete, this function provides user with information related to health care, healthy lifestyle, advice from doctor, symptoms of illness and else.

5. Helpline

This function displays list of important contact numbers for users especially during emergency. The helpline includes nearest police station, hospital, clinic, and specialist contact number.

6. Home Makers and Repairs

This is another function that will provide user with list of information regarding to home makers and repairs. The information provided including their address and contact number.

7. Health Care Live Chat

This function provides user a hyperlink to Prohighway health care site where user will be able to access to all the useful functions provided by the Prohighway including the live chat and others useful health care information.

8. Online Ticket Booking

This function allows user to make online ticket booking to TGV Cinema through the cinema online hyperlink.

Module 3: Developer Module

Developer module provides the online receive and request for quotation and the user for this module is the developer. Below describe the list of functions provided by this module:

1. Developer Login

Developer requires to login before they are able to access to the developer site and provided functions. During login, developer needs to input their ID and password. Only when the ID and password are both accurate, the login are consider successful. An error in any result is a deny of access.

2. View List of Quotations

This function provides developer the list of quotations received from suppliers. The information in the quotations including the product information together with the price quoted from the supplier and others charge and payment.

3. View Supplier Information

Developer will be able to view all their suppliers' information online through this function. Supplier information includes the contact person, contact number, address, company registration number, and remarks.

4. Send Request for Quotation

This function allows developer to inform the suppliers the list of materials the developer required. Developer will be displayed with an input form to insert information related to the material required, and then send it to supplier page. .

Module 4: Supplier Module

Supplier Module integrates five functions for the supplier. Only the suppliers who registered with the developer will be able to access to this module. Here includes the five functionality of this module:

1. Supplier login

Supplier requires to login before they are able to access to the supplier site and provided functions. During login, supplier needs to input their ID and password. Only when the ID and password are both accurate, the login are consider successful. An error in any result is a deny of access.

2. News

This function provides supplier with the news provided by the developer. This news function will allow the developer keeps in touch with their suppliers.

3. Information

This function provides supplier with the useful information such as supplier question and answer, developer business policies, how to become a member, and so on.

4. Send Quotation

This function allows supplier to send their quotation together with the price they quoted to developer online just after they received the list of quotation required by the developer. After checking thorough the list of quotation required by the developer, supplier can choose to send quotation if they want to. Supplier will be displayed with a quotation template when they clicks on the particular send quotation button. This template is an input form with all the material and supplier information, supplier only needs to key in their quoted price and other relevant charge or payment required. The quotation will then send to developer site.

5. List of Quotation Required

This function provides supplier the functionality to view the list of quotation required by the developer. This list will be received from the developer when the developer access the send quotation required function in Developer Module. Supplier will be able to view the list of material required by developer and make decision whether to send quotation or not.

3.2.2   Project Schedule

	Task Name	Start	End	Duration
1	Preliminary Study and Planning	18/06/01	27/06/01	8d
2	Identify objectives	18/06/01	21/06/01	4d
3	Identify Scope	22/06/01	22/06/01	1d
4	Identify Expected outcome	25/06/01	27/06/01	3d
5	Literature Review	28/06/01	16/07/01	13d
6	Asses exiting relief	28/06/01	09/07/01	8d
7	Analysis software and hardware	06/07/01	16/07/01	7d
8	Analysis architecture and others	06/07/01	16/07/01	7d
9	System Analysis	17/07/01	27/07/01	9d
10	Functional Requirements	17/07/01	23/07/01	5d
11	Non-functional requirements	23/07/01	26/07/01	4d
12	Decision on software and hardware	26/07/01	27/07/01	2d
13	System Design	23/07/01	13/08/01	16d
14	Structure Chart	23/07/01	07/08/01	12d
15	Data Flow Diagram	23/07/01	07/08/01	12d
16	Process flow	23/07/01	07/08/01	12d
17	ER diagram	27/07/01	07/08/01	8d
18	Data Dictionary	27/07/01	07/08/01	8d
19	User interface	08/08/01	13/08/01	4d

3.3 Procedure

3.3.1   Functional Requirements

The functional requirements describe what the system must be accomplished. In other words, functional requirements list the services offered by the system, how the system should react to particular inputs and how the system should behave in particular situations.

1) The system must be able to validate the user's login and password for the supplier and internal user's pages to validate the users. After this, the system will dynamically load ASP page according to the user. Access user should be controlled meaning only certain user will be able to obtain certain information for security purposes.

2) Validated supplier will be able to obtain information related to quotations required by the developer including product's code, types, specification and quantity. After this, supplier will be able to send the quotation together with their quoted price to the developer.

3) Validated developer will be able to view the quotation send by the supplier on the web site and at the same time, the system provided the functionality of delete, print and save the quotations. Reports can be automatically generated using the preformatted templates.

4) Validated developer will also be able to fill in a quotation requirement form and send it to the supplier page for their concern.

5) Public user including the existing and potential customer, accessing the system can obtain the property information using the simple searching by querying the database with parameters such as property types, location and budget.

6) Public user can also access to virtual community site to obtain useful information such as related housing estate's business directory, latest news and useful links.

7) Each form provided by the system must be validated before they are submitted to the database. Fields that must be filled up should be checked whether they are filled up or not. If not, the user should be prompt to fill it up. Restrictions which are imposed onto certain fields should be checked if they are imposed or not. The restrictions may be the number of characters accepted and type of character accepted. This is important for field such as the user ID, password, name, telephone number and email address.

8) Each session should be abandoned when the user log out of the system, or closes the web browser. This is to prevent another user form accessing the system using previous user's access.

3.3.2 Non-Functional Requirements

Non functional requirements describe a restriction on the system that limits our choices for constructing a solution to the problem. These requirement even though is very subjective but it play an important roles to ensure the system robustness and successful. It also defines the system properties and constraints.

1) Usability and User-friendliness

This system utilizes the GUI. The GUI provides better usual meaning to the user. The usage of suitable and meaningful icons will help ensure that users are use the system with more confidence and avoid mistakes made by user unintentionally. The icons conveyed information is concise, easy to understand and meaningful. The system will also display a confirmation message for any non-trivial process such as deletion and printing. Appropriate prompts and instruction will be shown to guide user along the operation of the system. The systems documentation also guides the users while using the system or throughout the entire installation of the system.

2) Modularity and Maintainability

The system coding and design will be implemented by using a modular approach so that it can be easily enhanced in the future. The procedure, subroutine and methods in the program are written in modular. It makes the program easier to understand in the cater times. Some common procedures or functions are reusable. This will save a lot of development time and prevent the codes redundancy. Later maintenance to the system can save a lot of effort.

3) Consistency

Consistency prevents function confusion to these keywords when shifting among difference modules. It can also enhance simplicity of the system.

4) Reliability and Dependability

A system is said to have reliability if it does not produce dangerous or costly failures when it is used in a reasonable manner, that is, in a manner that instructed by the system. Thus, the system does not cause physical or economical damage in event of system failure as the system was designed into four independent modules. Appropriate messages and prompts were designed to enable user follow step by step easily in using the system. Assumption was counted by the system design in order to prevent user acts in an unusual pattern.

5) Robustness

The system consists of four modules which will be completely tested to ensure each module achieve its expectation. The modules will be integrated into system and system testing will be started after integration process. Any errant that will be discovered during system testing will be solved immediately. This is to make sure the system is as robust as what had been expected before.

6) Legislation

All software including operating system platform will be assured a licensed copy. None of any pirated software will be used in this system.

7) Expandability

The system is capable to expand its modules, functionality, and as well as the whole system and volume of the products.

8) Multi-User

This system supports a large amount of concurrent and variety of users to access to the system at the same time no matter wherever they are.

3.3.3 Software Requirements

3.3.3.1 Project Software Configuration

Software	Description
Microsoft Window 2000 Sever	Operating System Platform
Microsoft IIS 5.0	Web Server Service
Microsoft SQL 2000	Database Server
ASP	Server Scripting Environment
HTML, VBScript	Programming and Scripting Languages
Microsoft Interdev	Development tool
Microsoft IE 5.0	Web Browser

3.3.3.2 Operating System Consideration

3.3.3.2.1   Unix System versus Microsoft Window 2000 Server

Below are the reasons why I choose Microsoft Server 2000 as my operating system than Unix System:-

1.   Open Platform Offer Choice

Windows NT Server is an open platform that provides a stable computing environment. Unlike UNIX, it is a single, consistent development target with public application programming interfaces (APIs). Also, unlike UNIX, it has very broad application availability and runs on standard, non-proprietary hardware. Applications written for one variant of UNIX usually require significant, non-trivial changes to compile on a different platform. Even simple utilities, shell script commands, and features vary widely across the different flavors of UNIX.

2.   Comprehensive, Integrated platform

Windows NT Server, and its successor Windows 2000 Server, is Microsoft's answer to customer requests for a comprehensive, integrated, network computing platform. With Windows NT Server, users get best-of-breed application services, file and print services, communications, remote administration, and Web services in a single operating system. Windows NT Server also has underlying support for distributed and scalable computing technologies, namely messaging queuing services, transaction services, and COM. This gives developers the tools they need to easily create robust, fault-tolerant and scalable applications. Windows 2000 will include Active Directory and COM+ to extend the scalability even further.

3.   Digital Nervous System

Windows NT is the foundation upon which the Digital Nervous System is built. The Digital Nervous System is Microsoft's vision of interconnected and distributed computing based on COM (Component Object Model) and the Windows DNA (Distributed interNet Architecture).

4. Application Windows is Behind Momentum

More developers are developing applications for Windows and more ISVs are shipping applications for Windows than any other platform in history. When Windows 2000 ships, approximately 60,000 applications that run across the server and client are expected to be available. In 1998, according to DataSources, ISVs developing applications for Windows NT increased 36 percent, whereas the number of ISVs writing applications on Solaris *shrunk* by 5 percent. More telling is the fact that 60 percent of Solaris ISVs now develop and license applications for Windows NT.

5. Marketplace Momentum

Windows NT has made substantial inroads into traditional UNIX strongholds at the very high end of the market, especially with the advances in scalability and availability in Windows NT Server 4.0, Enterprise Edition. Because of the application support that a large installed base and superior development tools have made possible, more than 70 percent of new intranets being deployed today are based on Windows NT Server.

6. Cost-effective Enterprise Solution

The cost of any network server and its operating system is a product of many variables, of which the initial purchase price is only one portion. It's also necessary to calculate in system and network upgrades, labor costs, applications development and maintenance costs, as well as out-of-pocket expenses associated with technical support and upgrades. Microsoft Windows NT Server improves the overall reliability and availability of the network and its servers, thus reducing downtime. It provides an easy-to-manage, flexible, and scalable platform for application development and enterprise management.

7. Availability and Reliability

Today, customers rely on the Windows NT Server operating system to deliver highly available solutions in a variety of critical environments. In the Cahners In-Stat

Group/BRG report, Distributed Computing Platforms: Requirements for High Availability, the majority of respondents reported that Windows NT Server can meet their needs for high availability.

8. Scalability

Windows NT Server 4.0, Enterprise Edition meets the needs of the majority of the enterprise computing marketplace today, providing near-linear scalability for very large database, application, and messaging systems, as measured by industry standard and independently audited benchmarks. At the same time, Windows NT Server-based systems have undisputed price/performance leadership, according to the Transaction Processing Council.

9. System Management

Windows NT Server provides a unified and coherent set of tools that eases the burden of systems management in the enterprise, while still providing support for a variety of third-party tools and utilities. The ease of use and consistent interface of Windows NT provide configuration, as well as desktop and security management advantages. For the advanced administrator, there are rich scripting tools allowing the uniform performance of repetitive tasks.

Windows NT also has a complete set of performance and event monitoring tools to give system administrators necessary information in a usable and easy-to-understand format so multiple servers can be managed from a single desktop. These tools allow for both reactive and predictive response to changes in the systems to minimize problems and downtime

10. Security

Although firewalls, encryption devices, and other discrete components play an important role in securing a business' infrastructure, a critical element is the choice of a server operating system. To remain competitive, businesses need to weigh not just

the number of security features provided, but the cost of maintaining security and the impact that security systems have on commerce.

With Windows NT Server, security is an integrated part of the base operating system, not a separate product to be added separately. Security features are integrated into the standard Windows NT graphical administration while remaining available from the command line and through scripting. Further, Windows NT provides a single, coherent set of administrative and security tools, regardless of the underlying hardware. This greatly reduces the cost of maintaining the necessary level of security with a minimal impact on business operations [12].

3.3.3.3 Development Tools Consideration

3.3.3.3.1 Why ASP?

Below are the reasons why I chose ASP as my development tools:-

1) Active Server Pages are browser independent.

An Active Server Page is executed on a Web server and not within a browser. This means that an Active Server Page is not dependent on the capabilities of a browser. Unlike JavaScript, Active Server Pages can be written so they work with any browser.

2) Active Server Pages use scripting languages

An Active Server Pages is written using scripts. This means that an Active Server Page is easy to modify. If you discover a bug in an Active Server Page, you can open the page with notepad and make a quick modification without recompiling your application.

3) Active Server Pages provide easy database access

You can easily perform complex database tasks within an Active Server Page. You can also use the same database access technology in an Active Server Page as you would within Visual Basic or Visual C++ (the ActiveX Data Objects).

4) Active Server Pages work with following operating systems

Active Server Pages work well with Window 2000 Server, Window NT Server, Window 95/98, and others third party operating system such as ChiliSoft.

3.3.3.4 Web Server Consideration

3.3.3.4.1   Apache Server versus Microsoft Internet Information Server 5.0

Below are the reasons why I chose Microsoft Internet Information Server 5.0 compare to Apache Server:

1) Reliability and performance

A number of features make IIS more reliable and improve performance. To make it faster and easier to restart IIS, the reliable restart feature of IIS 5.0 allows an administrator to restart Web services without rebooting the computer. To improve reliability, Application Protection provides the ability to run applications in an isolated pool, separate from the Web services. The new CPU Throttling and Socket Pooling features in IIS 5.0 can also improve reliability. For application developers, Web site performance can be improved through new features such as scriptless Microsoft Active Server Pages (ASP) processing, ASP self-tuning, and performance-enhanced ASP objects.

2) Management

IIS 5.0 is easier to install and maintain. A number of features support this increased ease of maintenance, including a simplified installation process, new security task wizards, the ability to account for time used by processes, more flexible remote administration, and the ability to create custom error messages.

3) Security

IIS 5.0 adds support for important industry-standard security protocols, including Digest Authentication, Server Gated Cryptography, Kerberos v5 authentication

protocol, Transport Layer Security, and Fortezza. In addition, three new task wizards make it easier for administrators to manage a site's security settings

4) Application Environment

Developers will find that IIS 5.0 expands the Web server's application development environment by building on new technologies included in Windows 2000 Server. These include Active Directory and the expanded Component Object Model (COM+). In addition, enhancements to IIS Active Server Pages, such as scriptless ASP processing, as well as improved flow control and error handling, let developers write more efficient Web-centric applications.

3.3.3.5 Database Server Consideration

3.3.3.5.1   Why SQL2000?

These are the strength of SQL 2000 as database server compare to the others DBMS:

1) SQL server was developed with the internet in mind, although it can certainly shine in any kind of network solution. It is a database server, rather than a stand-alone database. It can be accessed through virtually any kind of network connection, including TCP/IP.

2) The maximum size of a SQL server is 1,048,516 terabytes (a terabytes is 1,000 gigabytes), meaning that it has virtually no size limit.

3) By using replication, you can link several SQL Servers together to increase the number of concurrent client connections to any amount you wish.

4) SQL Server can be used to create stored procedures that can accept parameters, and perform a multitude of tasks. The stored procedures are cached, which increases performance. In general, SQL server yields much faster results than Access, and it can be configured to perform a great number of maintenance activities automatically. It even includes its own e-mail server.

5) SQL Server can be administered remotely (from a computer over the Internet, for example) using SQL Enterprise Manager, ad can be accessed remotely by other database applications via ODBC. In other words, an ODBC System DSN to access a SQL Server database doesn't have to reside on the same LAN as the database itself. It can reside anywhere that has access to the SQL Server via TCP/IP (in the other words, anywhere in the world that has a connection to the internet). That is because SQL Server is a client-server Database Management System. SQL Server can have its own permanent IP address on the Internet [13].

3.3.3.6 Programming Language

3.4.3.6.1 Why VBScript?

For this system, I have chosen VBScript as the Scripting language together with ASP. The reasons why I chose VBScript then JavaScript are:

1) Compare to JavaScript, VBScript is easy to use and learn and a great way to get into scripting.

2) VBScript is a default scripting languages on the IIS server.

3.3.4   Run Time Requirement

1) Server Hardware Requirements

- A server with at least Pentium 133 MHz processor.

- At least 128 MB RAM, 256 MB RAM recommended.

- 2 GB hard disk space with minimum of 1 GB of free space. Additional hard disk space is required if you are installing over network.

- Window 2000 compatible network interface card and network connection with recommended bandwidth at 10 Mbps or more.

- For CD-ROM installation: CD-ROM drive, 12x or faster recommended. If the computer does not support starting the setup program from a compact disk, a high density 3.5 inch disk is also required.
- Other standard computer peripherals.

2) Server Software Requirements
- Microsoft Windows 2000 Server
- Microsoft IIS 5.0
- Microsoft SQL 2000
- ASP
- Microsoft Visual Interdev

3) Client Hardware Requirements
- PC at least Pentium 133 MHz processor.
- At lease 16 MB RAM.
- Network connection through existing network configuration or modem (recommended at least 28.9 kbps)

4) Client Software Requirements
- IE 4.0 and above.

3.3.5   Architecture- Why 3-tier Architecture?

For all the client/server computing architecture, I have made my decision to follow the 3-tier architecture then the others; here are the reasons why I considered 3-tier architecture:

1) It provides the flexibility for modification. For e-commerce, evolution properly will occur to enhance the existing system towards a more secure and complete system. Therefore, the three-tier architecture is important to provide rapid revolution in whatever changes that will be occurred in the future.

2) The architecture can deliver greater application scalability. The modularity makes it easier to modify or replace one tier without affecting the other tiers.

3) Each developer enhances the network security. This is to avoid fraud and interception on the information.

4) Separation of application functions from the database functions makes the system easier to implement load balancing.

3.4 Summary

This chapter explained the system analysis including type of methodology for the system, system functional and non-functional requirement and software tools consideration. Next chapter will be focusing on the design of the system with list of diagrams to explain the design of the system in details.

Chapter Four: System Design

System Design is a very important factor in system development as it determines the success of the system. Design is a creative process of transforming the problem into solution; the description of a solution is also called design [9]. In this chapter, we will look at system architecture design, process flow diagram design, Data Flow Diagram design, page flow diagram design, ER Diagram design, data dictionary and user interface design for Timecity portal.

4.1 System Architecture Design

System architecture design describes the whole structure of Timecity portal. This includes list of modules under the whole system, and list of functions provided by every module. As describe in Chapter 3, Timecity portal integrated four main modules, which is Public Module, Virtual Community Module, Developer Module and Supplier Module. Figure 4.1 shows the system architecture design for the whole system.

Figure 4.1: System Architecture for Timecity portal
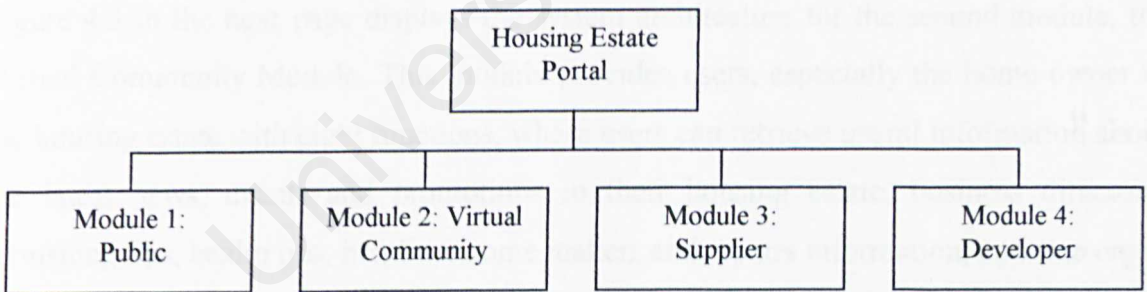
Each module in the system provides the users with a list of functionalities. Figure 4.2 below demonstrates the system architecture of the first module, Public Module which consists of four functions including the property search function, company profile function, contact us function and Dream House function. This module basically includes the basic functions provided by housing estate portal but with an extra feature, the Dream House function.

Figure 4.2: System Architecture for Module 1: Public Module
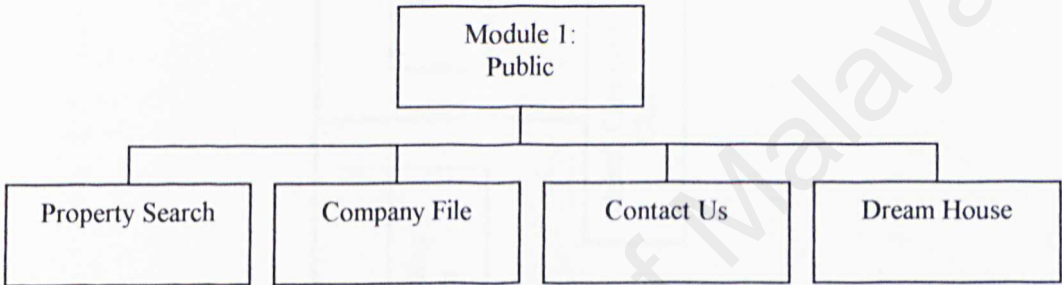
Figure 4.3 in the next page displays the system architecture for the second module, the Virtual Community Module. This module provides users, especially the home owner in the housing estate with eight functions, where users can retrieve useful information about the latest news, events and promotions in their housing estate, business directory, furnishing tips, health tips, helpline, home makers and repairs information, and also enjoy the health care live chat and online ticket booking function by browsing this Virtual Community site.

Figure 4:3: System Architecture for Module 2: Virtual Community Module

- Module 2: Virtual Community
  - News
  - Helpline
  - Business Directory
  - Home Makers and Repairs
  - Furnishing Tips
  - Health Care Live Chat
  - Health Tips
  - Online Ticket Booking
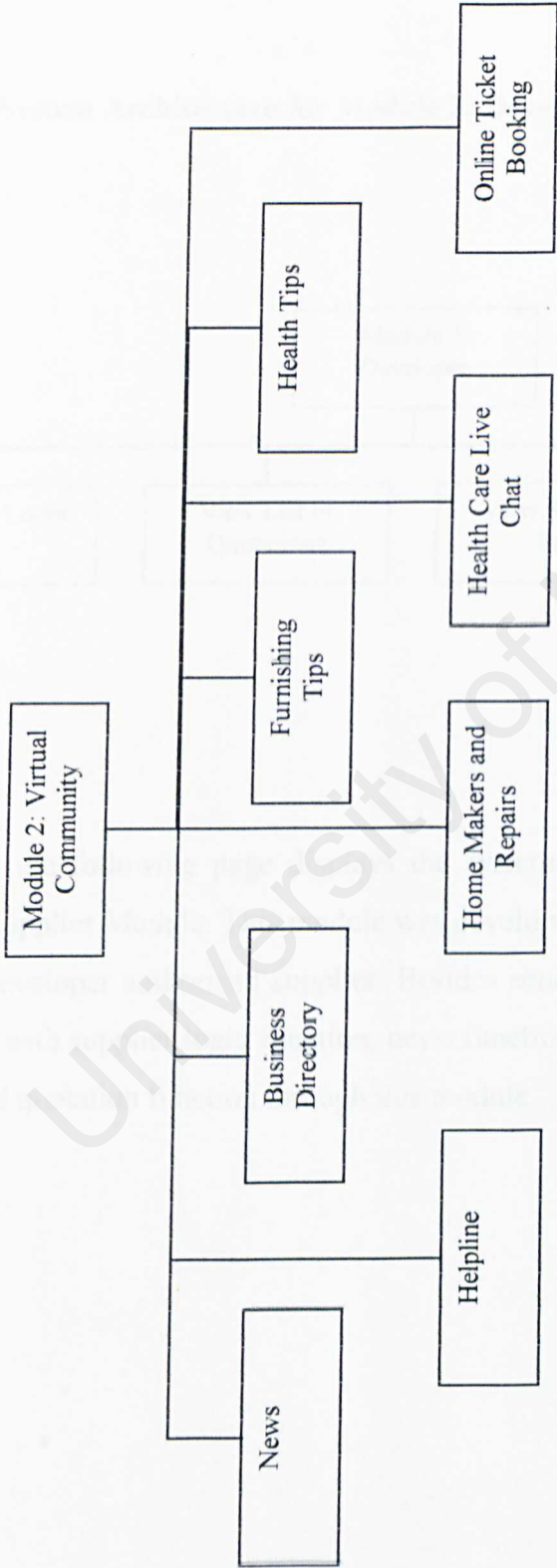
Module three, Developer Module provides the user, the developer with four functions which are the developer login function, view list of quotations function, view supplier information function and send request for quotation function. Figure 4.4 shows the system architecture design for this module.

Figure 4.4: System Architecture for Module 3: Developer Module
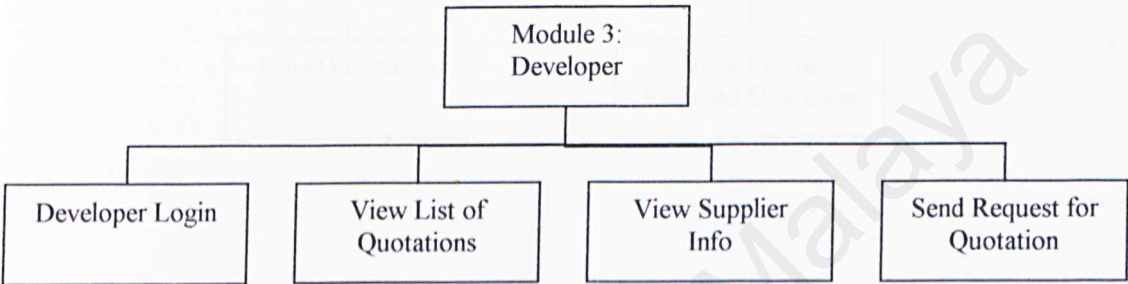
Figure 4.5 in the following page displays the system architecture design for the last module, the Supplier Module. This module was developed as an online sending quotation tool for the developer authorized supplier. Besides sending quotation function, supplier was provided with supplier login function, news function, information function and view list of required quotation function through this module.

Figure 4.5: System Architecture for Module 4: Supplier Module
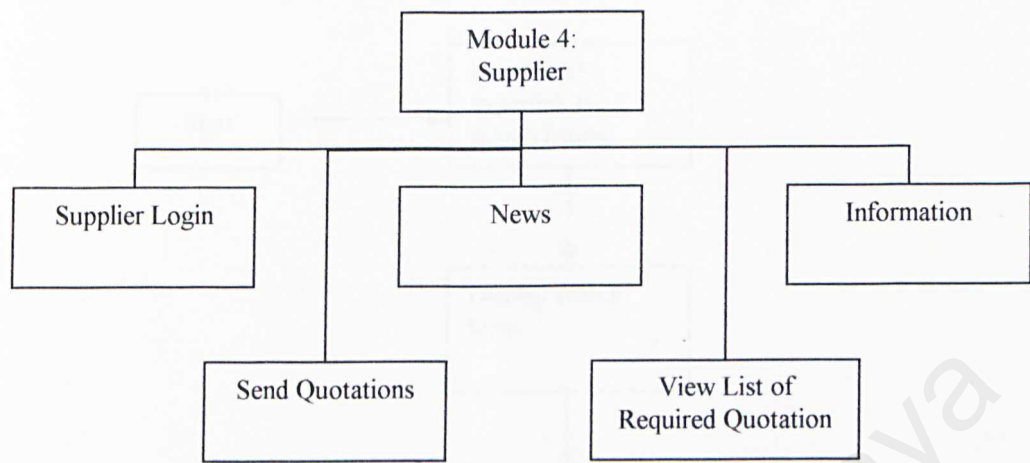
4.2 Process Flowcharts

Process flowcharts show the flow of process, step by step from the starting point until the process end. Incoming pages are list of process flowcharts for every function in the Timecity portal.

Figure 4.6: Process Flowchart for Property Search Function

```
                              ┌──────────────────┐
   ┌───────────┐              │ User clicks      │
   │   Start   │─────────────▶│ hyperlink to     │
   └───────────┘              │ search listing   │
                              └──────────────────┘
                                       │
                                       ▼
                              ┌──────────────────┐
                              │ Display search   │
                              │ form             │
                              └──────────────────┘
                                       │
                                       ▼
                              ╱──────────────────╱
                             ╱ Input search     ╱
                            ╱ preferences      ╱
                           ╱ for property     ╱
                          ╱──────────────────╱
                                       │
                                       ▼
                              ┌──────────────────┐
                              │ Display property │
                              │ listing according│
                              │ to preference    │
                              └──────────────────┘
                                       │
                                       ▼
                              ┌──────────────────┐
                              │      Stop        │
                              └──────────────────┘
```
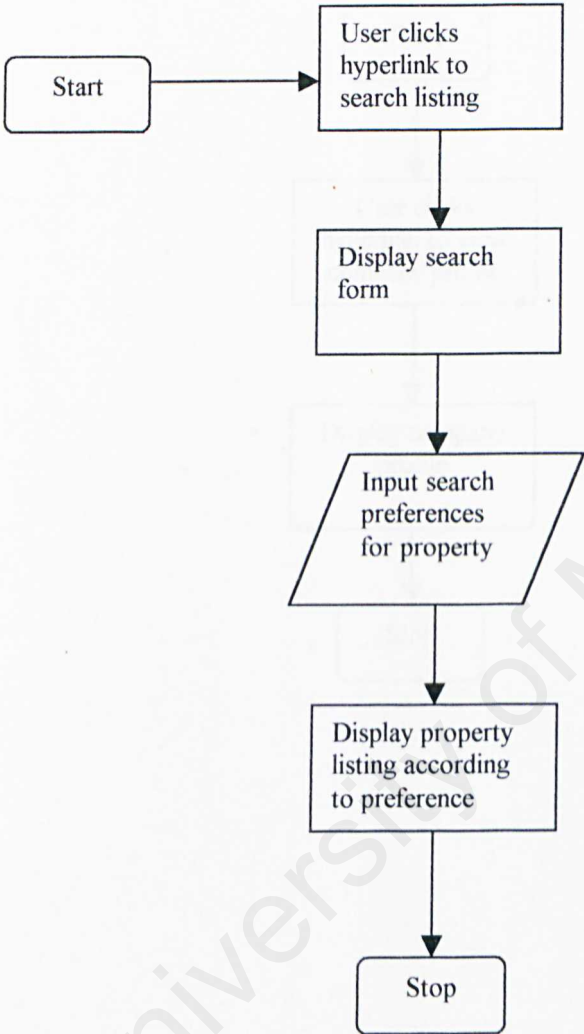
Figure 4.7: Process Flowchart for Company Profile Function
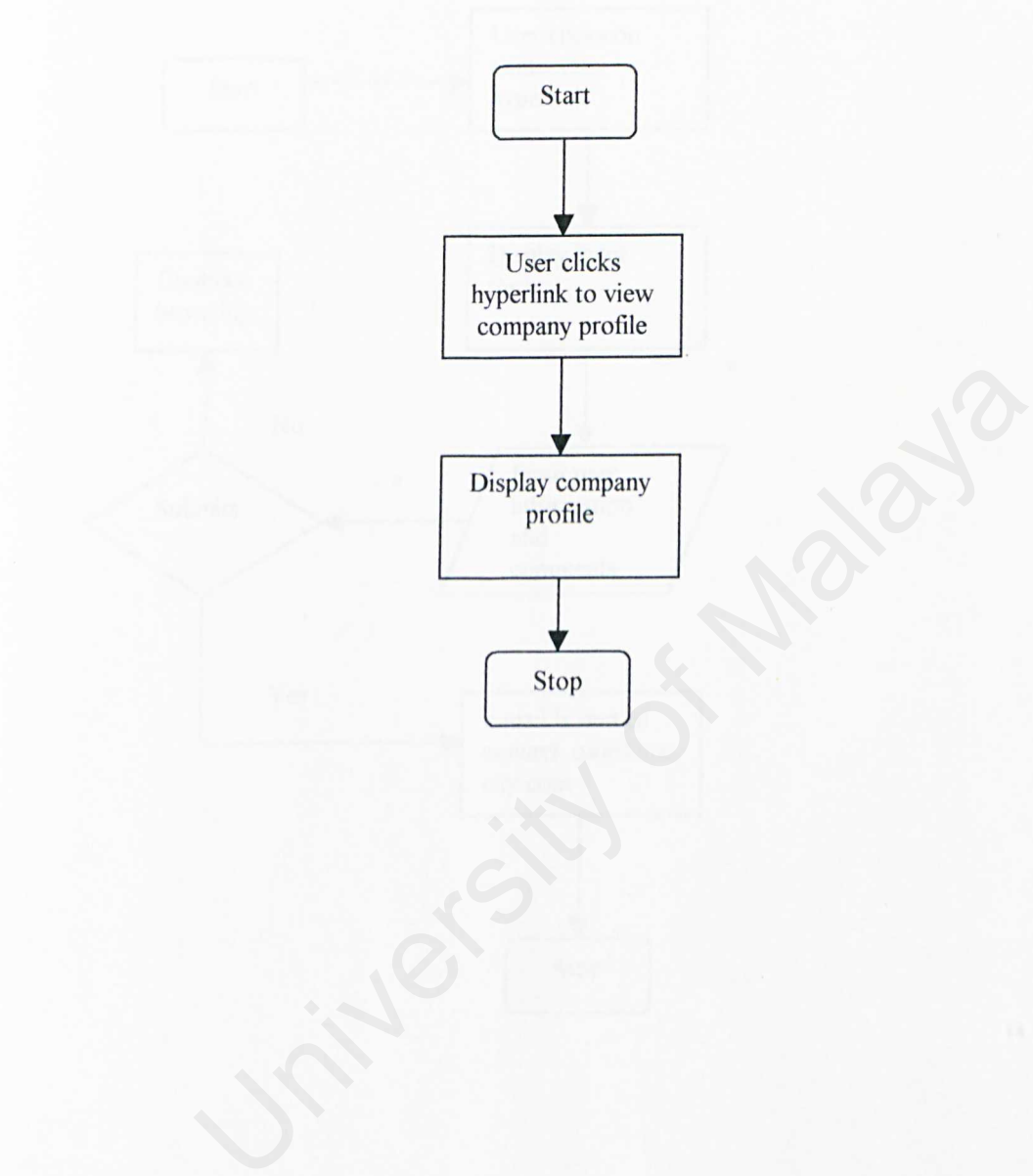
Figure 4.8: Process Flowchart for Contact Us Function

```
  ┌──────────┐          ┌──────────────────┐
  │  Start   │─────────▶│ User clicks on   │
  │          │          │ contact us       │
  └──────────┘          │ hyperlink        │
                        └──────────────────┘
                                │
                                ▼
  ┌──────────────┐      ┌──────────────────┐
  │ Continue     │      │ Display input    │
  │ browsing     │      │ form             │
  └──────────────┘      └──────────────────┘
         ▲                      │
         │                      ▼
        No              ┌──────────────────┐
      ◇◇◇◇◇◇◇           │ Input user       │
   ◇◇         ◇◇        │ information       │
  ◇  Submits    ◇◀──────│ and              │
   ◇◇         ◇◇        │ comments         │
      ◇◇◇◇◇◇◇           └──────────────────┘
         │
        Yes             ┌──────────────────┐
         │              │ e-mail is sent to│
         └─────────────▶│ contact_us@Time  │
                        │ city.com         │
                        └──────────────────┘
                                │
                                ▼
                        ┌──────────────┐
                        │    Stop      │
                        └──────────────┘
```

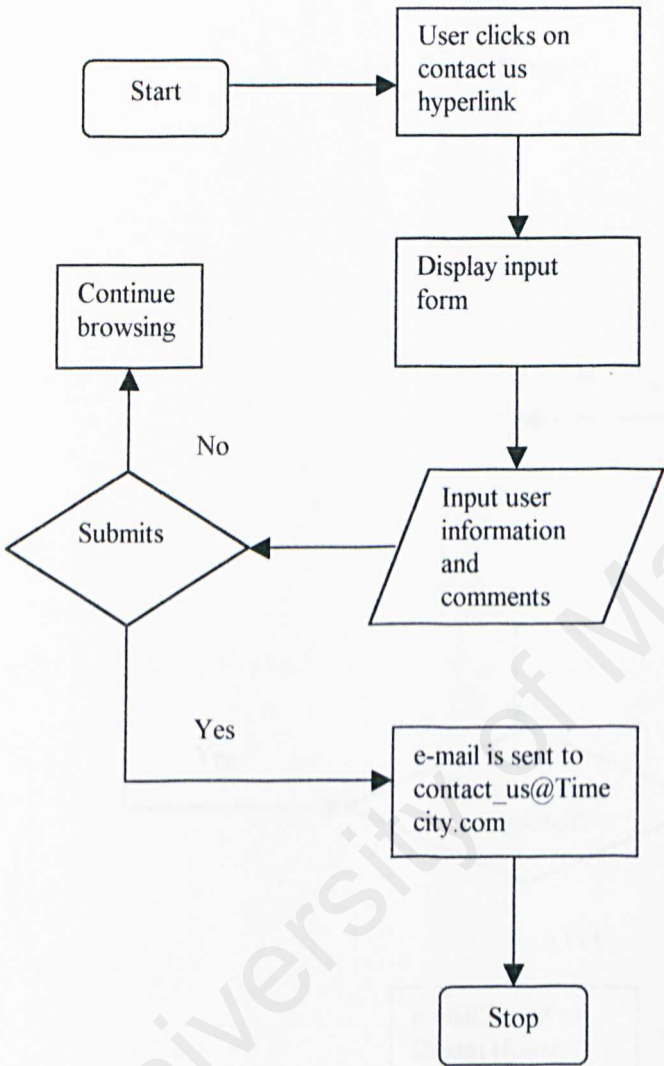**Figure 4.9: Process Flowchart for Dream House Function**
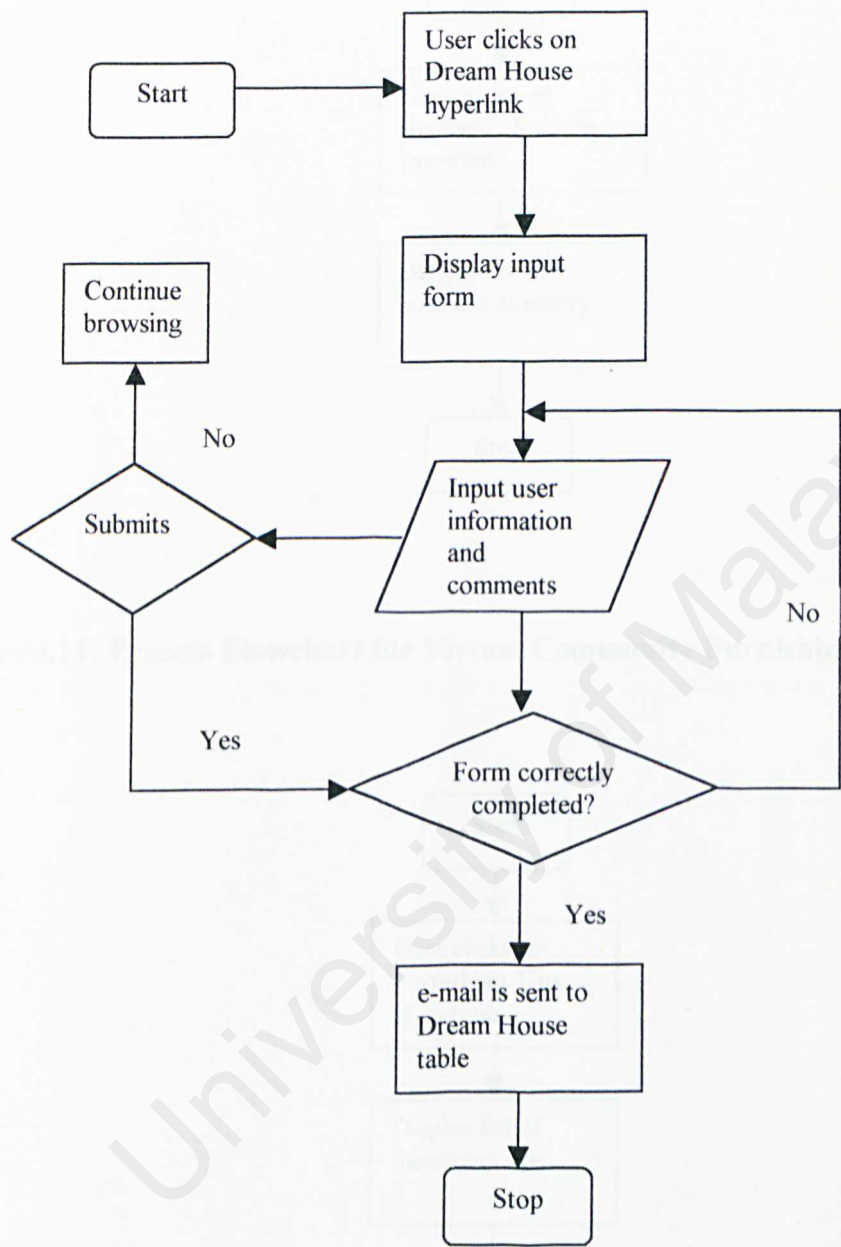
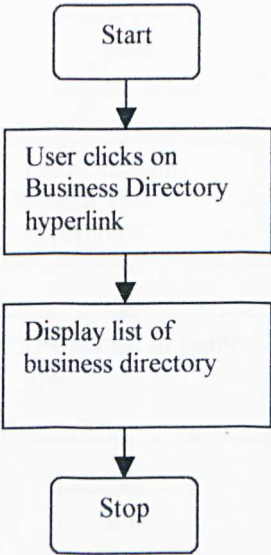**Figure 4.10: Process Flowchart for Virtual Community Business Directory Function**

```
              ┌──────────────┐
              │    Start     │
              └──────┬───────┘
                     │
                     ▼
        ┌──────────────────────┐
        │ User clicks on       │
        │ Business Directory   │
        │ hyperlink            │
        └──────────┬───────────┘
                   │
                   ▼
        ┌──────────────────────┐
        │ Display list of      │
        │ business directory   │
        └──────────┬───────────┘
                   │
                   ▼
              ┌──────────────┐
              │    Stop      │
              └──────────────┘
```

Figure 4.11: Process Flowchart for Virtual Community Furnishing Tips Function

```
              ┌──────────────┐
              │    Start     │
              └──────┬───────┘
                     │
                     ▼
        ┌──────────────────────┐
        │ User clicks on       │
        │ Furnishing Tips      │
        │ Hyperlink            │
        └──────────┬───────────┘
                   │
                   ▼
        ┌──────────────────────┐
        │ Display list of      │
        │ furnishing tips      │
        └──────────┬───────────┘
                   │
                   ▼
              ┌──────────────┐
              │    Stop      │
              └──────────────┘
```
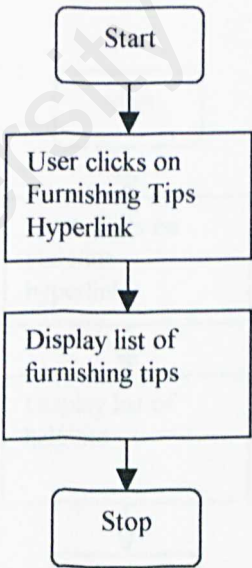
Figure 4.12: Process Flowchart for Virtual Community Health Tips Function

```
                    ┌─────────────┐
                    │    Start    │
                    └─────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │ User clicks on│
                    │ Health Tips  │
                    │ hyperlink    │
                    └─────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │Display list of health│
                    │ tips        │
                    └─────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │    Stop     │
                    └─────────────┘
```
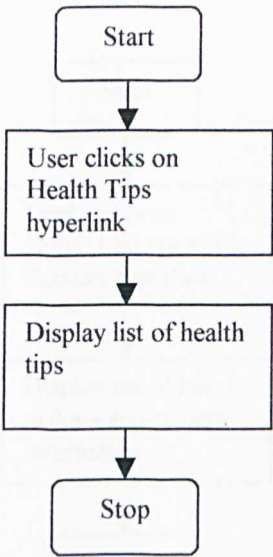
Figure 4.13: Process Flowchart for Virtual Community Helpline Function

```
                    ┌─────────────┐
                    │    Start    │
                    └─────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │ User clicks on│
                    │ Helpline    │
                    │ hyperlink   │
                    └─────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │Display list of│
                    │ helpline    │
                    └─────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │    Stop     │
                    └─────────────┘
```
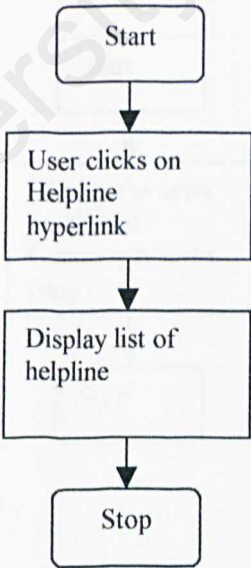
Figure 4.14: Process Flowchart for Virtual Community Home Makers and Repairs Function
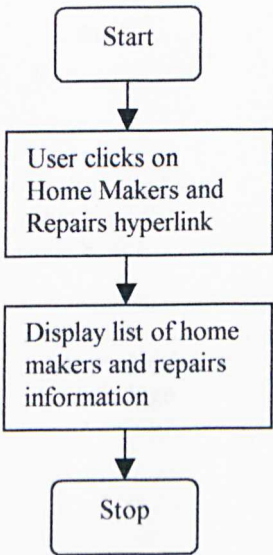
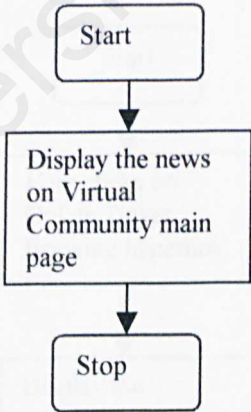**Figure 4.15: Process Flowchart for Virtual Community News Function**

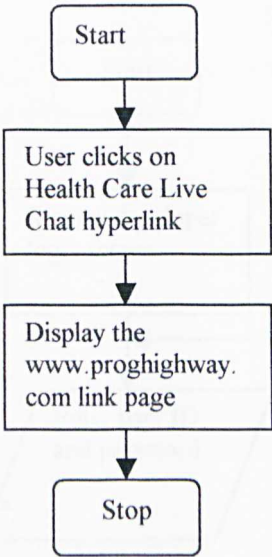**Figure 4.16: Process Flowchart for Virtual Community Health Care Live Chat Function**

```
            ┌──────────┐
            │  Start   │
            └────┬─────┘
                 ▼
        ┌──────────────────┐
        │ User clicks on   │
        │ Health Care Live │
        │ Chat hyperlink   │
        └────────┬─────────┘
                 ▼
        ┌──────────────────┐
        │ Display the      │
        │ www.proghighway. │
        │ com link page    │
        └────────┬─────────┘
                 ▼
            ┌──────────┐
            │  Stop    │
            └──────────┘
```

Figure 4.17: Process Flowchart for Virtual Community Online Ticket Booking

```
            ┌──────────┐
            │  Start   │
            └────┬─────┘
                 ▼
        ┌──────────────────┐
        │ User clicks on   │
        │ Online Ticket    │
        │ Booking hyperlink│
        └────────┬─────────┘
                 ▼
        ┌──────────────────┐
        │ Display the      │
        │ www.cinemaonline.│
        │ com.my link page │
        └────────┬─────────┘
                 ▼
            ┌──────────┐
            │  Stop    │
            └──────────┘
```
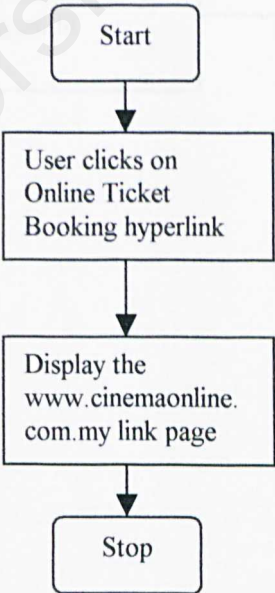
Figure 4.18: Process Flowchart for Developer Login Function
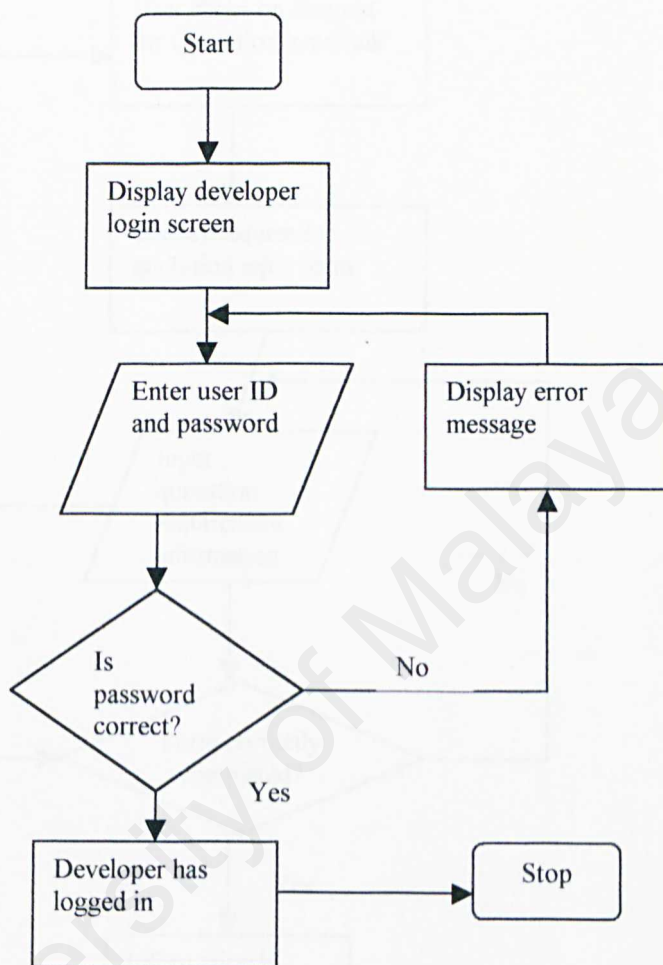
Figure 4.19: Process Flowchart for Developer Send Request for Quotation Function
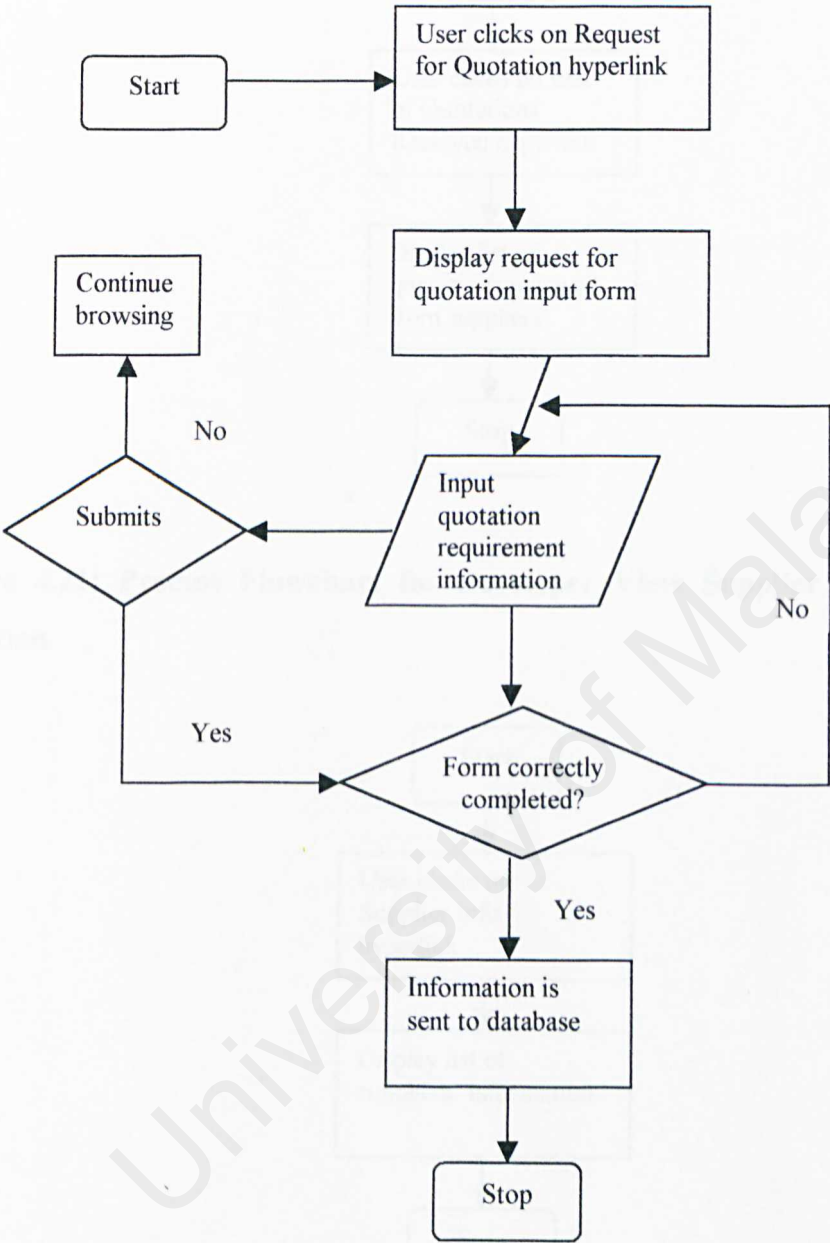
Figure 4.20: Process Flowchart for Developer View List of Quotations Received Function

```
                    ┌─────────────┐
                    │    Start    │
                    └─────────────┘
                           │
                           ▼
                    ┌─────────────────────┐
                    │ User clicks on List │
                    │ of Quotations       │
                    │ Received hyperlink  │
                    └─────────────────────┘
                           │
                           ▼
                    ┌─────────────────────┐
                    │ Display list of     │
                    │ quotations received │
                    │ from suppliers      │
                    └─────────────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │    Stop     │
                    └─────────────┘
```
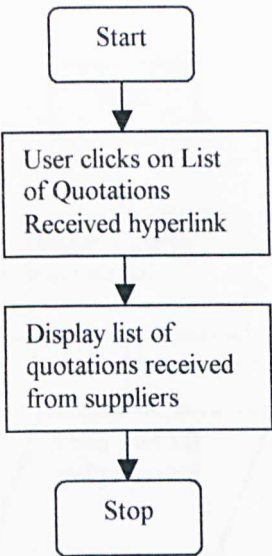
Figure 4.21: Process Flowchart for Developer View Supplier Information Function

```
                    ┌─────────────┐
                    │    Start    │
                    └─────────────┘
                           │
                           ▼
                    ┌─────────────────────┐
                    │ User clicks on      │
                    │ Supplier Info       │
                    │ hyperlink           │
                    └─────────────────────┘
                           │
                           ▼
                    ┌─────────────────────┐
                    │ Display list of     │
                    │ suppliers' information│
                    └─────────────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │    Stop     │
                    └─────────────┘
```
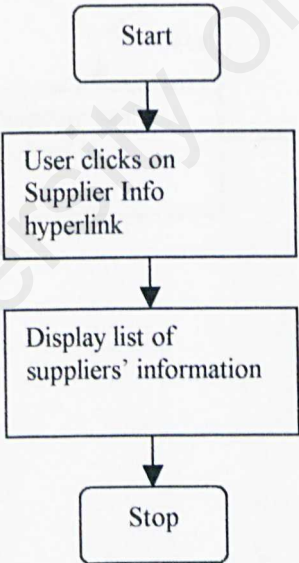
Figure 4.22: Process Flowchart for Supplier Login Function
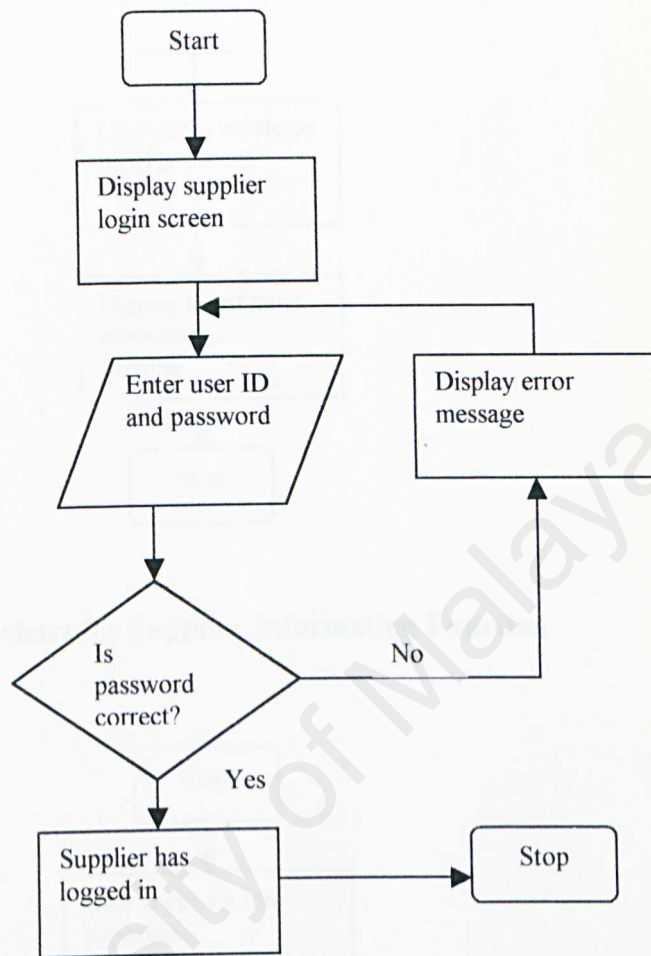
Figure 4.23: Process Flowchart for Supplier News Function

```
                    ┌──────────────┐
                    │    Start     │
                    └──────┬───────┘
                           │
                           ▼
                    ┌──────────────┐
                    │ User clicks  │
                    │ on News      │
                    │ hyperlink    │
                    └──────┬───────┘
                           │
                           ▼
                    ┌──────────────┐
                    │ Display list │
                    │ of news      │
                    │ provided for │
                    │ supplier     │
                    └──────┬───────┘
                           │
                           ▼
                    ┌──────────────┐
                    │    Stop      │
                    └──────────────┘
```
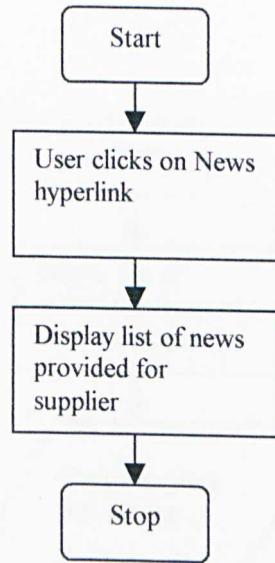
Figure 4.24: Process Flowchart for Supplier Information Function

```
                    ┌──────────────┐
                    │    Start     │
                    └──────┬───────┘
                           │
                           ▼
                    ┌──────────────┐
                    │ User clicks  │
                    │ on Info      │
                    │ hyperlink    │
                    └──────┬───────┘
                           │
                           ▼
                    ┌──────────────┐
                    │ Display      │
                    │ information  │
                    │ provided for │
                    │ supplier     │
                    └──────┬───────┘
                           │
                           ▼
                    ┌──────────────┐
                    │    Stop      │
                    └──────────────┘
```
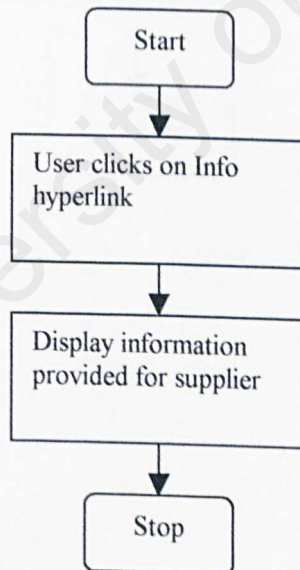
Figure 4.25: Process Flowchart for Supplier View List of Required Quotation Function
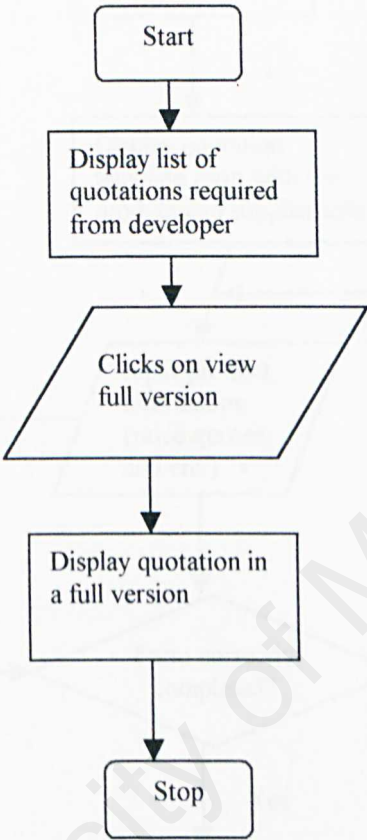
Figure 4.26: Process Flowchart for Supplier Sends Quotation Function

Start

User clicks on Send Quotation hyperlink

Display quotation template form with the product and supplier info

Continue browsing

No

Submits

Yes

Input product information (price quoted and etc.)

No

Form correctly completed?

Yes

Information is sent to database

Stop
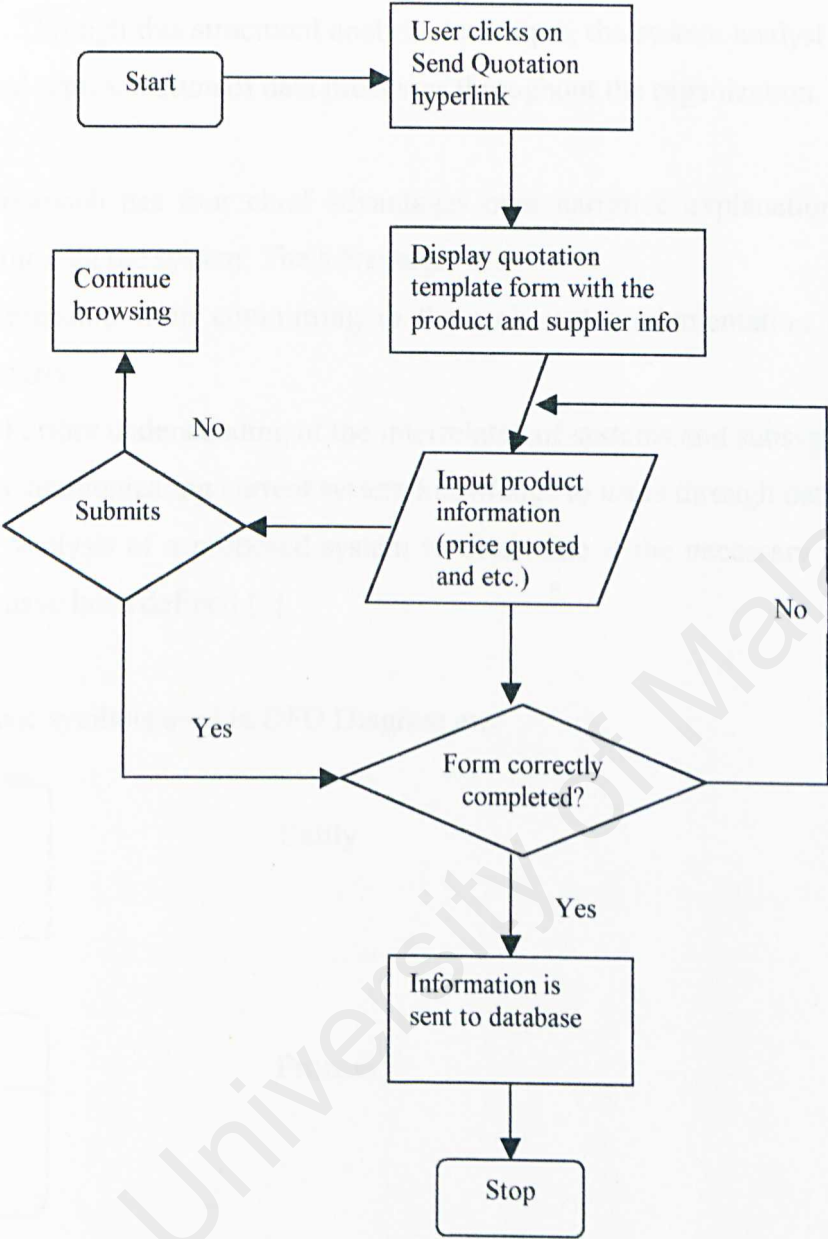
4.3 Data Flow Diagram

Data Flow Diagram, or known as DFD Diagram graphically characterize data processes and flows in a business system. It displays the system inputs, processes, and outputs of a system. Through this structured analysis technique, the system analyst can put together a graphical representation of data processes throughout the organization.

DFD approach has four chief advantages over narrative explanation of the way data moves through the system. The advantages are:

- Freedom from committing to the technical implementation of the system too early.
- Further understanding of the interrelated of systems and subsystems.
- Communicating current system knowledge to users through data flow diagrams.
- Analysis of a proposed system to determine if the necessary data and processes have been defined [5].

Four basic symbols used in DFD Diagram are:
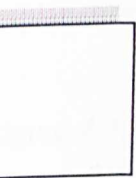
Entity
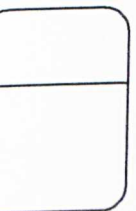
Process
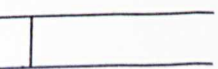
Data Store

Flow of Data

With a top-down approach to diagramming data movement, the diagram move from general to specific. For this system, I will include here four types of DFD diagram, from the Context Diagram, to a more specific Diagram 0 and Diagram 1 and finally the Child Diagram to explain in detail step by step the whole system including the inputs, outputs, processes, flow of data and the data store.

Entities for this system consist of Public, Developer and Supplier. This system provides five data stores, D1 LISTING FILE, D2 DREAM HOUSE FILE, D3 DEVELOPER FILE, D4 QUOTATION FILE and D5 SUPPLIER FILE.

Figure 4.27 in the following page displays the Context Diagram of Timecity portal. Context Diagram is an overview diagram for the system, including the basic inputs, general system and outputs.

Figure 4.28 displays the Diagram 0 of Timecity portal. Diagram 0 is the explosion of the Context Diagram. Figure 4.29 to Figure 4.32 show the Diagram 1 of the system, in detail explanation on the four modules itself in the system.

Figure 4.33 to Figure 4.39 display the Child Diagram of Diagram 1, explaining certain processes in Diagram 1 in more detail.

Figure 4.27: Context Diagram for Timecity Portal
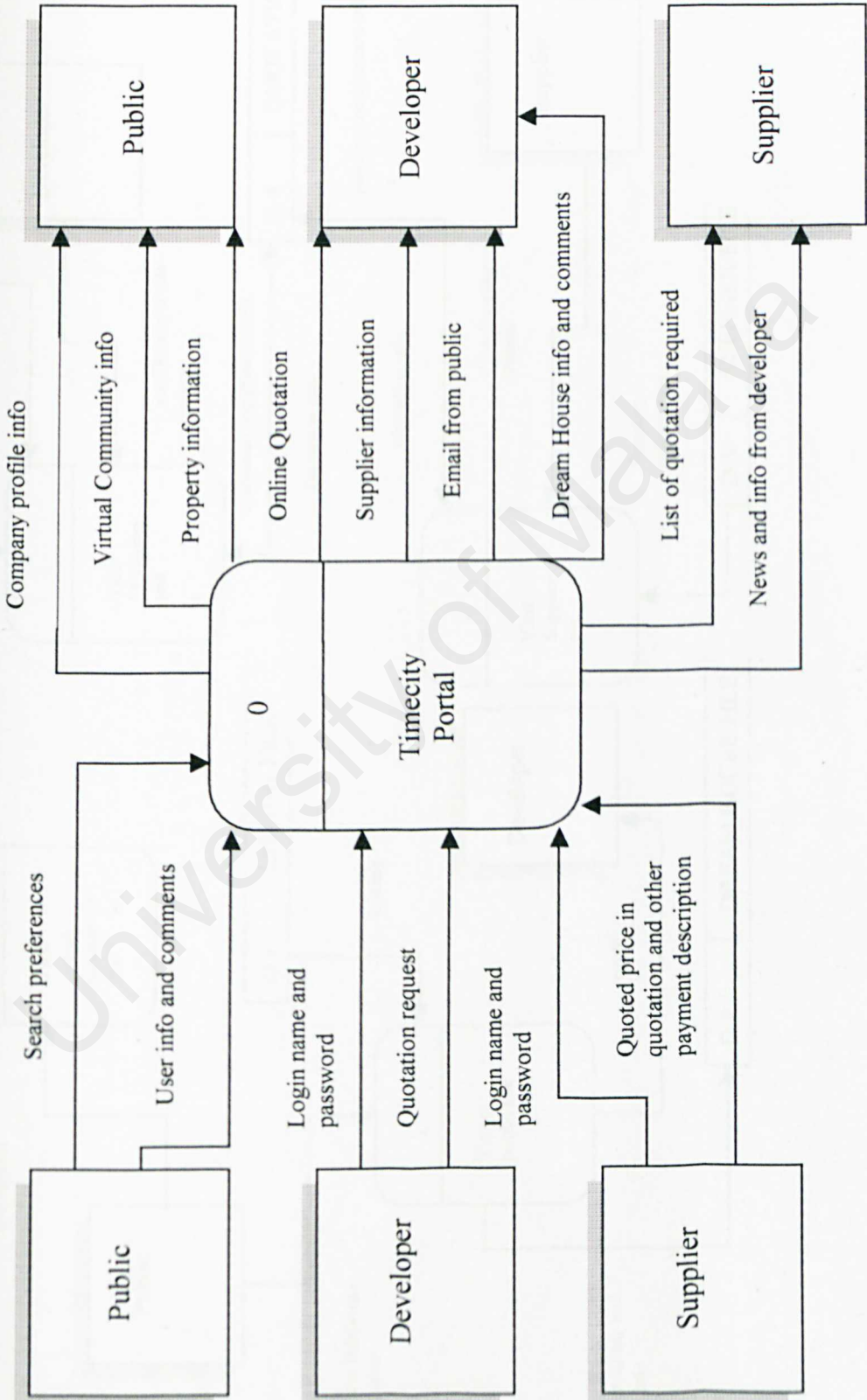
Figure 4.28: Diagram 0 for Timecity Portal
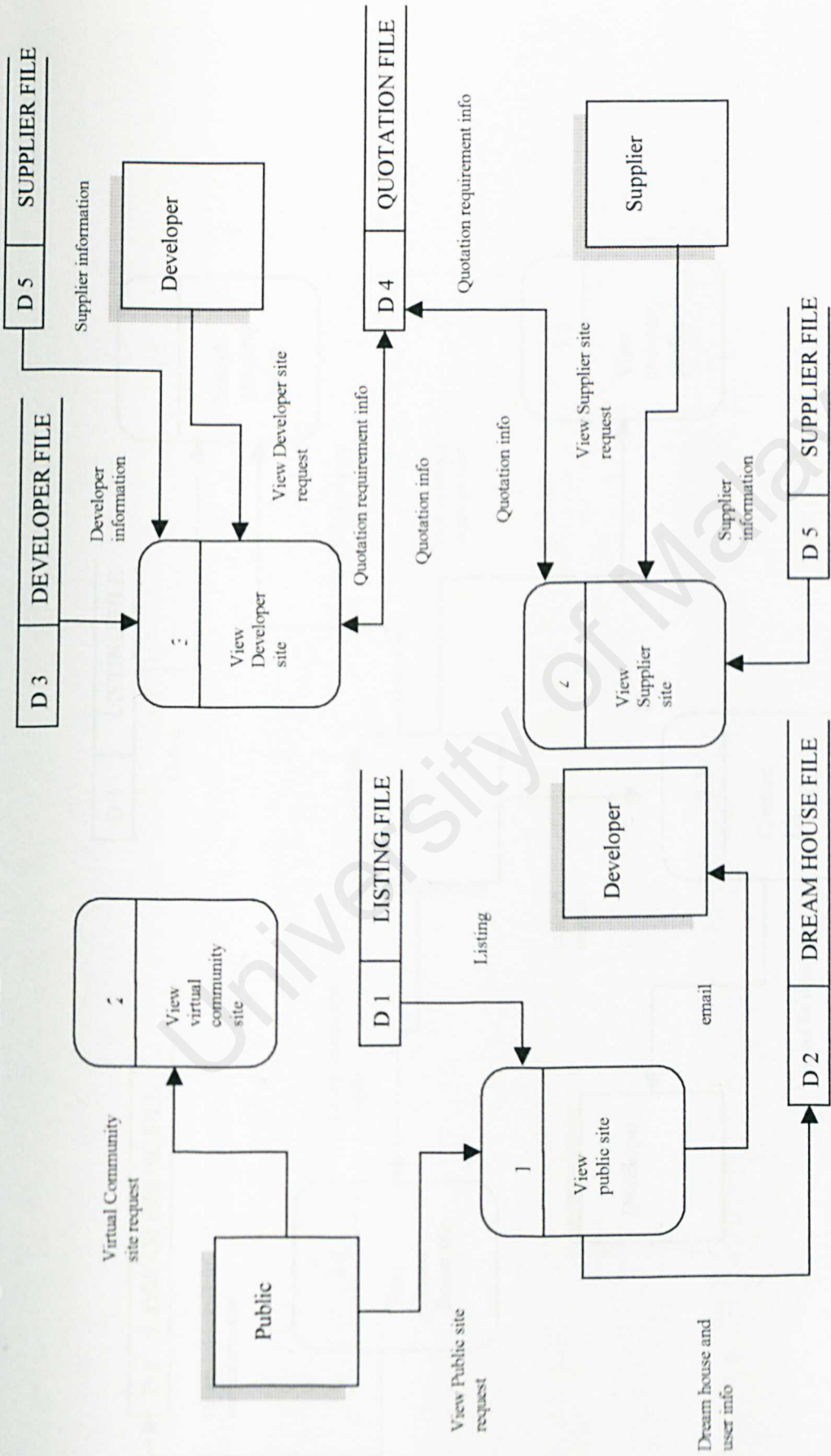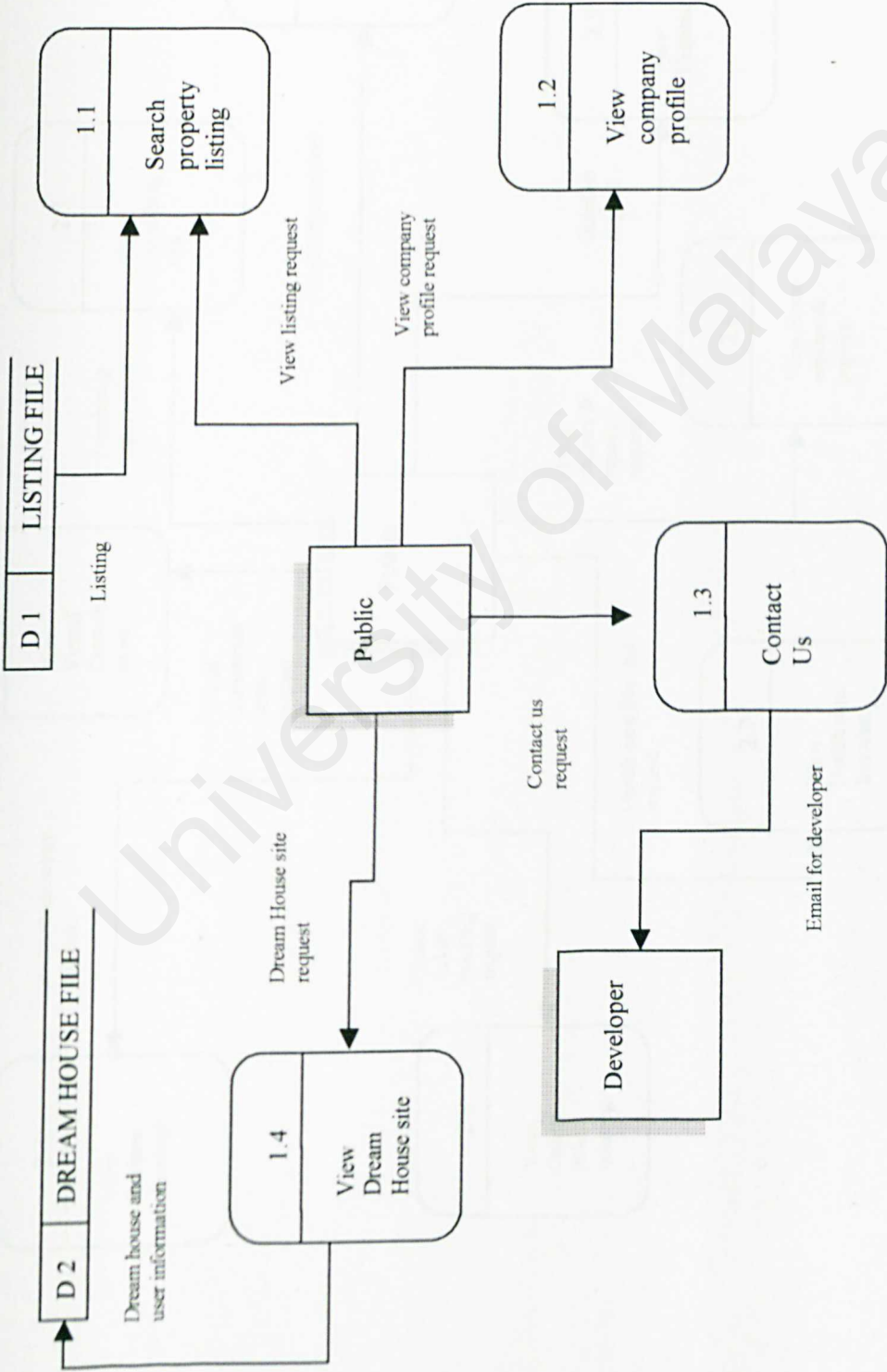
Figure 4.29: Diagram 1 for Process 1 Timecity Portal

Figure 4.30: Diagram 1 for Process 2 Timecity Portal
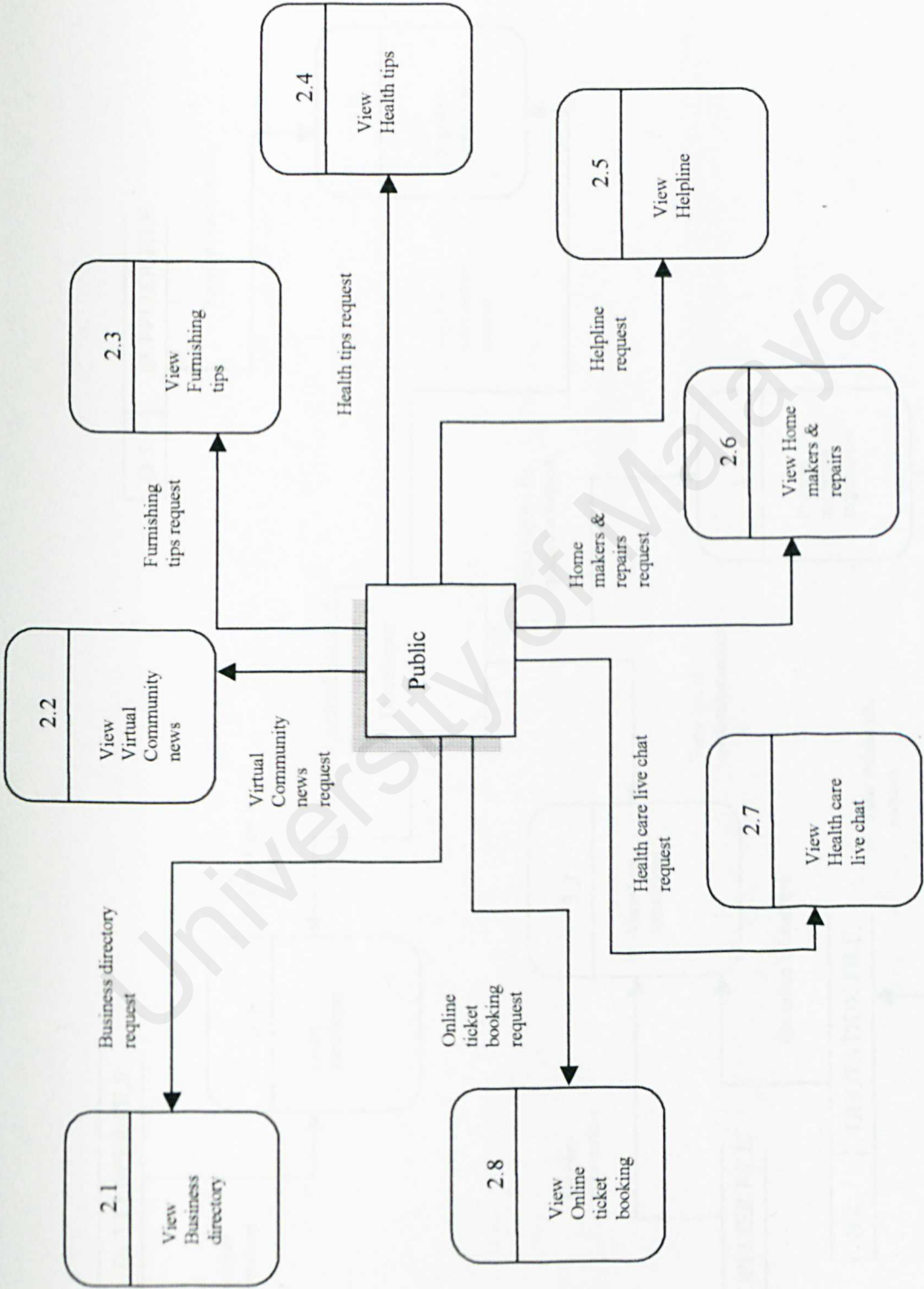
Figure 4.31: Diagram 1 for Process 3 Timecity Portal
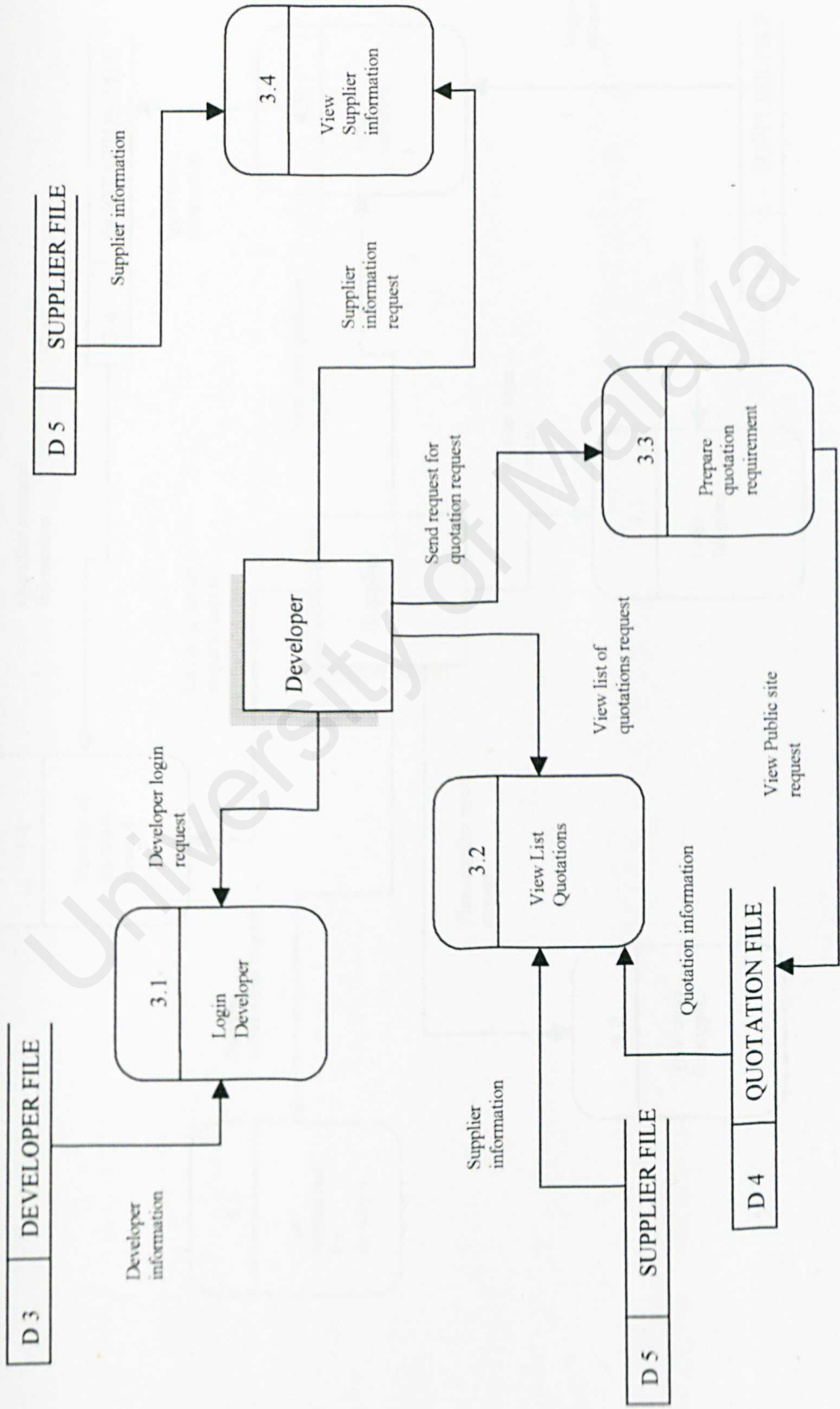
Figure 4.32: Diagram 1 for Process 4 Timecity Portal
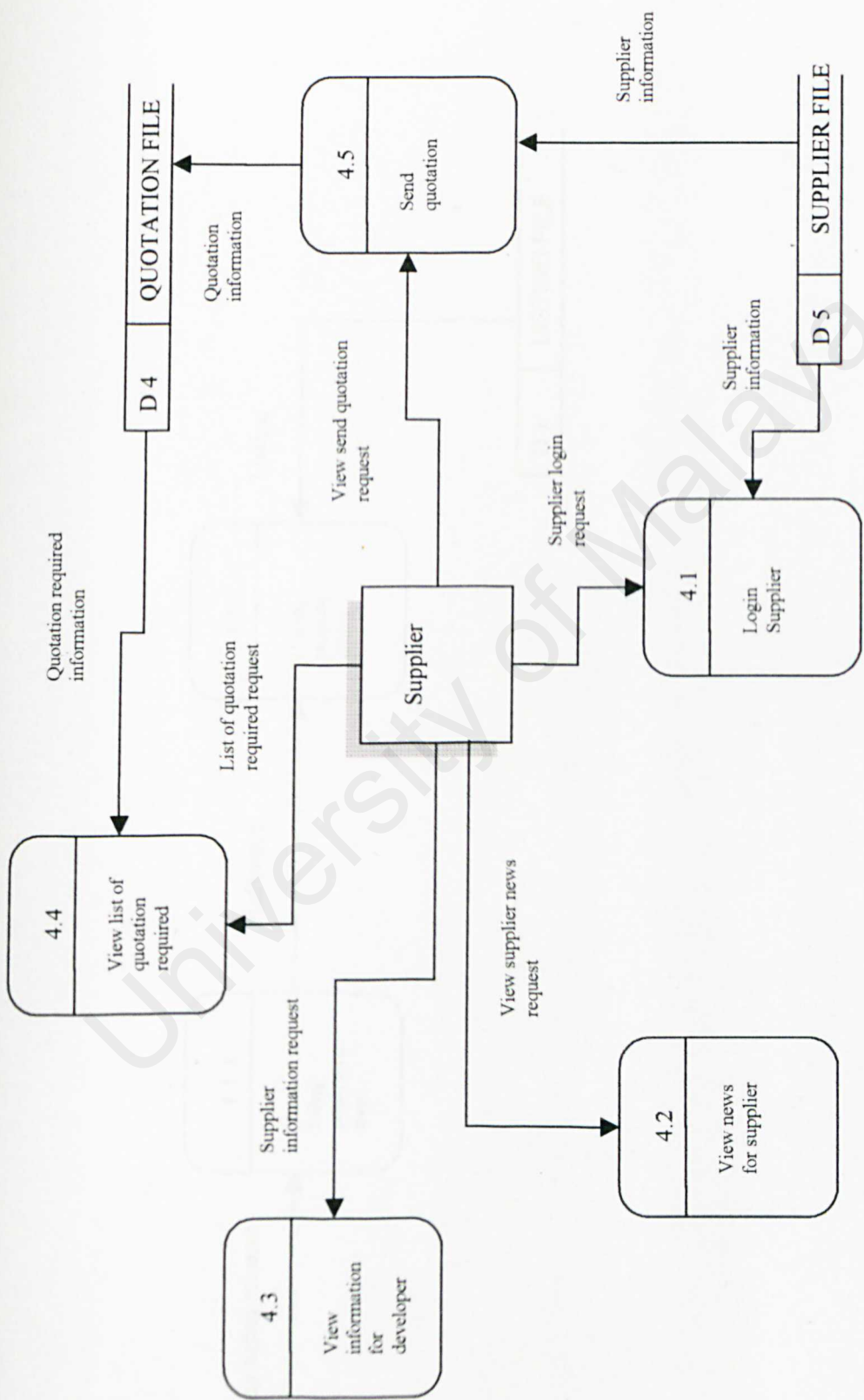
Figure 4.33: Child Diagram for Process 1.1 Timecity Portal
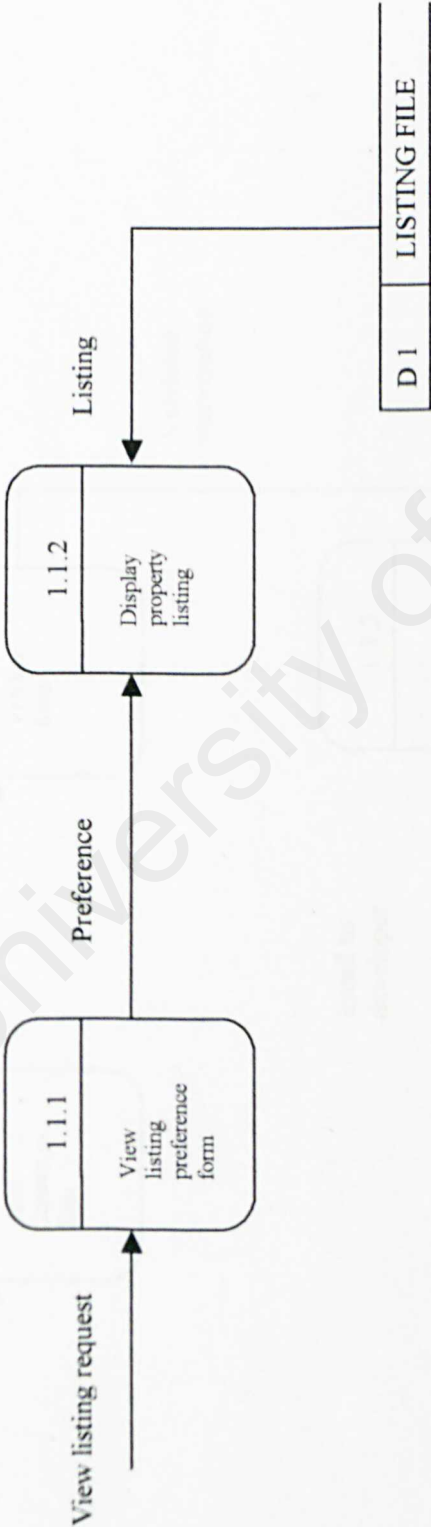
Figure 4.34: Child Diagram for Process 1.3 Timecity Portal
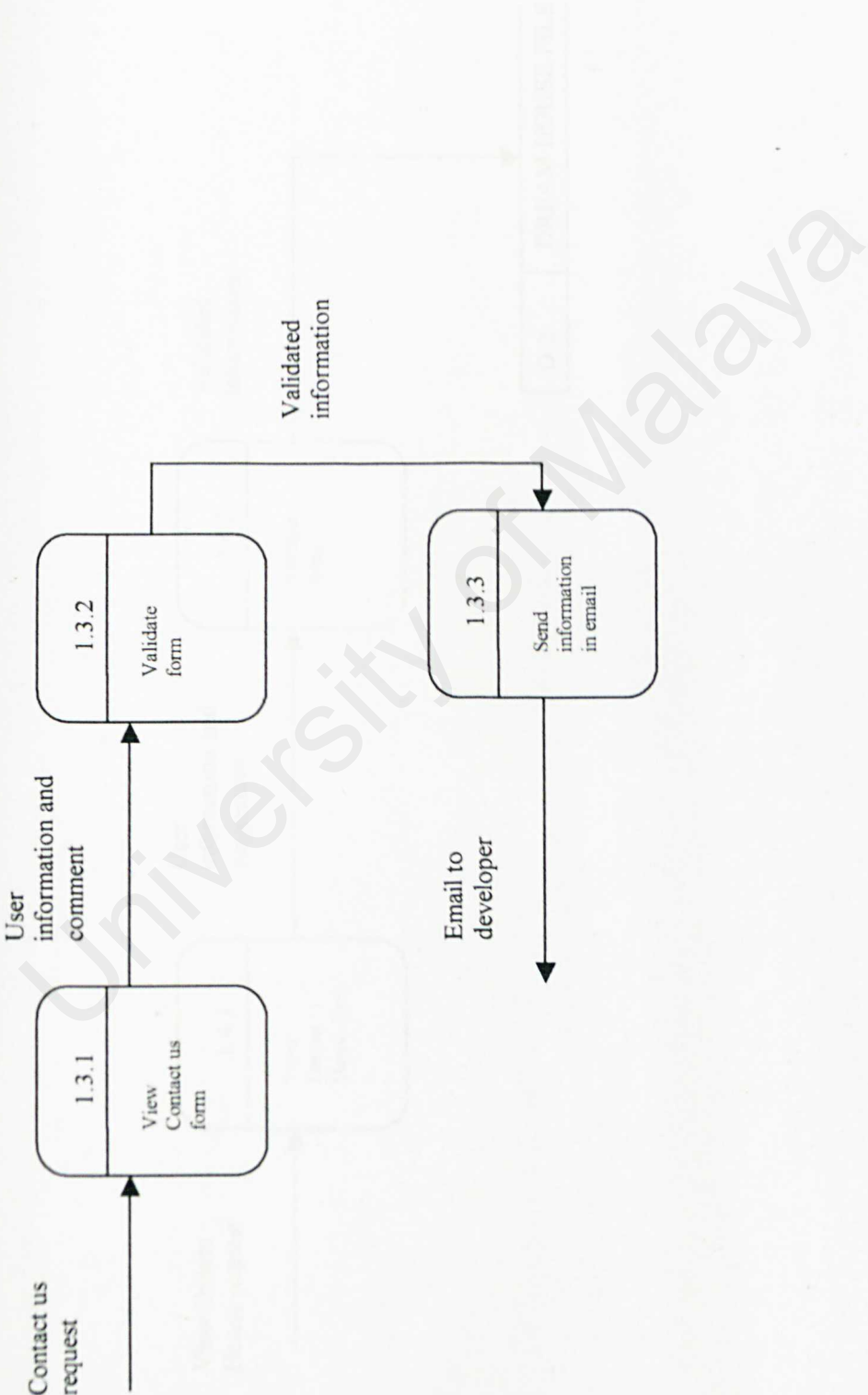
Figure 4.35: Child Diagram for Process 1.4 Timecity Portal
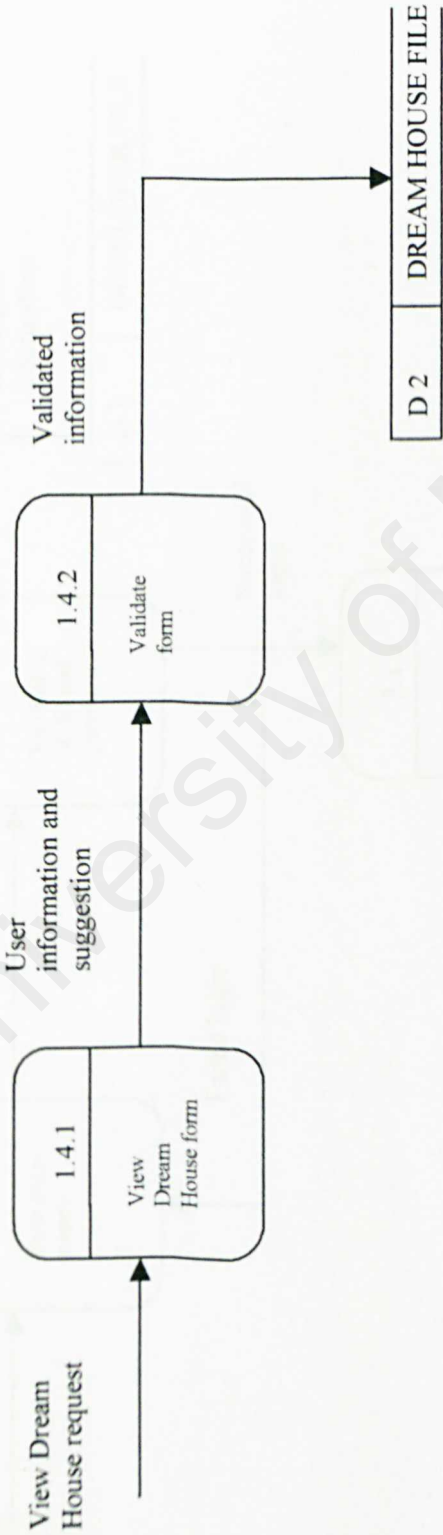
Figure 4.36: Child Diagram for Process 3.1 Timecity Portal
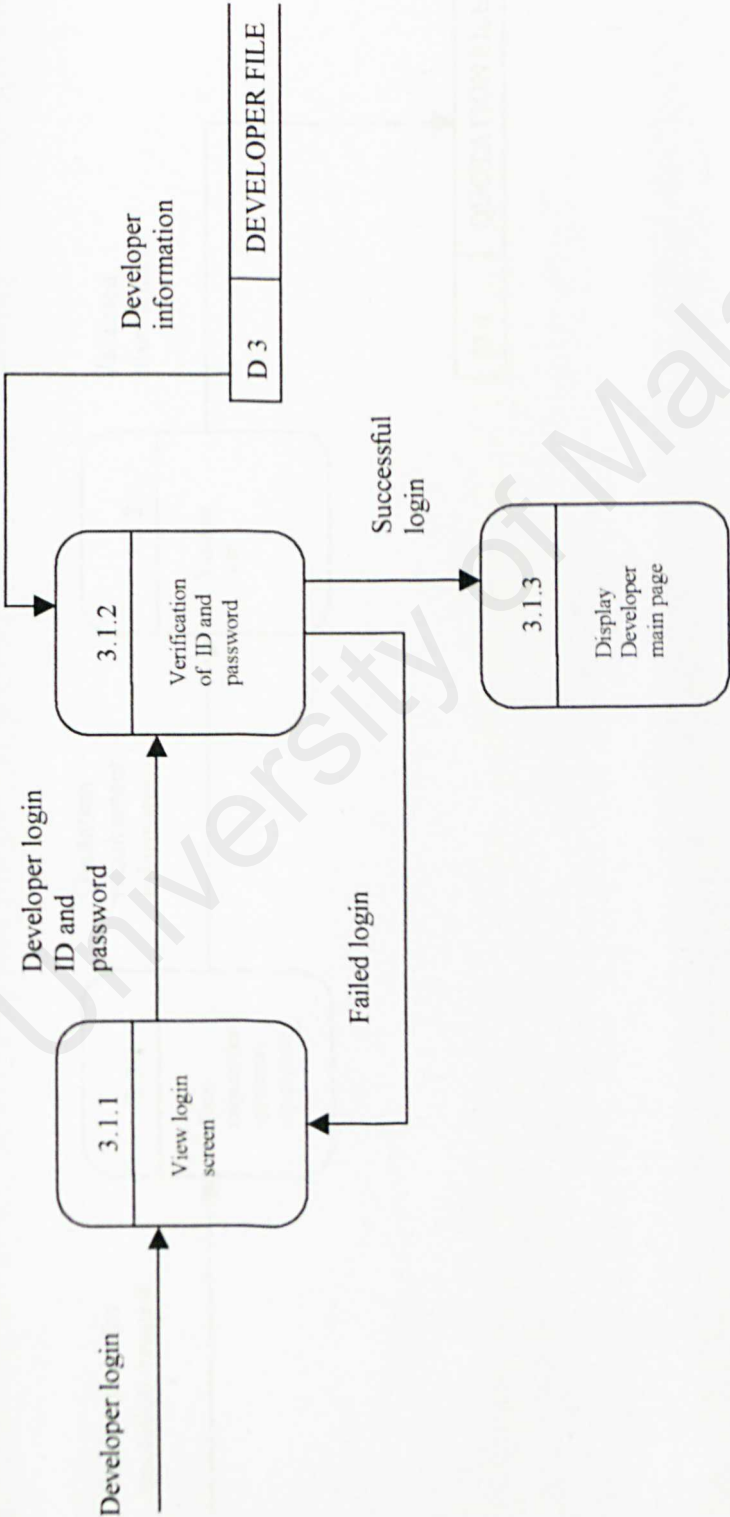
Figure 4.37: Child Diagram for Process 3.3 Timecity Portal
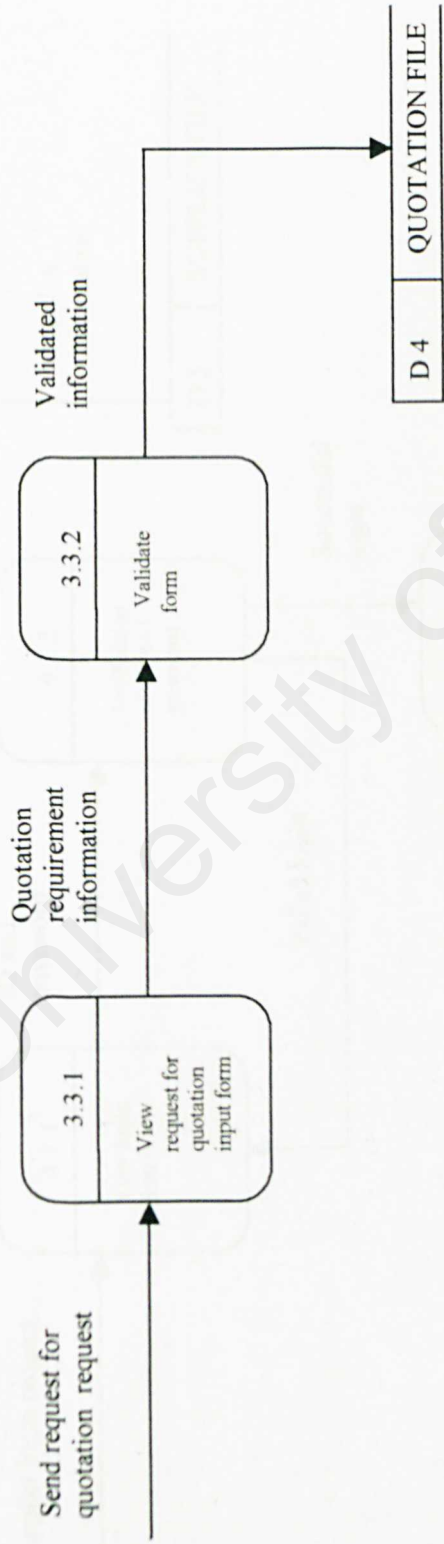
Figure 4.38: Child Diagram for Process 4.1 Timecity Portal
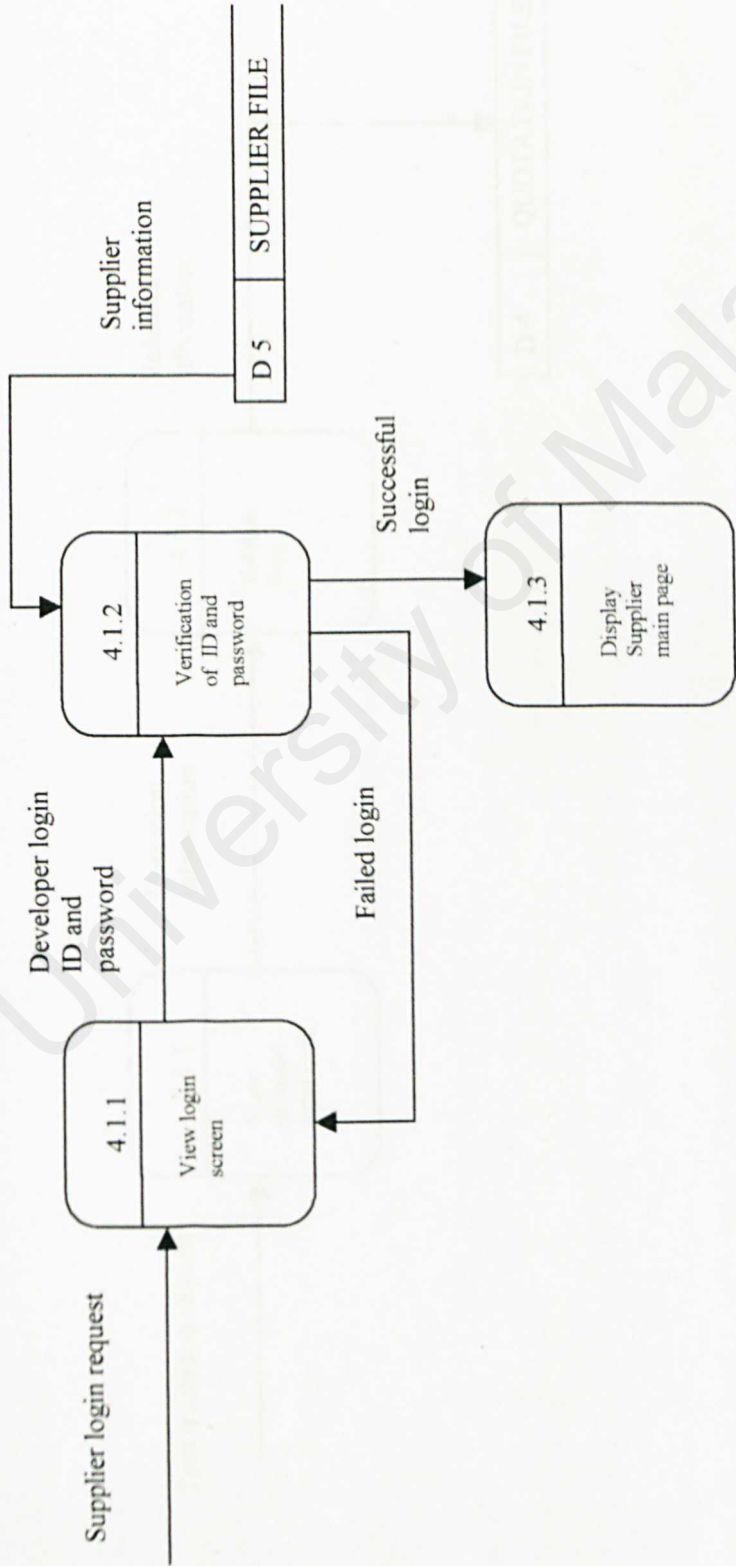
Figure 4.39: Child Diagram for Process 4.5 Timecity Portal
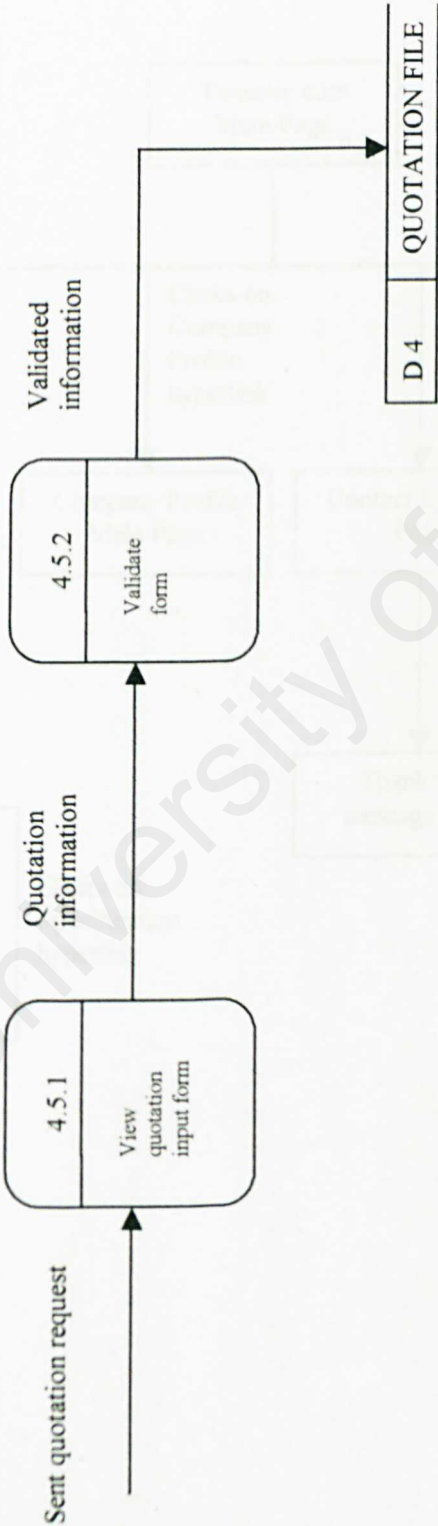
4.4 Page Flowcharts

Page flowcharts display the flow of pages in Timecity portal after every action done by the users of this system. Figure 4.40 to Figure 4.43 present the page flow charts of every module in Timecity portal.

Figure 4.40: Page Flowchart for Public Module
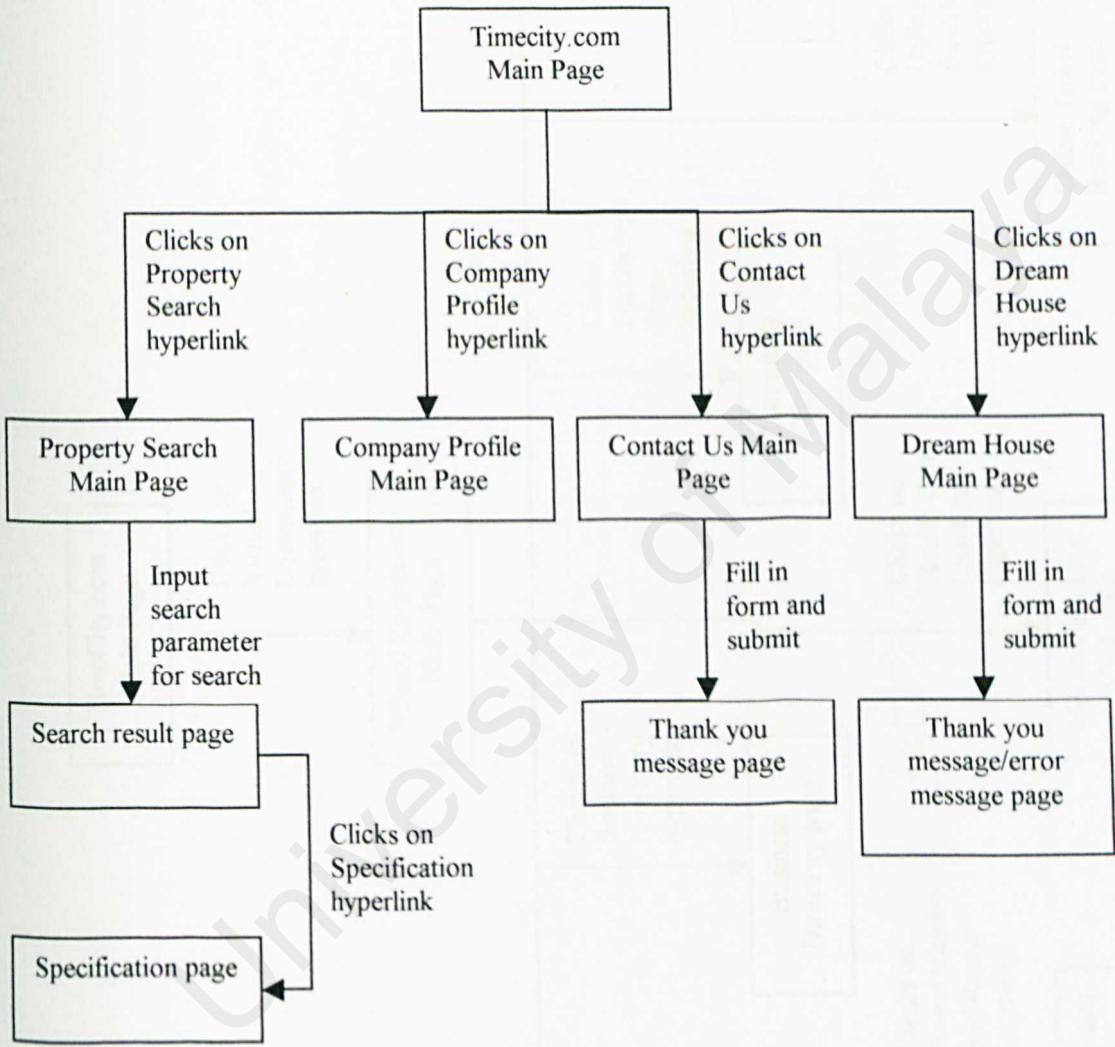
Figure 4.41: Page Flowchart for Virtual Community Module
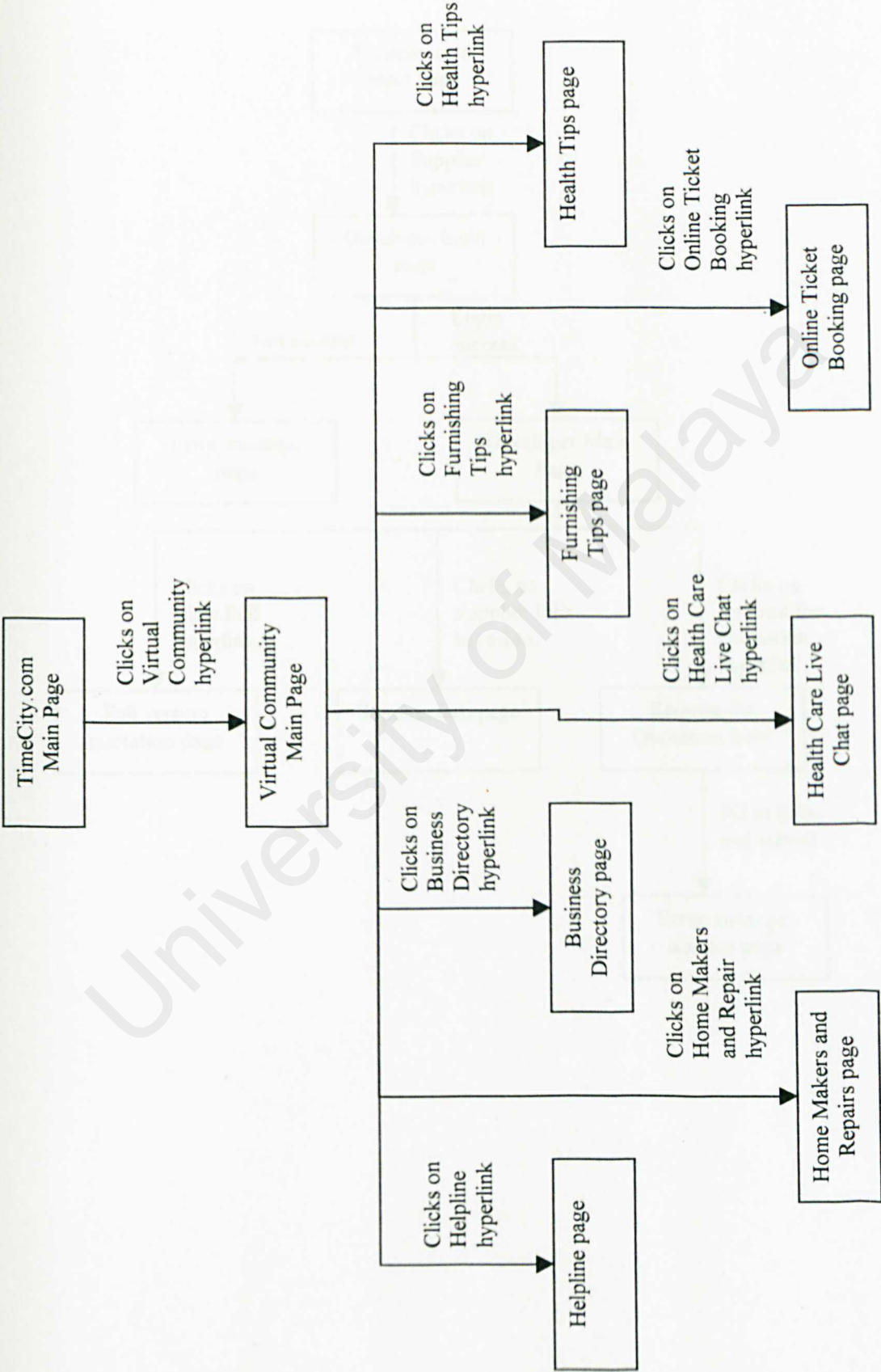
Figure 4.42: Page Flowchart for Developer Module
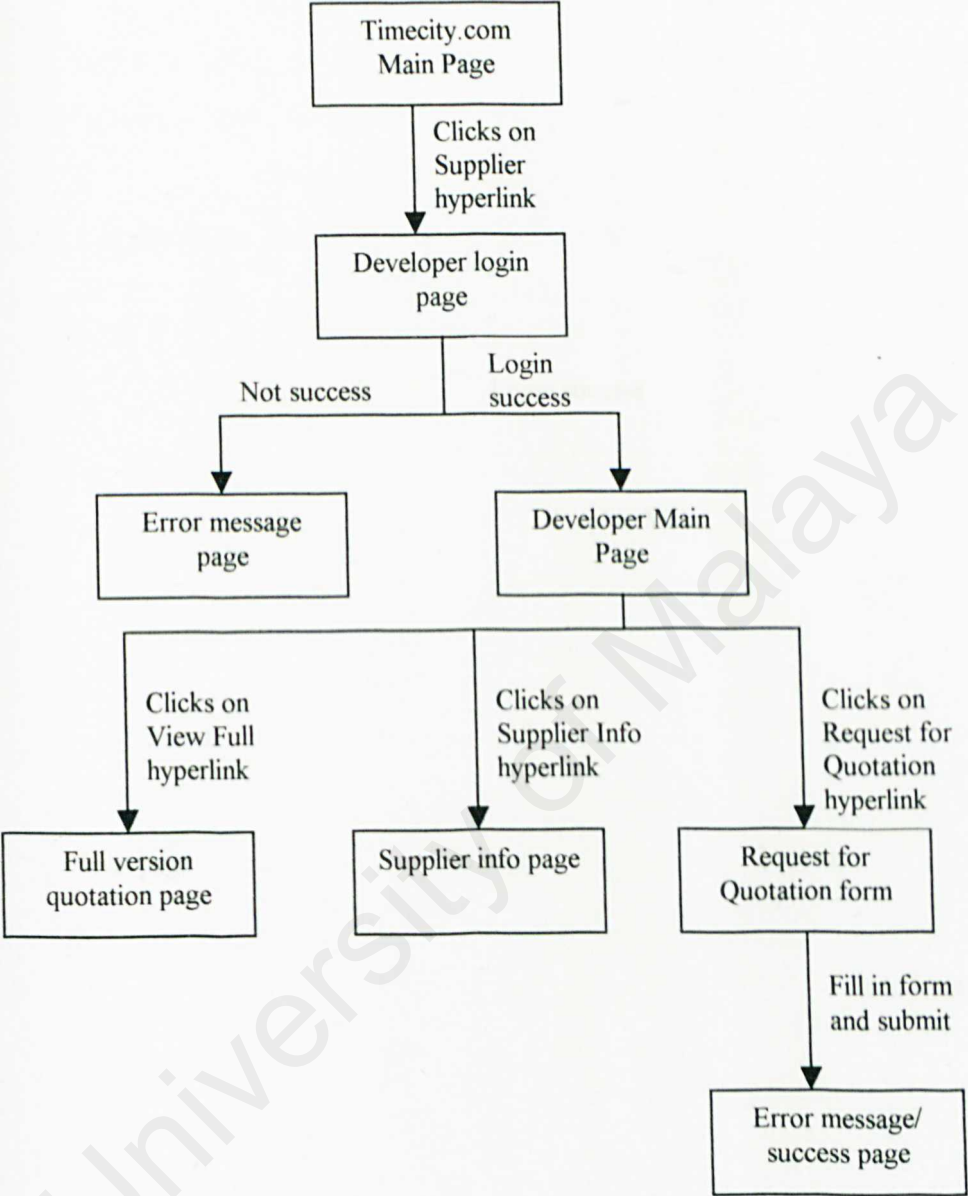
Figure 4.43: Page Flowchart for Supplier Module

```
              ┌──────────────────┐
              │   Timecity.com   │
              │    Main Page     │
              └──────────────────┘
                        │ Clicks on
                        │ Supplier
                        │ hyperlink
                        ▼
              ┌──────────────────┐
              │  Supplier login  │
              │       page       │
              └──────────────────┘
           Not success │    │ Login success
          ┌─────────────┘    └──────────────┐
          ▼                                 ▼
  ┌────────────────┐              ┌────────────────┐
  │  Error message │              │  Supplier Main │
  │      page      │              │      Page      │
  └────────────────┘              └────────────────┘
               │                  │                  │
      Clicks on │         Clicks on │         Clicks on │
      News      │         Info      │         Send      │
      hyperlink │         hyperlink │         Quotation │
                │                  │         hyperlink │
                ▼                  ▼                  ▼
       ┌──────────────┐   ┌──────────────┐   ┌──────────────┐
       │  News page   │   │  Info page   │   │  Quotation   │
       │              │   │              │   │ Template form│
       └──────────────┘   └──────────────┘   └──────────────┘
                                                     │ Fills in form
                                                     │ and submit
                                                     ▼
                                            ┌──────────────┐
                                            │ Error message/│
                                            │ success page │
                                            └──────────────┘
```
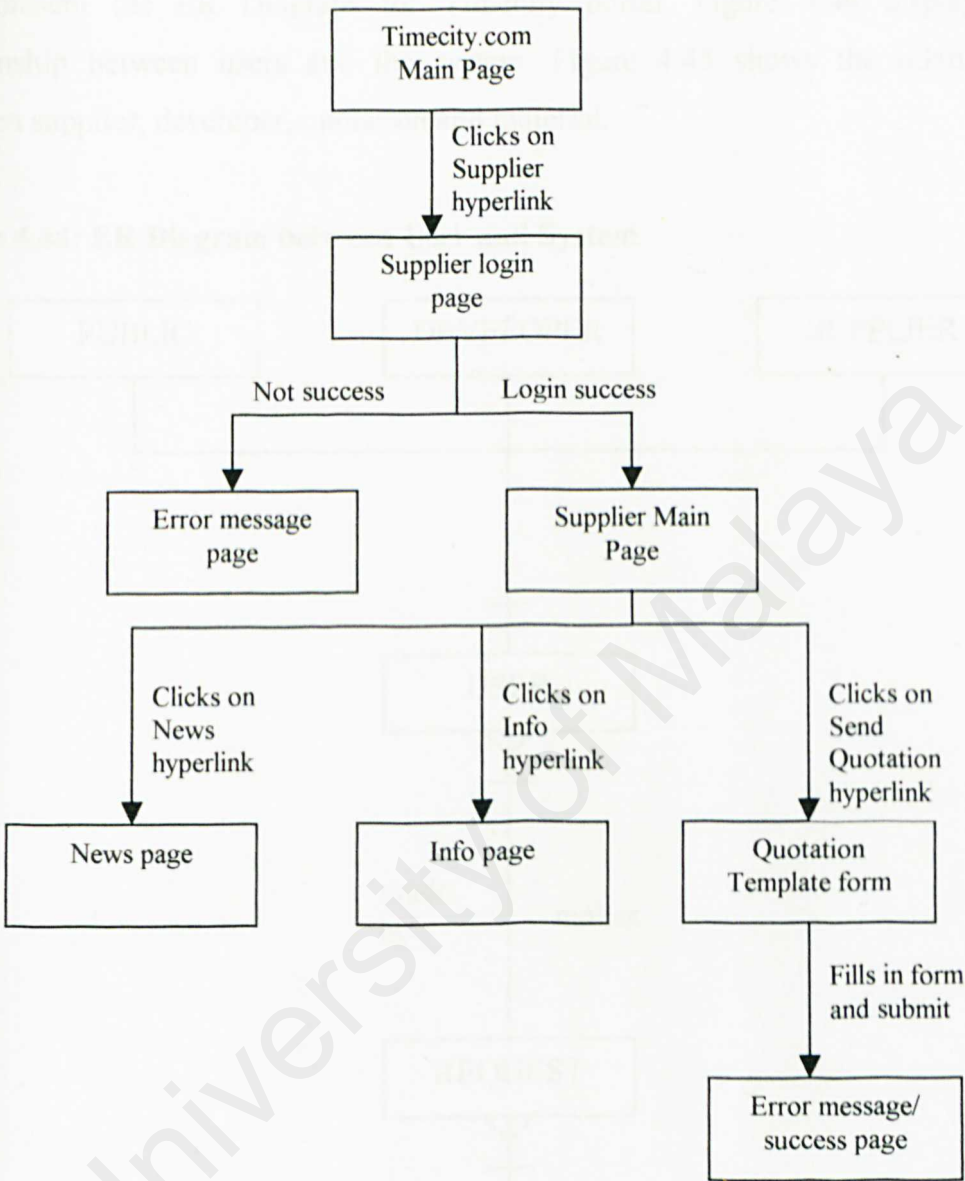
4.5 ER Diagrams

Entity Relationship Diagram, or known as ER Diagram, define proper system boundaries and describe the interaction among the entities [5]. Figure 4.44 and Figure 4.45 present the ER Diagram for Timecity portal. Figure 4.44 displays the relationship between users and the system. Figure 4.45 shows the relationship between supplier, developer, quotation and material.

Figure 4.44: ER Diagram between User and System

4.6 Data Dictionary

Data dictionary holds the list or inventory of all the data tables. It describes the type of data that is being stored, allows the control to complexity of the data, and helps the system developer and users find the data they need[?]

Table 4.2 presents the data dictionary for product table. This data dictionary holds the definitions or terms required in project, listed in Tumenta's panel. Table 4.3 displays the data dictionary for development table. This table includes type of data about the development information such as dataset name information. Table 4.3 shows the data dictionary for user requirement, where it stores type of data related to contact the operation. Table 4.4 displays the data dictionary for quotation table. This table holds all the data about product and quotation. Lastly, Table 4.5 present the data dictionary for supplier table. Here it stores all data about the supplier.

Figure 4.45: ER Diagram between Developer, Supplier, Quotation and Product
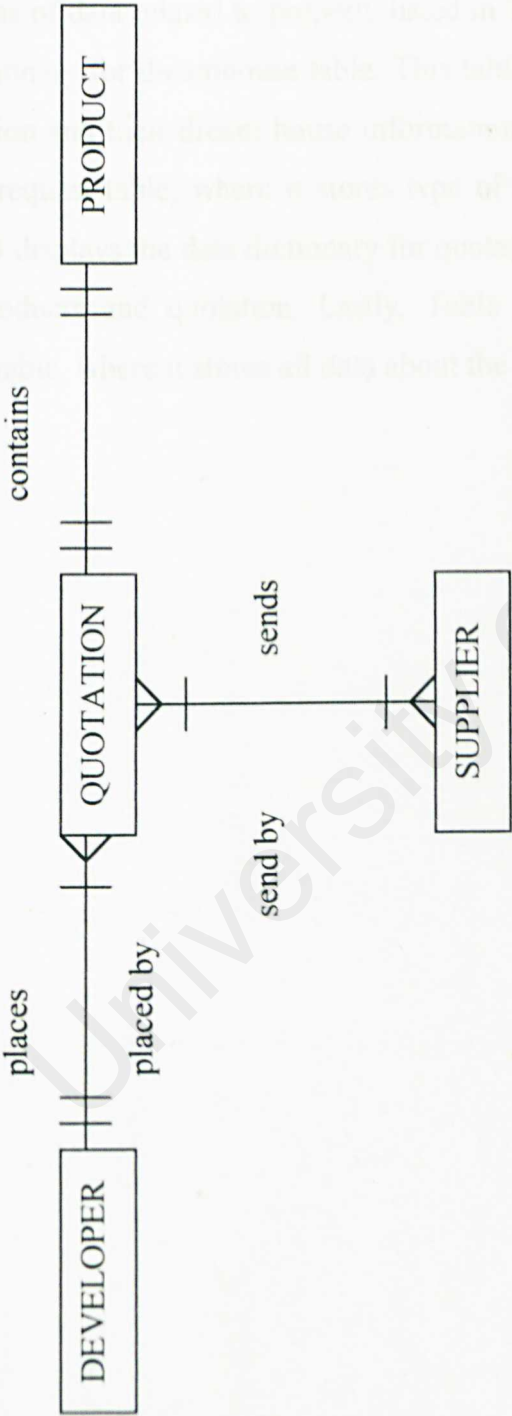
4.6 Data Dictionary

Data dictionary holds the definitions of all the data tables. It describes the type of data that is being stored, allows the DBMS to keep track of the data, and helps the system developer and users find the data they need [5].

Table 4.1 presents the data dictionary for product table. This data dictionary holds the definitions of data related to property listed in Timecity portal. Table 4.2 displays the data dictionary for dreamhouse table. This table includes type of data about the user information and their dream house information. Table 4.3 shows the data dictionary for quo_request table, where it stores type of data related to request for quotation. Table 4.4 displays the data dictionary for quotation table. This table holds all the data about products and quotation. Lastly, Table 4.5 presents the data dictionary for supplier table, where it stores all data about the suppliers.

Table 4.1: Data Dictionary for Product Table

Field	Field Type	Field Width	Description
ProductName	nvarchar	40	The name of the building product
ProductManufacturer	nvarchar	40	Building product manufacturer name
ProductDescription	nvarchar	100	Simple description about the product
ProductUnit	nvarchar	40	Product Unit
QuantityPerUnit	nvarchar	20	Quantity of the product per unit

Table 4.2: Data Dictionary for Dream House Table

Field	Field Type	Field Width	Description
txt_name	nvarchar	50	User name
txt_email	nvarchar	50	User email
txt_add1	nvarchar	50	User address
txt_add2	nvarchar	50	User address
txt_age	nvarchar	24	User age
opt_race	nvarchar	24	User race
opt_gender	nvarchar	24	User gender
opt_marital	nvarchar	24	User marital status
opt_children	nvarchar	24	User number of children
txt_ocu	nvarchar	50	User occupation
txt_comp	nvarchar	50	User company name
opt_income	nvarchar	30	User income per month
opt_interest	nvarchar	30	Type of dream house
opt_budget	nvarchar	30	User budget for dream house
stxt_comment	nvarchar	300	User comment

Table 4.3: Data Dictionary for Quo_request Table

Field	Field Type	Field Width	Description
RequestID	int	4	Request ID
RequestDate	datetime	8	Request date
ProductName	nvarchar	50	The name of the requested product
Quantity	nvarchar	30	The total quantity requested
ReplyBeforeDate	nvarchar	50	The reply before date
ProjectName	nvarchar	40	The name of the project

Table 4.4: Data Dictionary for Quotation Table

Field	Field Type	Field Width	Description
QuotationID	int	4	ID for quotation
Price	money	8	Product price stated in quotation
Quantity	nvarchar	20	Product Quantity
Discount	nvarchar	24	Discount stated in quotation
Deliver	nvarchar	24	Price including deliver or undeliver
Currency	nvarchar	24	Type of currency use in quotation
CurrencyRate	nvarchar	24	Currency rate
Remark	nvarchar	300	Remark supplier want to add in quotation
RequestID	int	4	Request ID
SupplierName	nvarchar	50	Supplier name
QuotationDate	datetime	8	Quotation date
ProductName	nvarchar	40	Product Name

Table 4.5: Data Dictionary for Supplier Table

Field	Field Type	Field Width	Description
SupplierID	int	4	Supplier ID
CompanyName	nvarchar	40	Company Name
ContactName	nvarchar	30	Contact person name
ContactTitle	nvarchar	30	Contact person title
Address	nvarchar	60	Company address
Postcode	nvarchar	24	Address postcode
City	nvarchar	24	Address city
State	nvarchar	30	Address state
Country	nvarchar	30	Country
Phone	nvarchar	24	Company phone number
Fax	nvarchar	24	Company fax number
Homepage	nvarchar	50	Company homepage
LoginName	nvarchar	30	Supplier login name
Password	nvarchar	30	Supplier login password
CompanyNo	nvarchar	50	Company registered number
DateRegistered	datetime	8	Date supplier registered

4.7 User Interface Design

The interface is the system for most users. However well or poorly designed, it stands as the representation of the system. My goal in designing the user interface for Timecity portal is to design interfaces that help users and businesses get the information they need in and out of the system by addressing the following objectives:

1. Effectiveness as achieved through the design of interfaces that allow users to access the system in a way that is congruent with their individual needs.
2. Efficiency as demonstrated through interfaces that both increase the speed of data entry and reduce errors.
3. User consideration as demonstrated in the design of suitable interfaces and by providing appropriate feedback to users from the system.
4. Productivity as measured by ergonomically sound principles of design for user interfaces and workspaces [5].

For Timecity portal, I have developed the user interface design using Microsoft Front Page to demonstrate to user the basic user interface design version 2.0 for the main page and some important pages in Timecity portal so that user will have the sense and feel how the portal will look liked.

For the design, I emphasize on four main concept, which are formal, simple, attractive and user friendly. Formal because it is a business portal and it represented the image of the housing estate company. So it should develop using the official color of Timecity which is green and gold color. Attractive meaning to attract the main users of the portal, the customer and simple meaning the portal only adds features and functions that will add value to users and related information only in this portal to prevent users getting confused with the features provided by the portal. User friendly portal meaning that, without further instruction and guideline, the users know how to use the portal.

Figure 4.44 shows the user interface design for Timecity main page. Figure 4.45 shows the user interface design for the login page. Figure 4.46 displays the user interface for

Virtual Community main page. Figure 4.47 shows the user interface design for Developer main page. Figure 4.48 demonstrates the user interface design for Supplier main page.

Figure 4.44: User Interface Design for Timecity Main page
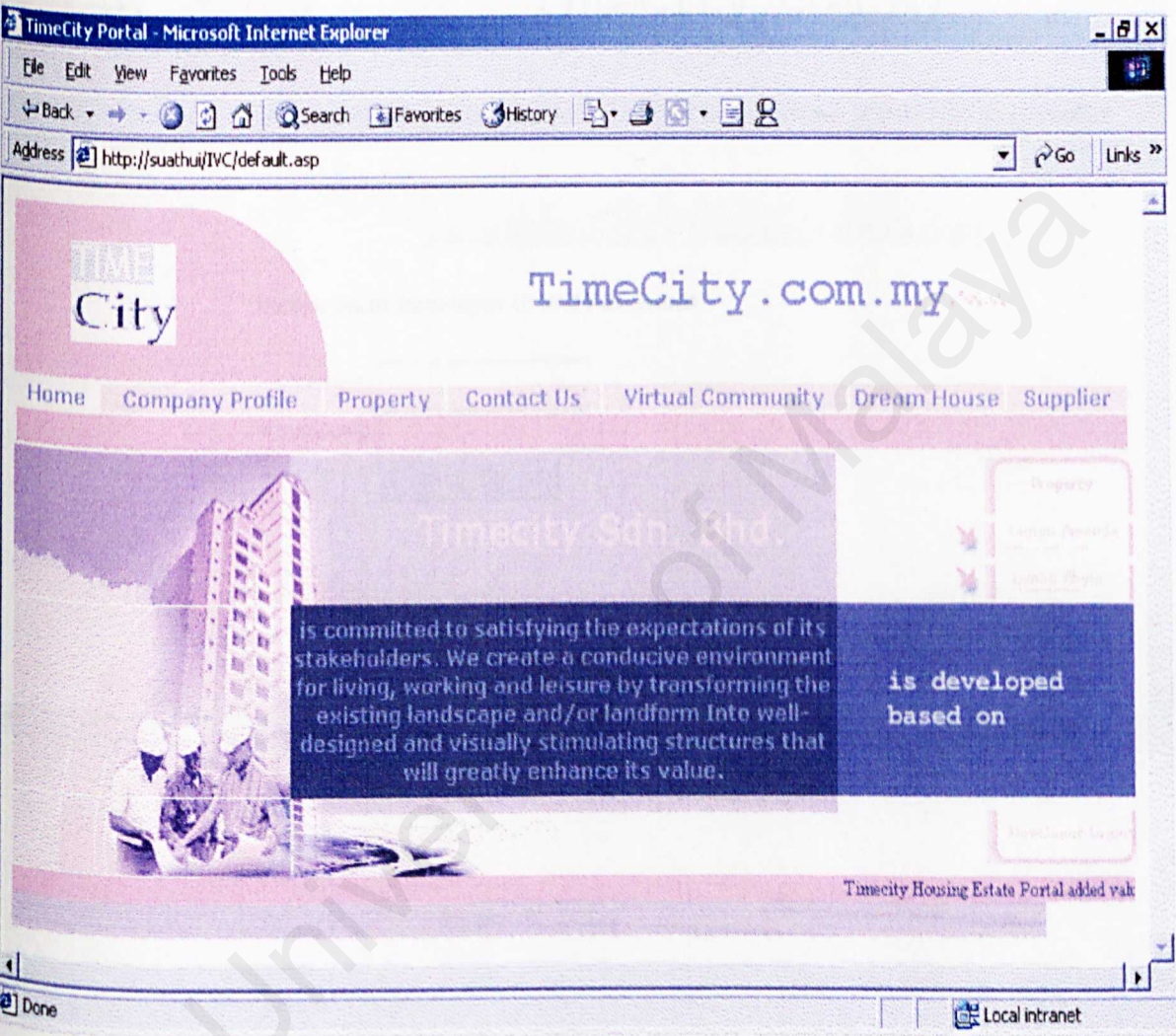
Figure 4.45: User Interface Design for Timecity Login page
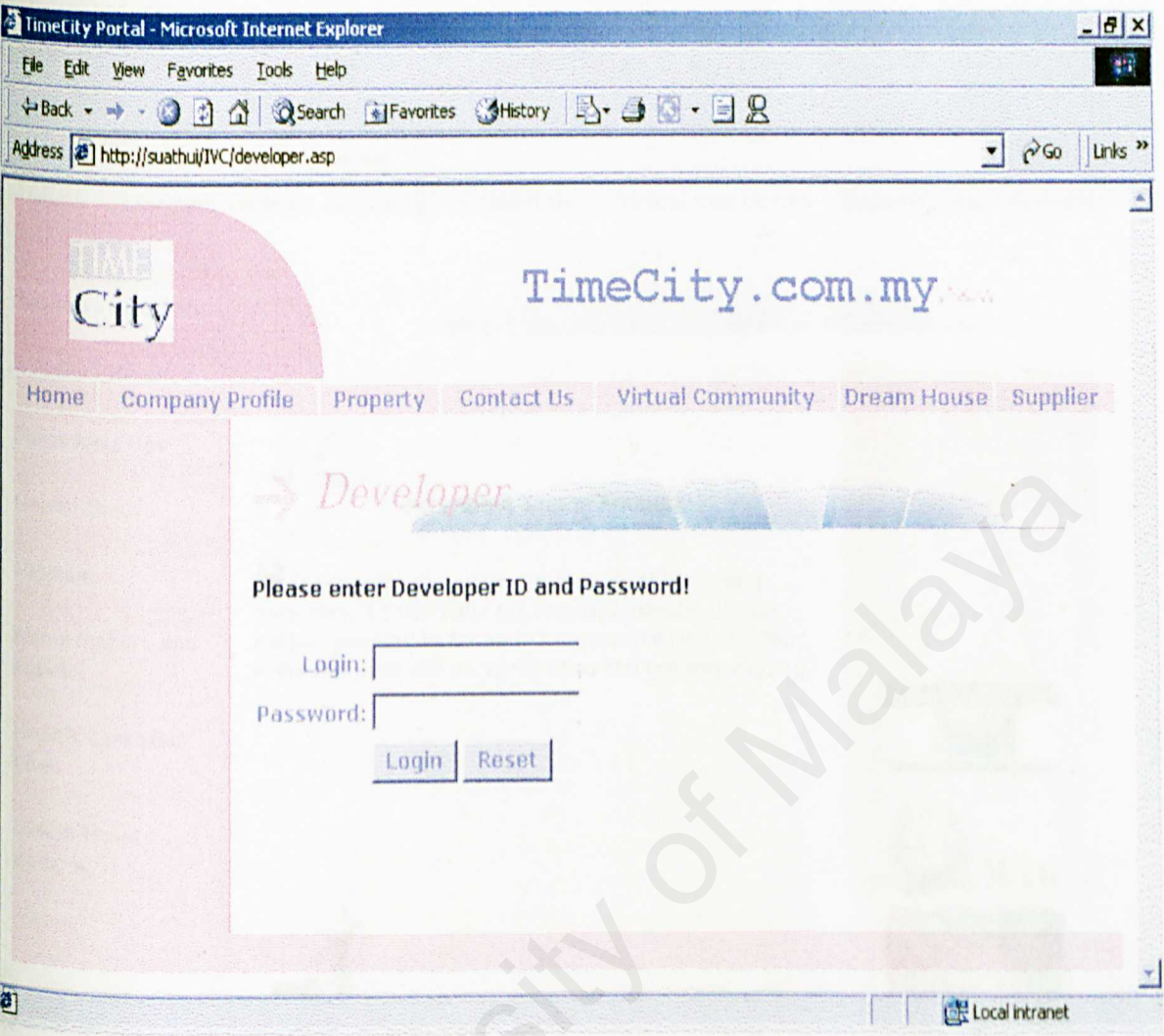
Figure 4.46: User Interface Design for Timecity Virtual Community Main page
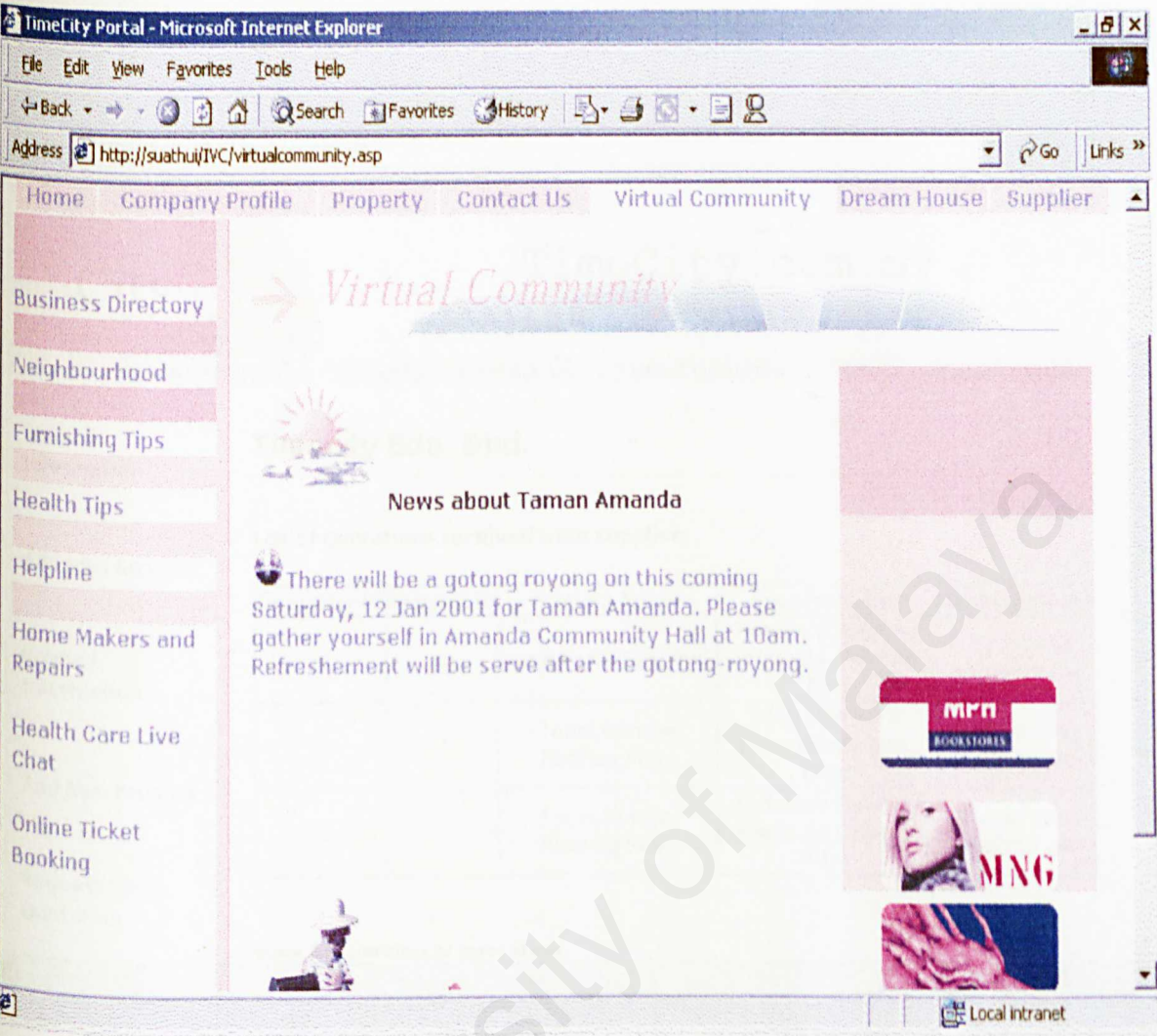
Figure 4.47: User Interface Design v2.0 for Timecity Developer Main page
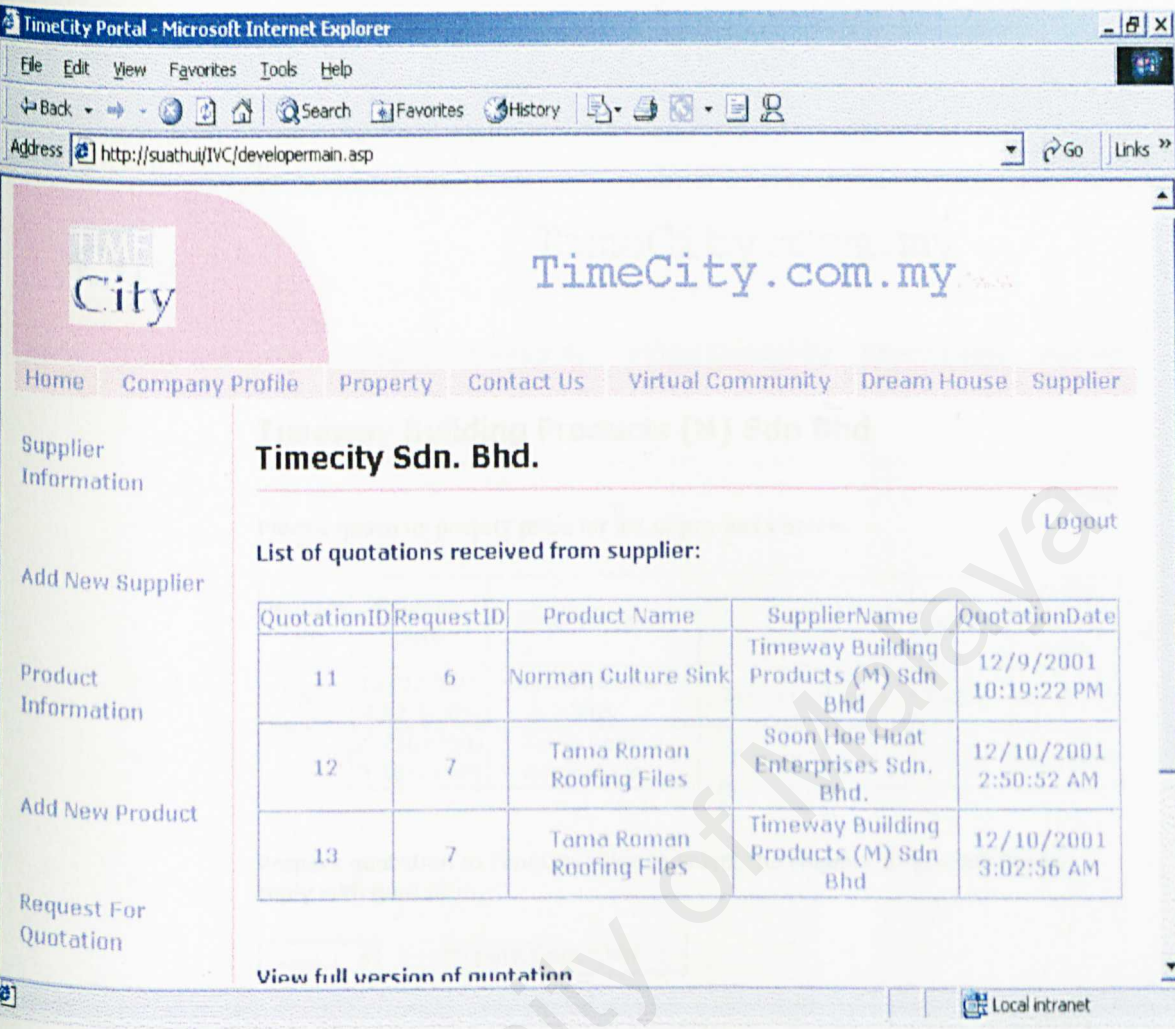
Figure 4.48: User Interface Design for Timecity Supplier Main page
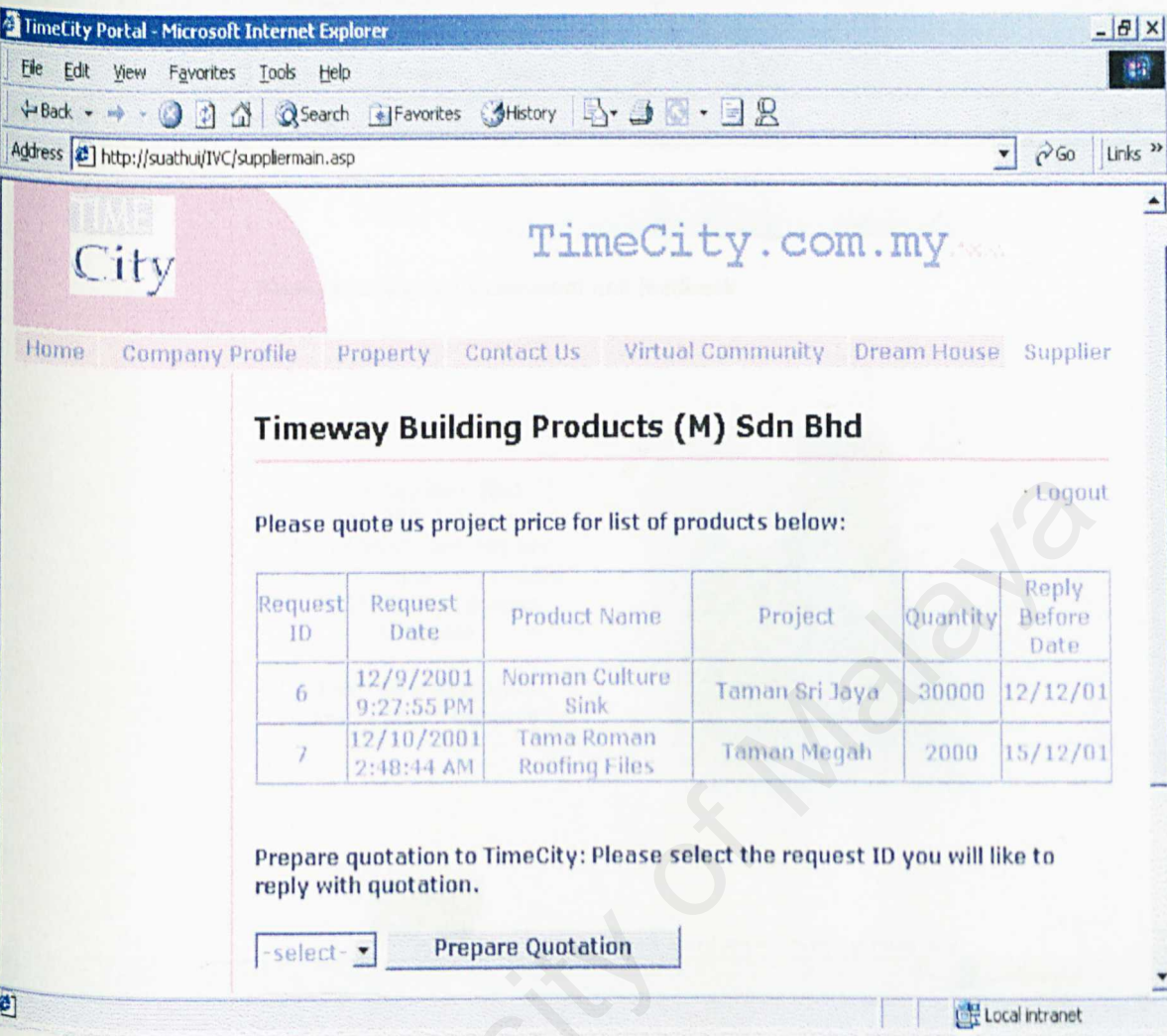
Figure 4.49: User Interface Design for Timecity Contact Us page
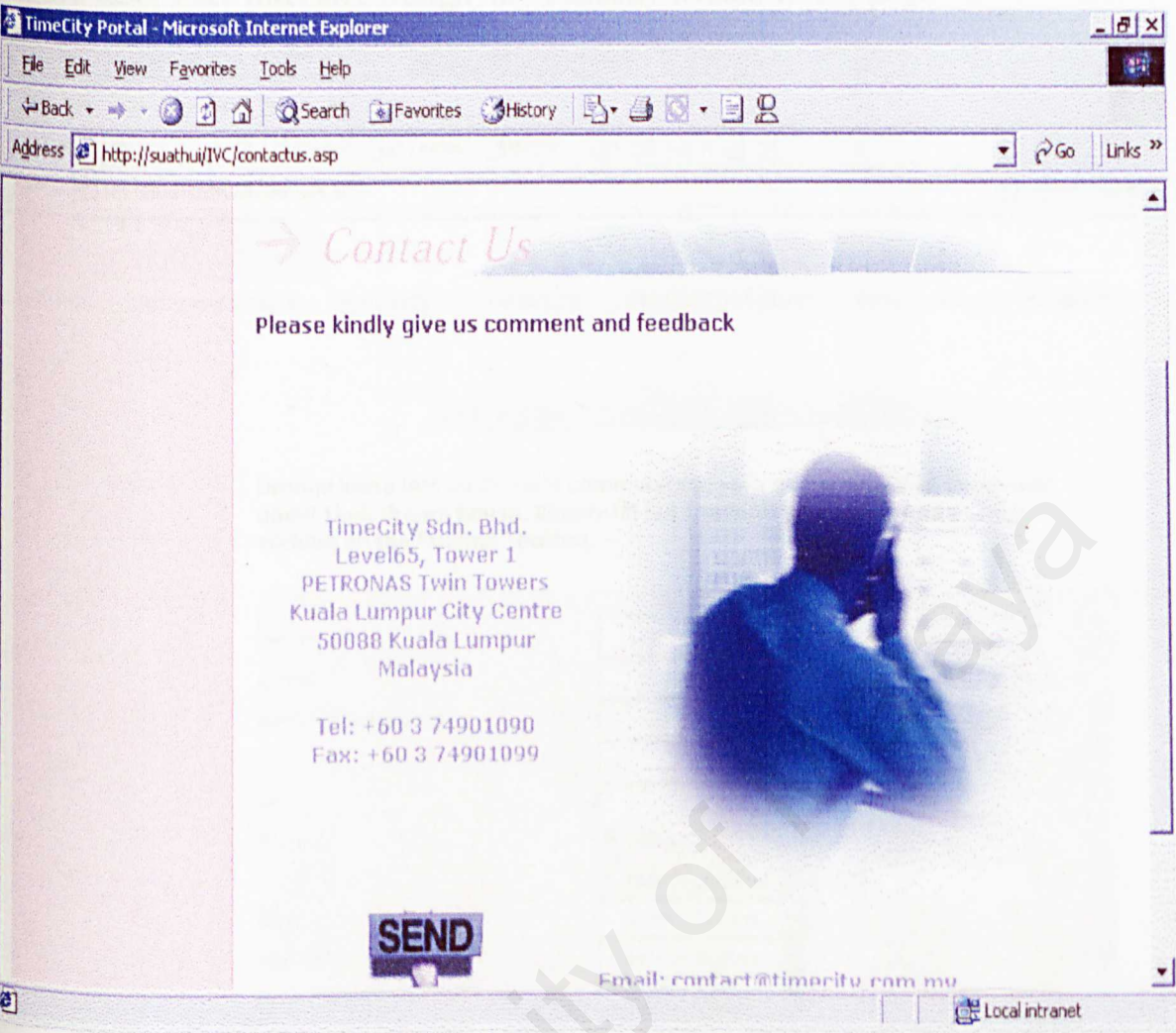
Figure 4.50: User Interface Design for Timecity Dream House page
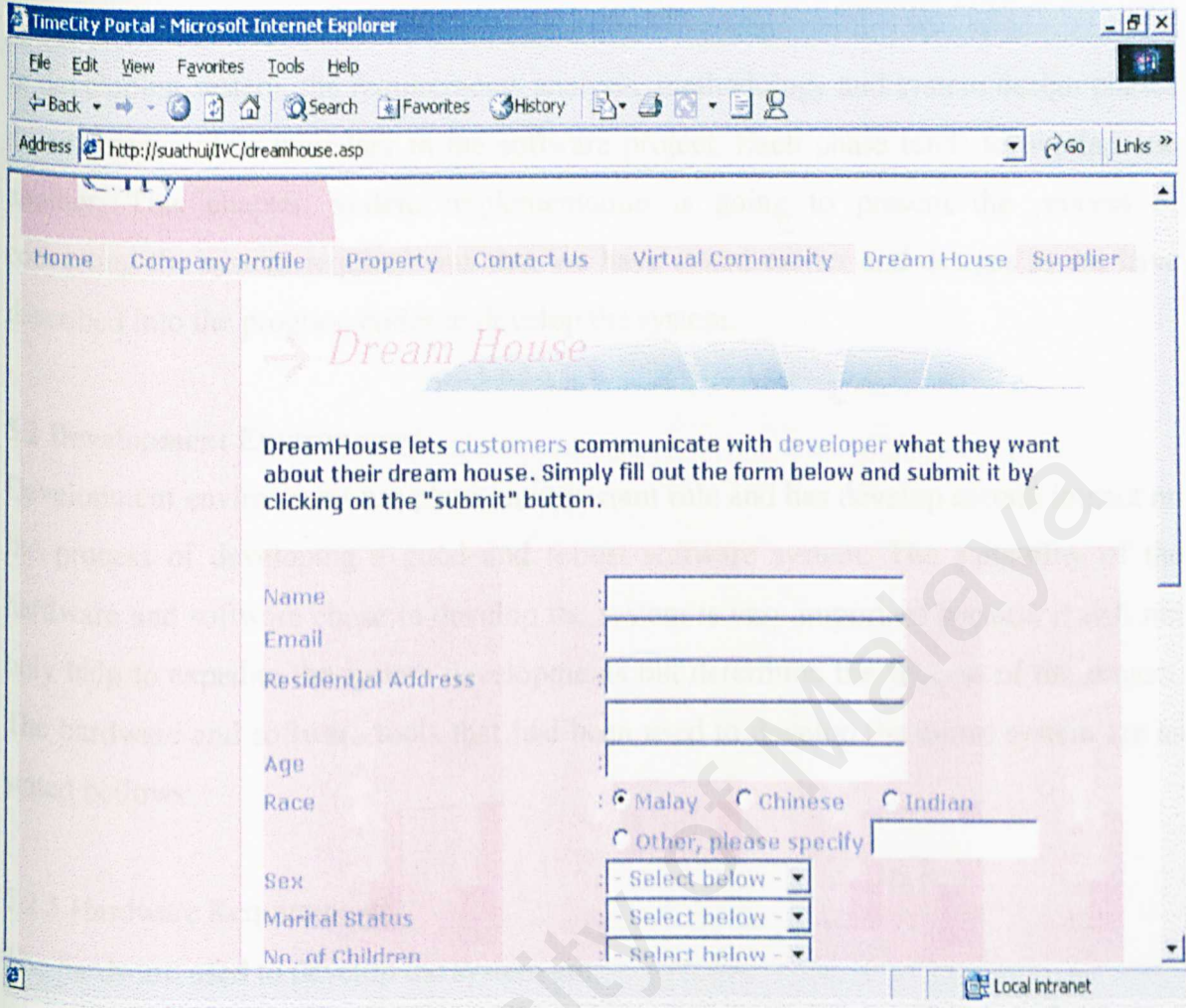
4.8 Summary
This chapter presented list of diagrams and charts that explained in details the design of Timecity Housing Estate Portal, including the process and database design together with the user interface design.

Chapter Five: System Implementation

5.1 System Implementation

In developing system, the requirements analysis, methodology and system design phases do not have a clear boundary in the software project. Each phase tends to overlap one another. This chapter, system implementation is going to present the process of converting the system requirements that we have stated earlier and designs as we have described into the program codes to develop the system.

5.2 Development Environment

Development environment has plays an important role and has develop certain impact on the process of developing a good and robust software system. The suitability of the hardware and software chose to develop the system is very important because it will not only help to expedite the system developments but determine the success of the project. The hardware and software tools that had been used to develop the entire system are as stated bellows:

5.2.1 Hardware Requirements

The hardware used to develop the system are:

- AMD-K6(tm) 3D Processor
- Memory 192 MB RAM
- 2 GB hard disk

5.2.2 Software Requirements

Table 5.1 below illustrates the software tools used to develop the entire system:

Software	Purpose	Description
Microsoft Windows 2000 Server	System requirements	Operating system
Microsoft Internet Information Server 4.0	System requirements	Web server host
Microsoft Visual Interdev 6.0	System development	Development tool for coding
Microsoft Internet Explorer 5.0	System development	Web browser
Microsoft FrontPage 2000	System development/ interface design	Development tool for coding and system design
Microsoft SQL Server 7.0	System development	Database server
Adobe PhotoShop 5.0	Interface design	Image design and creation
Macromedia Flash 5.0	Interface design	Animation design for homepage

Table 5.1: Summary of list of software tools used for system

5.3 System Development

System development consists the used of methodology chosen, web pages coding, web-based development tools and database connection. The details are illustrated as below:

5.3.1 Methodology

The development strategy or methodology used in this project is Waterfall model with prototyping. The development of this project will consists of eight stages, which are requirements analysis, system design, program design, coding, unit and integration testing, system testing, acceptance testing and operation and maintenance stage together with the prototyping stage. The system is design using logical flow and it allows the estimation of the milestones. Each stage must be completed before proceed to the next stage to ensure that the system is built according to the requirements and specifications.

5.3.2 Web Pages Coding

ASP is actually an extension to your web server that allow server-side scripting and plays a role as scripting environment. The languages used to develop as active server page are HTML together with scripting languages such as VBScript and JavaScript. The challenge of coding in ASP is determining and separating the HTML source code from the scripting counterpart.

For client-side scripting, it must be delimited by the <SCRIPT>...</SCRIPT> tags. On the other hand, server-side scripting requires the RUNAT attribute set to Server so that the script should be executed on the server rather than the client(browser). An example is as below:

```
<SCRIPT LANGUAGE="VBScript" RUNAT="server">
...
</SCRIPT>
```

The easiest way to add a script to an Active Server Page is by using the script delimiters <% and %>. Any text enclosed within these delimiters will be processed as a script. The preparation of a HTML and ASP document involves endless cycle of testing and modifying of the ASP source codes, loading the file in the browser for viewing and validating. Further changes will be made if necessary.

5.3.3 Web-based Development Tools

Microsoft Visual Interdev 6.0 is used as the main development tool for this project. This tool enables easy performance of the many complex programming and database tasks required in the creation of a Web site, as well as the incorporation of HTML formatting and layouts, graphics and other multimedia components.

Microsoft Visual Interdev 6.0 will creates a second copy of the files on the local computer while performing tasks like adding files to the Web site or editing any of the existing files. This is called the working copy and whenever these working copies are saved, Visual Interdev 6.0 will updates the file on the Web server as well.

All the graphics and animations in this project are created using Microsoft Front Page 2000, Adobe PhotoShop 5.0 and Macromedia Flash 5.0.

5.3.4 Database Connection

The database for this project is created using Microsoft SQL Server 7.0. By using the SQL Server, the database can be accessed through virtually any kind of network connection and enable great amount of users accessed the system at the same time. The database for this system is TIMECITY and it included five tables as the database resource to store all the important data.

ActiveX Data Object (ADO) is used to store and retrieve data from the database. This project uses the (Data Source Name) DSN-less connection strings to connect to Microsoft SQL Server. The connection string is written as:

Driver={SQL Server}; Server=server_name; Database=database_name; UID=; PWD=;

All communication with a database takes place through an open connection. Before any information can be inserted into or retrieved from the database, a connection with the database must be established. The ADO connection object serves the purpose. For example:

Set objConn=server CreateObject("ADODB Connection")
ObjConn.Open strConnect

1.4 Summary

This chapter presented the implementation of the system together with the hardware and software that had been used throughout the whole process of developing the entire system. It also explained the system development on how the coding and connection of the system.

Chapter Six: System Testing

6.1 Introduction

Software testing is one of the main phases in the Waterfall Life Cycle model. In this phase, the process of testing and debugging are done to detect defects and bugs of a system. These processes are usually done incrementally with system development.

This phase is also often referred to as Verification and Validation (V&V). Verification refers to the set of activities that ensure the software correctly implements a specific function. Validation refers to a different set of activities that ensure the software has been built is traceable to user requirements. A successful test is one in which no errors are found.

Glen Myers (1979) states a number of rules that can serve well as testing objectives:

- Testing is a process of executing a program with the intent of finding an error.
- A good test case is one that has a high probability of finding an as-yet-undiscovered error.
- A successful test is one that uncovers an as-yet-undiscovered error.

In addition, data collected as testing is conducted provide a good indication of software reliability and some indication of software quality as a whole. However, testing cannot show the absence of errors and defects, it can show only that software errors and defects are present.

This project was tested with the following generic characteristic:

- Testing begins at the module level and works "outward" toward the integration of the entire system.
- Different testing techniques are appropriate at different points in time.
- Testing and debugging are different activities, but debugging must be accommodated in any testing strategy.

6.2 Testing Principles

There is a set of testing principles that should understand to guide the system testing. Several testing principles suggested by Davis (1995) have been followed in testing the system:

- All tests should be traceable to customer requirements.
- Test should be planned long before testing began. Testing planning can begin as soon as the requirement model is complete.
- Testing should begin "in the small" and progress toward testing " in the large". The first test planned and executed generally focus on individual components. As testing progress, focus shifts in an attempt to find errors in integrated clusters of components and ultimately in the entire system.

6.3 Unit Testing

Unit testing focuses verification effort on the smallest unit of software design which is the software component or module. All the important control paths in this project are tested to uncover errors within the boundary of the module. The relative complexity of tests and uncovered errors is limited by the constrained scope established for unit testing. The unit test usually white-box oriented and the step can be conducted in parallel for multiple components.

The tests that occur as part of unit tests are illustrated schematically in Figure 6.1. The module interface is tested to ensure that information properly flows into and out of the program unit under test. The local data structure is examined to ensure that data stored temporarily maintains its integrity during all steps in as algorithm's execution. Boundary conditions are tested to ensure that the module operates properly at boundaries established to limit or restrict processing. All independent paths (basis path) through the control structure are exercised to ensure that all statements in a module have been executed at least once. Finally, all error handling paths are tested.

Figure 6.1: Unit Test
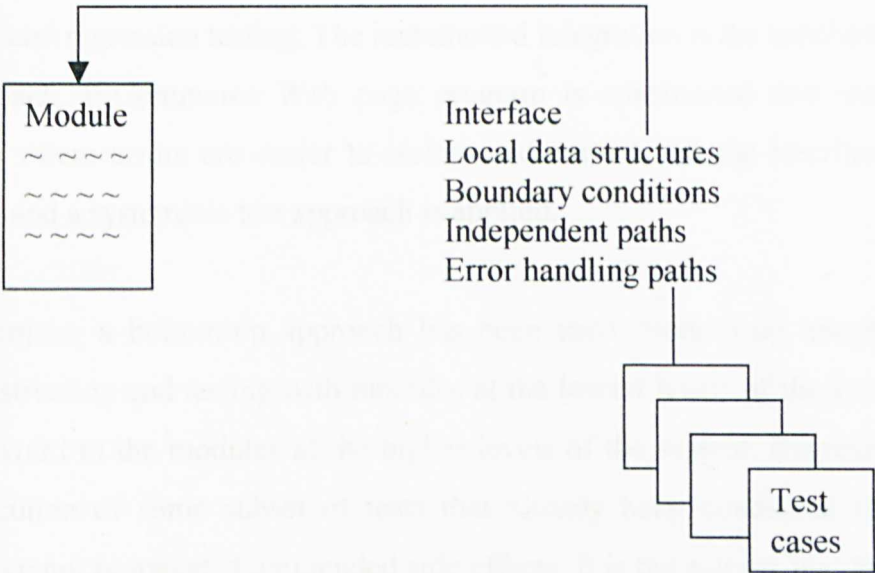
The following areas were tested during unit testing for this project:

- Boundary value analysis

  Ensure that the module operates properly at boundaries established to limited or restrict processing.

- Error handling paths

  Ensure that the specific module executes the recovering process should an error occurs. For example, the updating process should be able to continue to function again after encountering duplicate record in the database.

- All possible independent program paths are executed

  Ensure that the control structures are implemented correctly.

6.4 Integration Testing

Integration testing is a systematic technique for constructing the program structure while at the same time conducting tests to uncover errors associated with the interfacing. The objective is to take unit tested components and build a program structure that has been dictated by design. This testing will ensure that the interfaces such as module calling in this project are arranged correctly.

The approach used in this phase is an incremental integration strategy, the bottom-up integration and regression testing. The incremental integration is the antithesis of the high bang approach. E-Commerce Web page program is constructed and tested in small increments where errors are easier to isolate and correct. All the interfaces are tested completely and a systematic test approach is applied.

For this project, a bottom-up approach has been used. Bottom-up integration testing begins construction and testing with modules at the lowest levels of the system and then moving upward to the modules at the higher levels of the system. Regression testing is the re-execution of some subset of tests that already been conducted to ensure that changes have not propagated unintended side effects. It is the activity that helps to ensure that changes (due to testing or for other reasons) do not introduce unintended behavior or additional errors.

6.5 Validation Testing

At the culmination of integration testing, this project is completely assembled as a package, interfacing errors have been uncovered and corrected. A final series of software tests that is the validation testing are carried out during this phase.

Software validation is achieved through a series of black box tests that demonstrate conformity with requirements. For this project, a test plan outlines the classes of tests to be conducted and a test procedure defines specific test cases that will be used to in an attempt to uncover errors in conformity with requirements. Both the plan and procedure are designed to ensure that:

- All functional requirements are satisfied
- All behavior characteristic are achieved
- All performance requirements are attained
- Documentation is correct
- Other requirements are met (e.g. error recovery, maintainability, compatibility)

Alpha test and beta test are also being carried out to uncovers errors that only the end-user seems able to find. Alpha test is conducted at the developer's site by an end-user in a controlled environment. Beta test is conducted at one or more customer sites by the end-user of the software and it is a "live" application of the software.

6.6 System Testing

System testing is a series of different tests designed to fully exercise the software system to uncover its limitations and measure its capabilities. The objective is to test an integrated system and verify that it meets specified requirements. Although each test in this project has a different purpose, all work to verify that system elements have been properly integrated and perform allocated functions.

There are several types of system testing that are worthwhile for a software system. For this project, three types of system testing are used:

- Recovery Testing

  It is a system test that forces the system to fail in a variety of ways and verifies that recovery is properly performed. If recovery is automatic (performed by the system itself), then reinitialization, checkpointing mechanisms, data recovery and restart are evaluated for correctness. If recovery requires human intervention, the mean-time-to-repair (MTTR) is evaluated to determine whether it is within acceptable limits.

- Security Testing

  This system test will attempts to verify that protection mechanism built into the system will protect it from improper penetration.

- Performance Testing

  The purpose of this testing is to test the run-time performance of software within the context of an integrated system. It requires both hardware and software instrumentation. Resource utilization is measured in an exacting fashion.

6.7 Error Handling and Debugging

Error handling enables the development of clearer, more robust and more fault-tolerant programs. Error handling provides the ability to attempt to recover from infrequent fatal errors rather than letting them occur and suffering the consequences (Deitel, 1999).

Debugging is the process of finding and correcting errors or bugs in the source code of computer program. There are number of debugging tools being used in performing the system debugging, including Toggles Breakpoint, Step Into, Add Watch and so on. When debugging the system, the Locals windows and Immediate window are used to check the value of variables.

6.8 Summary

Testing of computers system is another major task in the process as it validates the requirements to ensure that the system is functioning according to the requirements and specifications laid down.

Chapter Seven: System Evaluation

7.1 System Evaluation

During the coding and implementation of the system, various problems were encountered. All this problem were solved through research and studies. Every system also has it own strengths, limitations and future enhancements where can be identified.

7.2 Problems Encountered and Solutions

There are several problems encountered throughout the development of this system. These includes:

7.2.1 Difficulty in Choosing a Suitable Development Technology, Programming Language and Tools

There are many software tools available to develop a housing estate website as stated in the earlier stages such as Microsoft products, Java and so on. Choosing a suitable technology and tools to develop the system was a critical process as all the tools possesses their own strengths and weakness. In addition, the availability of the required tools for development was also a major consideration.

In order to solve this problem, research and evaluation had been carried out before the decision was made. Furthermore, seeking advice from supervisor and referred to the similar project had helped in choosing the most suitable tools for this project.

7.2.2 Lack of Knowledge in ASP and VBScript

These new programming languages and concepts were never been taught before and to implement such an application requires a fair grasp of the languages. These programming approaches seem to be totally different from the traditional programming languages. Besides, since there was no prior knowledge of programming in ASP and VBScript, there was an uncertainty on how to organize the cods in the web pages.

Although it really cause a lot of time to learn the new technology, but choosing to program in ASP and VBScript proved to be a wise move. Most of the problems faced were manageable through browsing the Internet for related materials and referring to the reference books available in the market. Discussion with friends using the same software was a great help. However, the most efficient method of learning is by trial and error method during the coding phase.

7.2.3 Readability Problem in ASP

Almost all web-based programming languages do not support for variety types of variable. It increases the write ability for programmer but at the same time decrease the readability for the programmer. Problems become more tedious when there are bugs detected in the program. Since the readability of the program is decreased, then the code maintainability also decreased. It is very difficult to debug the errors especially semantics errors that are unable to be detected by the debugger engine.

In order to minimize the problem in this area, a series of testing must be taken if the components are to be used in implementation of this project. Minimization in using the component is need for a stable system.

7.3 System Strengths

During the development of this project, several system strengths had been identified as below:

7.3.1 Attractive and Simple Graphic User Interface

The Timecity Housing Estate Portal has a very attractive user interface and made users feel comfortable in browsing the website to get the information they want or the features that will add value to them. The commands and the layout of this system are simple and well organized, therefore it is easy to use, simple to learn and understandable. Normal users with some computer knowledge will find the system easy to handle.

7.3.2 User Friendliness and Easy to Use Interface

Some useful Graphical User Interface (GUI) such as command buttons, check boxes and drop-down list boxes are provided in the entire system which attract the users to navigate through the system and give faster access. This user-friendly interface can shorten the learning curve and reduce training costs, which include money and time. The menu-driven and pop-up windows or pull-down menus are built to facilitate the individual needs of the users.

7.3.3 Different User Privileges

There are four different types of users, namely the developer, supplier, potential customer and existing customer for Timecity Sdn. Bhd. Except for the customers, the developer and supplier need to login before the can perform their task and view the important information. The access right of each user is clearly differentiated and will not interface with one another.

7.3.4 Fast Response Time for Document Retrieval

The web pages are designed in such a manner that they are loaded in a reasonable amount of time to ensure users need not wait for a long time to view the pages. Heavy graphics are avoided and ActiveX controls are kept to the minimum wherever possible.

7.3.5 Provide Database Access

All the data are organized and stored in the form of database using Microsoft SQL Server. It is a real-time database information and any changes made to the records can be updated instantly to the Timecity database.

7.3.6 System Transparency

System transparency refers to the condition where the users do not need to know the underlying structure of the system, where the database resides, the database management system and anything related to the system design.

7.3.7 System Security

User name and password are required to access the certain modules of the system and only the authorized user is allowed to view the important information and features. For example, only the authorized supplier can view the list of required quotation and performs the send quotation function. Besides, only the authorized developer and get the list of quotation sent by the suppliers and register the authorized supplier.

7.4 System Limitations

As in other systems, there are also several setbacks and limitations in Timecity Housing Estate Portal. These limitations can be addressed in future development and system enhancements.

7.4.1 Unable to Update and Delete the Data in the Database

All the users are not provided with the function to update and delete the data in the database. This limitation happened due to security awareness. An assumption had been made due to the database where this database are shared among the whole system of the company, including the inventory and other related system that shared the database. Therefore, this update and delete function are included in company other's system. Besides, it is not applicable and secure to provide this function online using the website because without a highly security system.

7.4.2 Lack of Firewall

The second limitation of this system is the lack of the use of firewall. Firewall normally is used to create a security checkpoints at the boundaries of a private network. By providing the routing function between the private network and the Internet, firewall inspect all communications passing between the two networks and either pass or drop the communications depending on how they match the programmed policy rules.

7.5 Future Enhancement

Further development and many new ideas have come about while the system being implemented. Owing to time constraint and other factors, not all of the ideas could be incorporated into the system. It is hoped that the following aspects could be considered in future:

7.5.1 Provide More Related Functions and Features in Supplier and Developer Modules

Although the supplier and developer module had been provided with the major functions such as sending and receiving quotation and register for supplier function and so on, other related features between the developer and supplier such as sending email and news functions can be provided in the future enhancement to add more value to the modules of the system.

7.5.2 Develop a Chat Room or Bulletin Board Function in the Virtual Community Module

Timecity can consider to develop a chat room or a bulletin board in the virtual community site when the numbers of people staying in Taman Amanda and Taman Aliyia had increased. This chat room will allow communication in the community and bulletin board will provide them with the functionality to share their idea and as a communication tool in the community. This two features are currently not available in Timecity.com.my because of time constraints and the maintenance cost is wasted if the features has limited number of users.

7.5.3 Error Detection Features

This system actually needs a more comprehensive error detection feature to ensure that only valid input is being passed to the server and it is done through client-side scripting. This is important in ensuring that the system is robust and easy to maintain the reliability of the system.

7.6 Summary

The system life cycle is often described as an on going effort and the phases go in circle. Therefore, the life cycle is not completed without the evaluation of the system to determine the problem encountered, system strength and limitation and also the future enhancement that we can plan for it. Few system are perfect at the very first time it is produced, therefore it is important to evaluate the system objectively to analyze the entire system so that it can then be improved in the future to become a better system.

Summary

Overall, the Timecity Housing Estate Portal has achieved and fulfilled the objectives and requirements of a web based housing estate portal that implemented the Internal Value Chain concept as the backbone as stated in the report. But, there are still many rooms for improvement in the system, in terms of implementing a comprehensive and complete housing estate portal. With the initial step taken, enhancements could be made by inserting more features and functions that will add value to the users. Type of users can also be increased in the enhancement steps by providing functions for the internal users besides the developer, according to the Internal Value Chain concept, to implement the concept completely. Anyway, this system has provides a foundation upon which more sophisticated and innovative system may be built in the future.

This project has also provided me with opportunity to gain experience and useful knowledge in software development, which will definitely prove useful in future system development. Knowledge that I have gained including the whole life cycle of the system, the knowledge of hardware and software tools, the programming languages, design and so on. All this will definitely contribute to the success of developing the system. This project also lets me realized the important of planning. Planning is very important in system development, with targeted goals and objectives in mind even before the development take place, makes the software development process move systematically. Also, adherence to development schedule is very important in order to get job done on time.

Bibliography

[1]   Merriden, Trevor, *Business The Nokia Way, Secrets of World's Fastest Moving Company*, 1ˢᵗ Edition, Capstone Publishing Limited, 2001.

[2]   S. Winer, Russell, *Marketing Management*, Prentice Hall, 2000.

[3]   W. L. Hill, Charles and R. Jones, Gareth, *Strategic Management*, 5ᵗʰ Edition, Houghton Mifflin Company, 2001.

[4]   Kotler, Philip, *Marketing Manegement*, 5ᵗʰ Edition, Prentice Hall, 2000.

[5]   Kendall and Kendall, *System Analysis and Design*, 4ᵗʰ Edition, Prentice Hall, 1999.

[6]   V. Post, Gerald, *Database Management Systems*, International Edition, Irwin McGraw-Hill, 1999.

[7]   Kauffman, John, *Beginning ASP Databases*, Wrox Press Ltd., 2000.

[8]   Ullman, Chris and Buser, David, *Beginning ASP 3.0*, Wrox Press Ltd., 1999.

[9]   Lawrence, Shari, *Software Engineering Theory and Practice*, 2ⁿᵈ Edition, Prentice-Hall, 2001.

[10]   Johnston, Red, *Microsoft Official Curriculum, Microsoft Windows 2000 Networking and Operating System Essentials 2151A*, Microsoft Corporation, 1999.

[11]   Client/Server Technology presented by Joseph Nattey, *http:// www.personal.kent .edu/~jnattey/natteypres.htm,* Date Referred: 18 July 2001.

[12]   Unix System versus Microsoft NT Server, *http://www.microsoft.com/ntserver/nts /compares/NT and UnixComp.asp*, Date Referred: 18 July 2001.

[13]   *http://www.microsoft.com/technet/treeview/default.asp*, Date Referred: 18 July 2001.

[14]   HTML, *http://www.whatis.com/html.htm*, Date Referred: 20 July 2001.

[15]   Scripting Languages, *http://www.whatis.com/scripting.htm*, Date Referred: 20 July 2001.

Appendix A: User Manual

Table of Contents

List of Figures

<div align="center">**User Manual**</div>

Chapter One: Introduction

1.1 Welcome

Welcome to Timecity Housing Estate Portal, a housing estate portal that developed based on Internal Value Chain approach that provided features and functions that can add value to developer, supplier as well as the customers. This user manual consists of two major sections, which are the developer section and supplier section.

This manual will provide a step-by-step comprehensive guide for both the developer and supplier of this system. Each step will be explained in detail together with the appropriate figures.

Timecity Housing Estate Portal is a web-based application running on popular web browsers such as Microsoft Internet Explorer and Netscape Navigator. Only authorized users can access the restricted portion of the system.

1.2 About This Manual

This user manual is organized and divided into 4 chapters as follow :

Chapter 1 – Introduction

Provides introductory information that users should know before using the system.

Chapter 2 – Hardware and Software Requirements

Describe the recommended hardware and software requirements before users can begin to use the system.

Chapter 3 – Developer Section

Describe all the functions and technical configuration required for the developer module with step-by-step instructions. The appropriate figures also included in this chapter for easy reference.

Chapter 4- Supplier Section

Provides the user guides needed for using the system with detail explanation. The appropriate figures or tables also included in this chapter in order to assists the users while they are using the application.

Chapter 2: Hardware and Software Requirements

2.1 Hardware Requirements

The hardware required for this system are :

- Pentium II 233 MHz

- Memory – 64 MB RAM

- 4.5 GB hard disk

2.2 Software Requirements

The software required for this system are:

- Browsers such as Microsoft Internet Explorer and Netscape Navigator

Chapter Three: Developer Section

Developer can begin their online quotation function by clicking on the link on the main page of the website, located on the bottom right hand side of the page, as shown in figure 3.1. This link will bring them into the developer login page where developer needs to type in their id and password before being authorized to visit the developer main page.
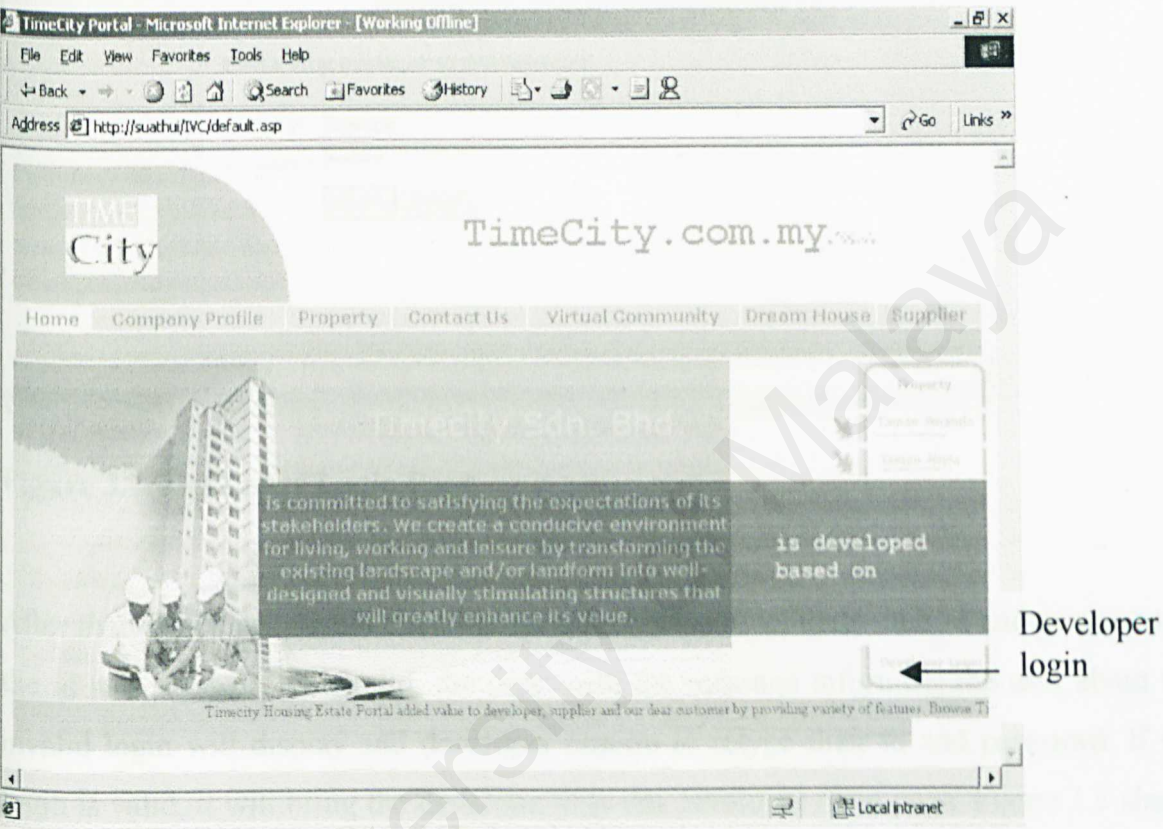
Figure 3.1: Timecity Main Page

3.1 Developer Login

Figure 3.2 on the next page shows the developer login page where the developer must type in the id and password.
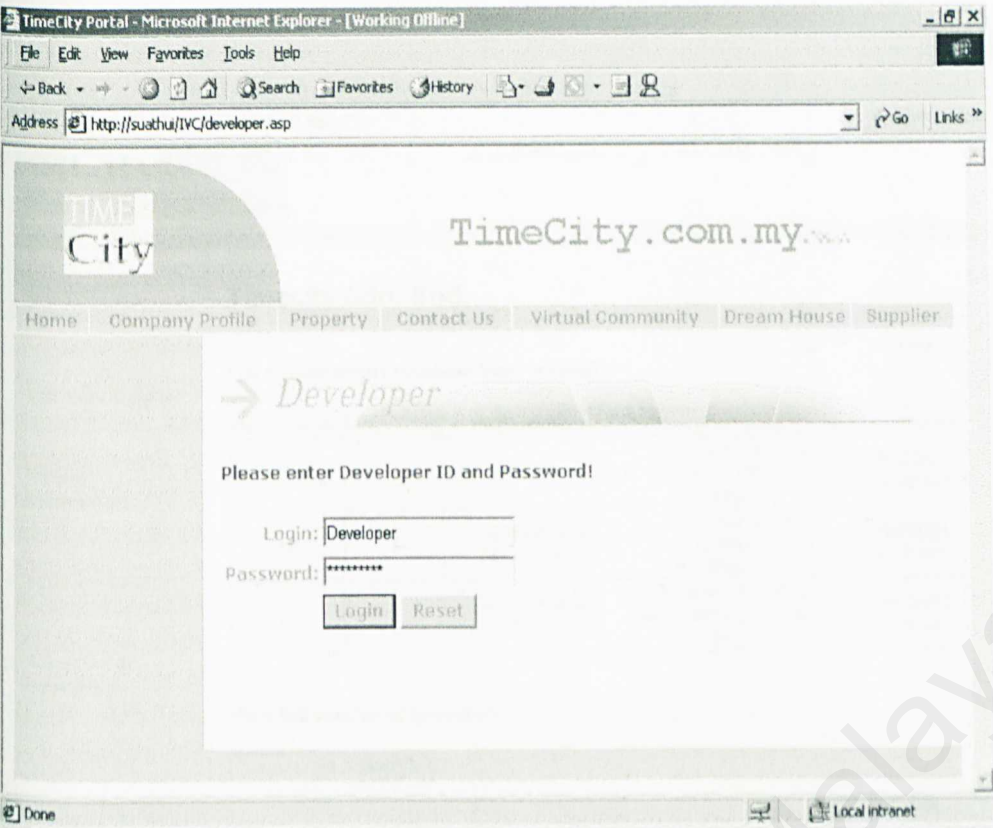
Figure 3.2: Developer Login Page

After that, developer should click on the login button to validate their id and password. If the id and password is invalid, the page with the message informing the user about the invalid login will display and developer require to retype their id and password. If the login is valid, it will bring the developer into the developer main page. Figure 3.3 shows the developer main page with all the features and functions provided to the developer.
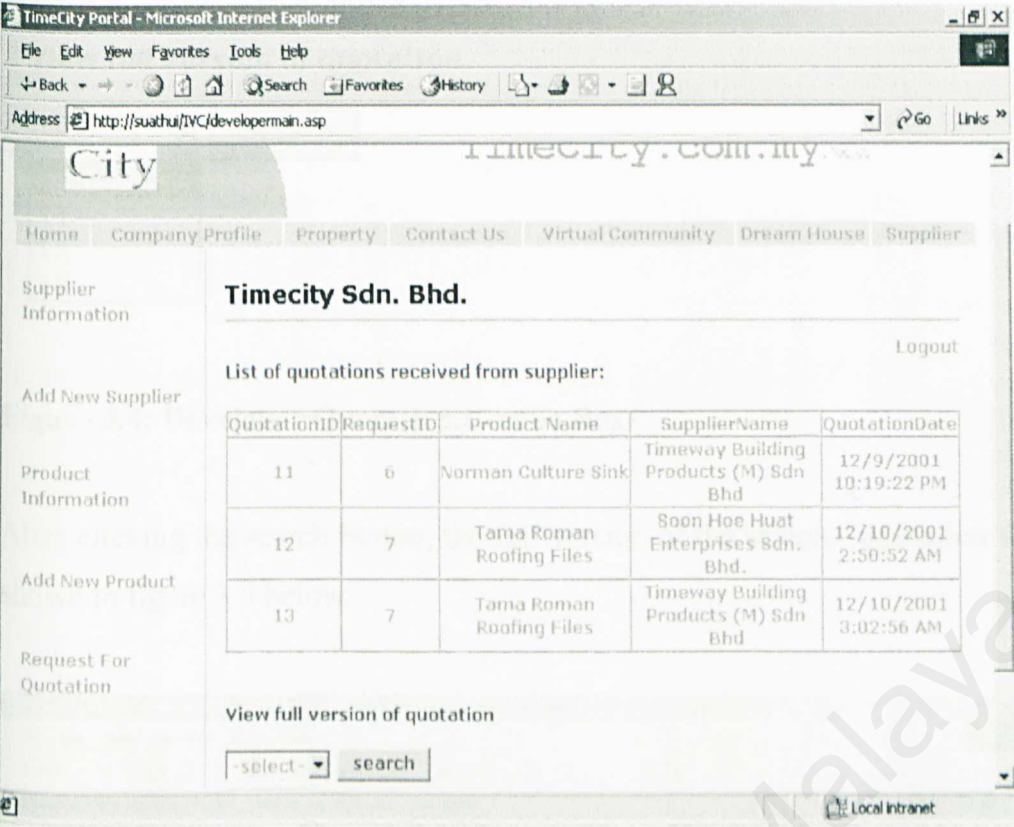
Figure 3.3: Developer Main Page

3.2 View the List of Quotation

In the center of the developer main page, displays the information of the quotation received from the suppliers in a summary form. From the table, developer can get the information about the quotation ID, request ID, product name and the supplier name together with the date the quotation received. Below the table, there is a search function where developer can get the full version of the quotation received from the supplier. The developer needs to select the quotation ID that they want to view in full version, than click on the search button. Figure 3.4 displays the combo box where developer selects their choice before clicking the search button.

View full version of quotation

Figure 3.4: Developer Quotation Combo Box

After clicking the search button, the full version of the selected quotation will display as shown in figure 3.5 below.
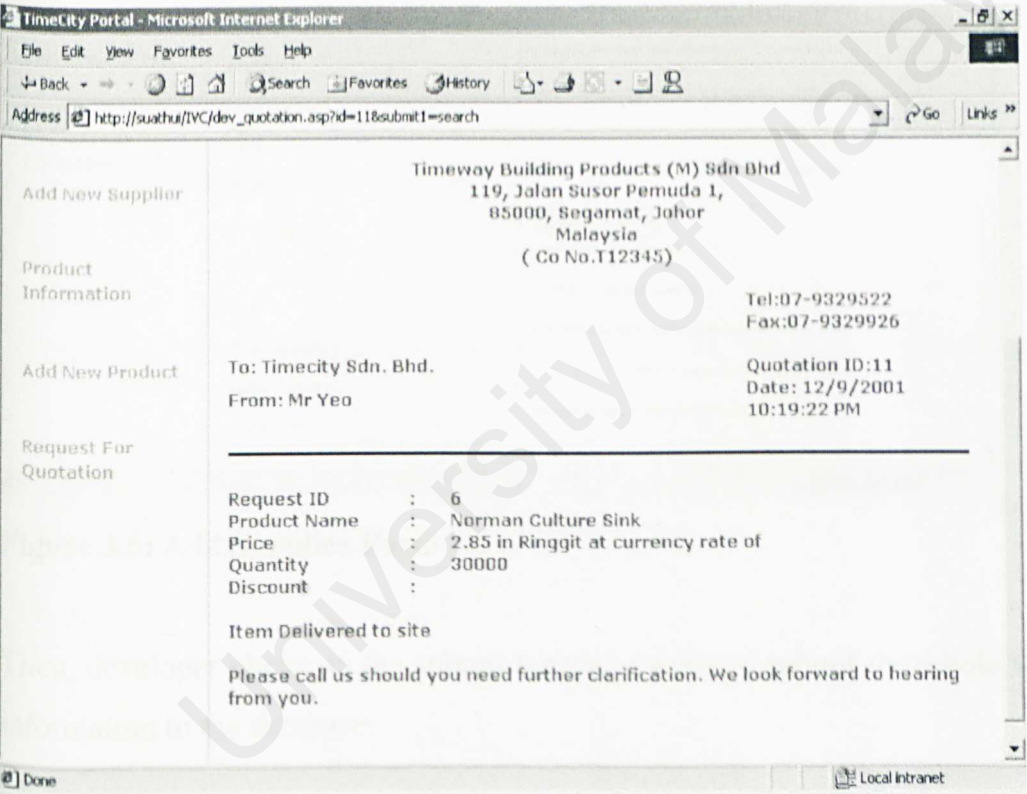
Figure 3.5: Full Version of Quotation

3.3 Add Supplier

On the navigation bar of the developer site, displays features where developer can add new supplier and view the supplier information. For the add new supplier function, by clicking on the Add New Supplier link, it will display a form where developer needs to key in the supplier information. Figure 3.6 displays the form.

Figure 3.6: Add Supplier Form

Then, developer clicks on the submit button in order to submit the whole set of supplier information to the database.

3.4 View Supplier Information

By clicking on the Supplier Information link, page as shown in Figure 3.7 will display. The supplier information will be shown on the table. If the developer required more detail information about the particular supplier, the developer can use the combo box at the bottom page, select the supplier name and click on the search button.
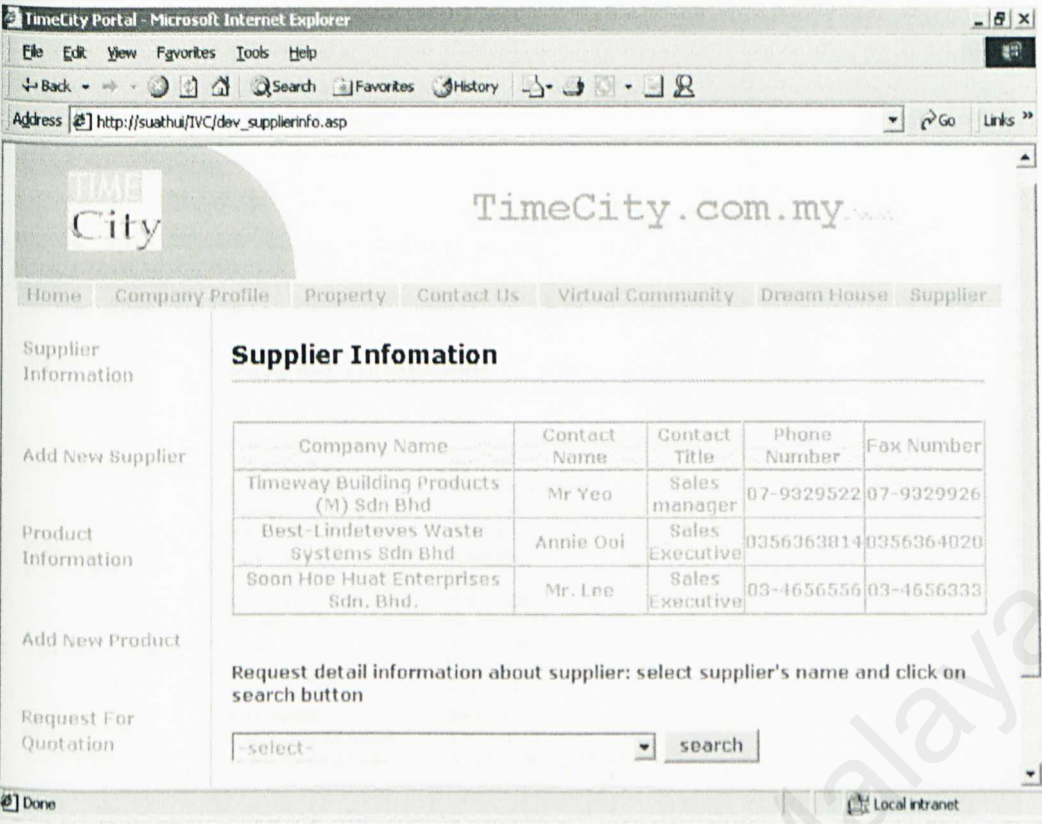
Figure 3.7: Supplier Information Main Page

Request detail information about supplier: select supplier's name and click on search button
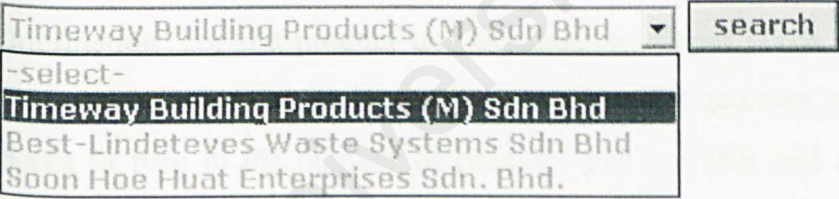
Figure 3.8: Supplier Information Combo Box

The clicking on the search button will bring developer to the full information about the supplier as shown in Figure 3.9. Developer can then get the full information about the supplier.
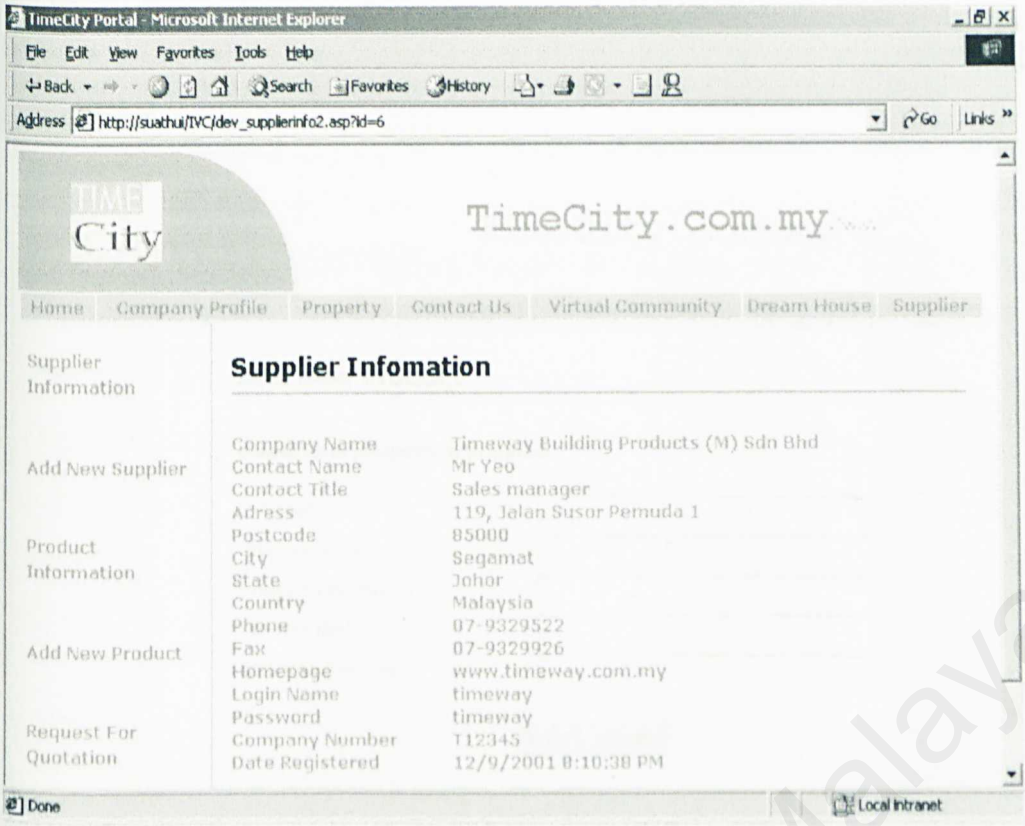
Figure 3.9: Supplier Information in Full Version

3.5 Add New Product

Developer will also be provided with add new product function. First, developer clicks on the Add New Product link and a form will require developer to type in the product information. For the product unit column, developer needs to type in the unit for the product such as box, packet and so on. Fore the quantity per unit column, developer needs to type in the number of products per unit that had specified. After completed filling in the form, developer needs to click on the save button to submit the form.

3.6 View Product Information

By clicking the View Product Information, developer will be able to view the product information.

Figure 3.10: Add New Product Form

Figure 3.11: Product Information Page

3.7 Request for Quotation

To request for quotation, developer needs to click on the Request for Quotation link on the navigation bar. This link will bring developer to a form where developer needs to type in the information about the request and click on the request button to submit all the information. Figure 3.12 below shown the request form. To fill in the form, first, developer has to select the product he requests from the combo box. Then, he has to specify the project name and the amount of products he needs. Finally, he has to fill in the Reply Before Date column by stated the date when is the last date where supplier needs to sent the quotation according to the format DD/MM/YY, where D=Date, M=Month, and Y=Year. For example, 31/12/01 means 31 of December, year 2001.

Figure 3.12: Request for Quotation Form

3.8 Logout

To logout from the developer site, developer can click on the Logout link on the right hand side of the page and the developer will logout from the developer site. After logout, developer needs to login again before visit the developer site.
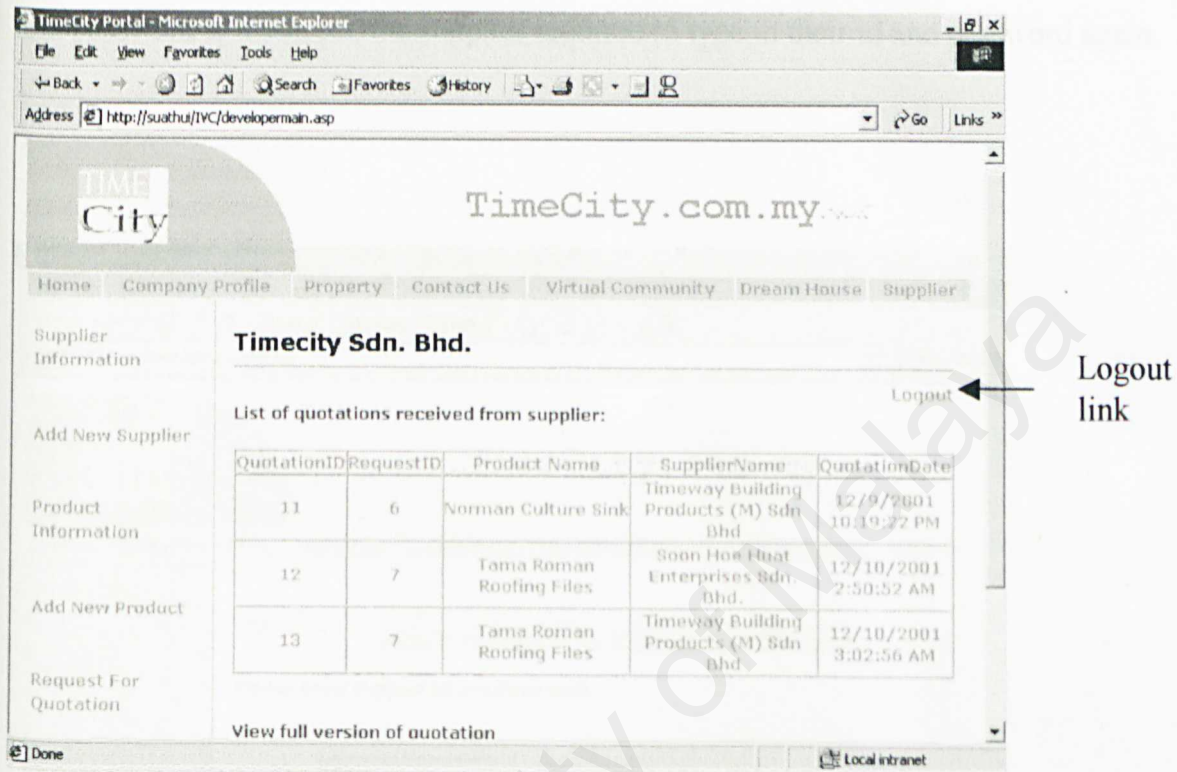
Figure 3.13: Developer Logout

Chapter Four: Supplier Section

By clicking on the Supplier link, the supplier needs to login before they can visit the supplier site. Figure 4.1 displays the supplier login page. Supplier needs to type in their id and password gave by the developer, then he clicks on the login button to login. If the id and password is incorrect, the supplier required to type in their id and password again.
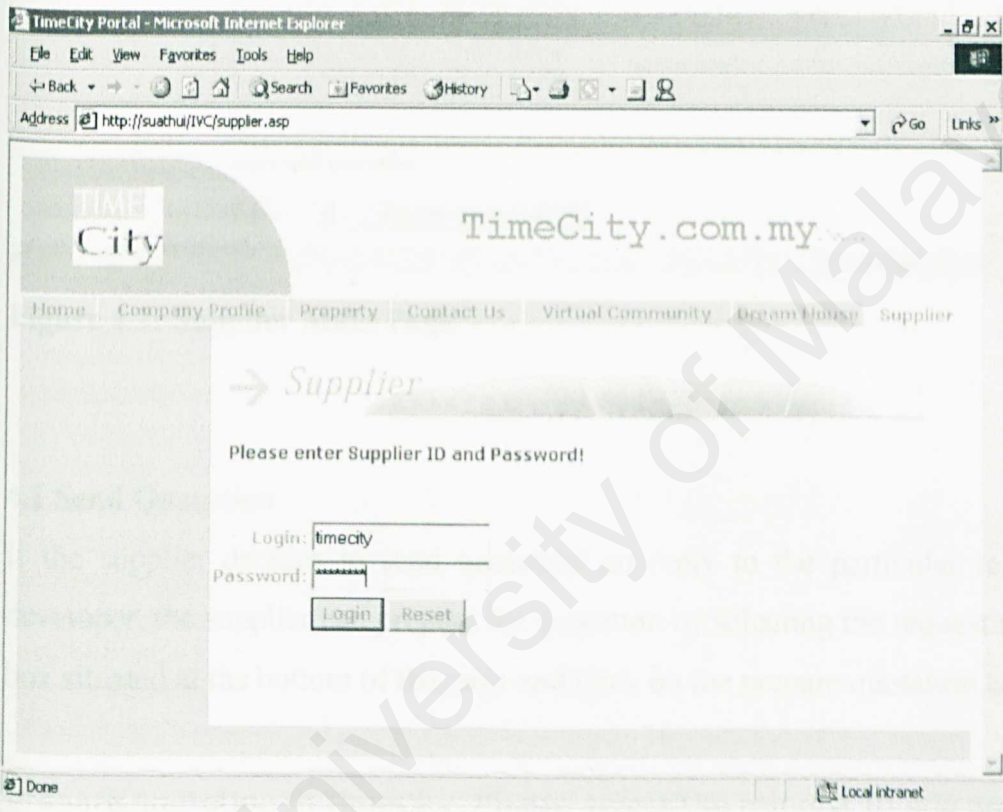
Figure 4.1: Supplier Login Page

After the successful login, the website will display the supplier main page. The main page displays the list of request received from the developer and supplier can get the information about the request for quotation before they make their decision whether to send quotation or not.
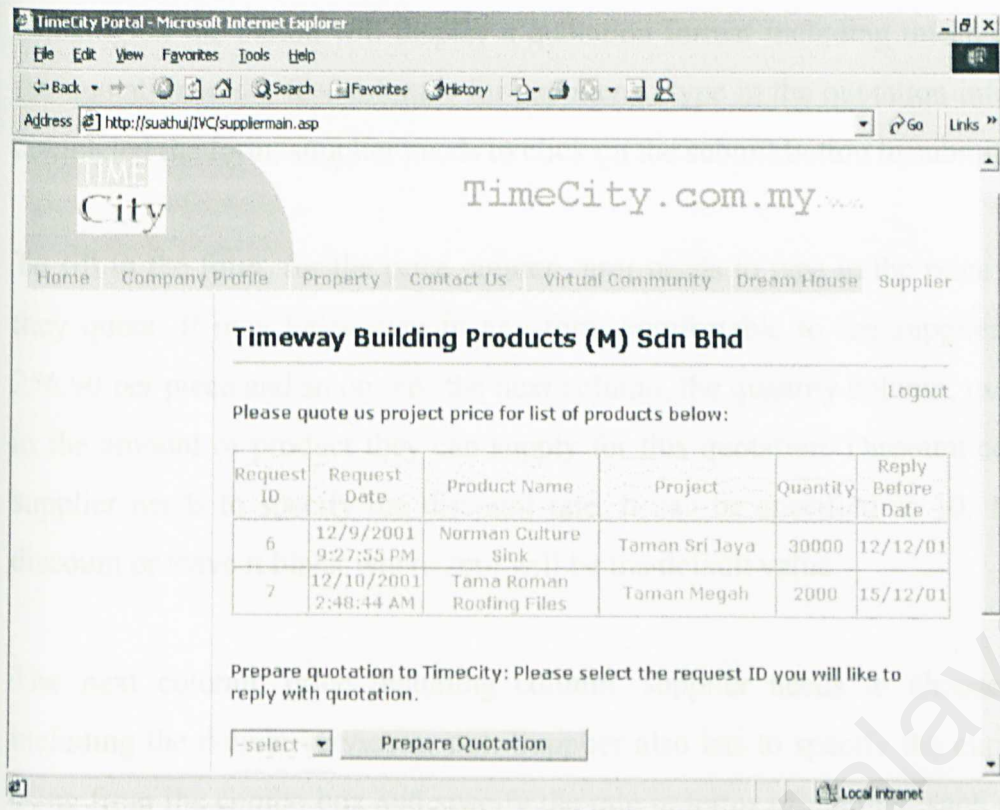
Figure 4.2: Supplier Main Page

4.1 Send Quotation

If the supplier decides to send quotation on reply to the particular request from the developer, the supplier can prepare the quotation by selecting the request id at the combo box situated at the bottom of the page and click on the prepare quotation button.

Prepare quotation to TimeCity: Please select the request ID you will like to reply with quotation.
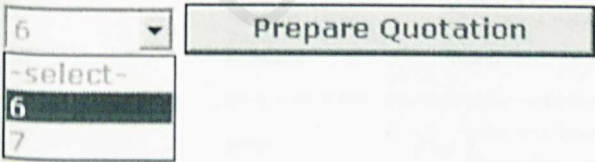

Figure 4.3: Request ID Combo Box

Clicking on the button will display a quotation format including information needed in the quotation and a few columns for supplier to type in the quotation information. After completed the form, supplier needs to click on the submit button to submit the quotation.

To fill in the form, for the price column, user needs to type in the price for the product they quote. It may be written in any form comfortable to the supplier. For example, 256.90 per piece and so on. For the next column, the quantity column, user needs to type in the amount of product they can supply for this quotation. Discount column is where supplier needs to specify the discount rate. It can be specified as 10, 15 or 0 for non discount or leave it blank where zero will be the default value.

The next column, price including column, supplier needs to choose whether it is including the deliver service or not. Supplier also has to specify the currency that he is using from the combo box and specify the rate in terms of number, such as 1, 2.5 and so on. The last column is the remark column where it allows supplier to insert any extra information or term and conditions where he will like to inform the developer together with the quotation.

Figure 4.4: Quotation

4.2 Logout

To logout from the supplier site, supplier can click on the Logout link on the right hand side of the page and the supplier will logout from the developer site. After logout, supplier needs to login again before visit the supplier site.
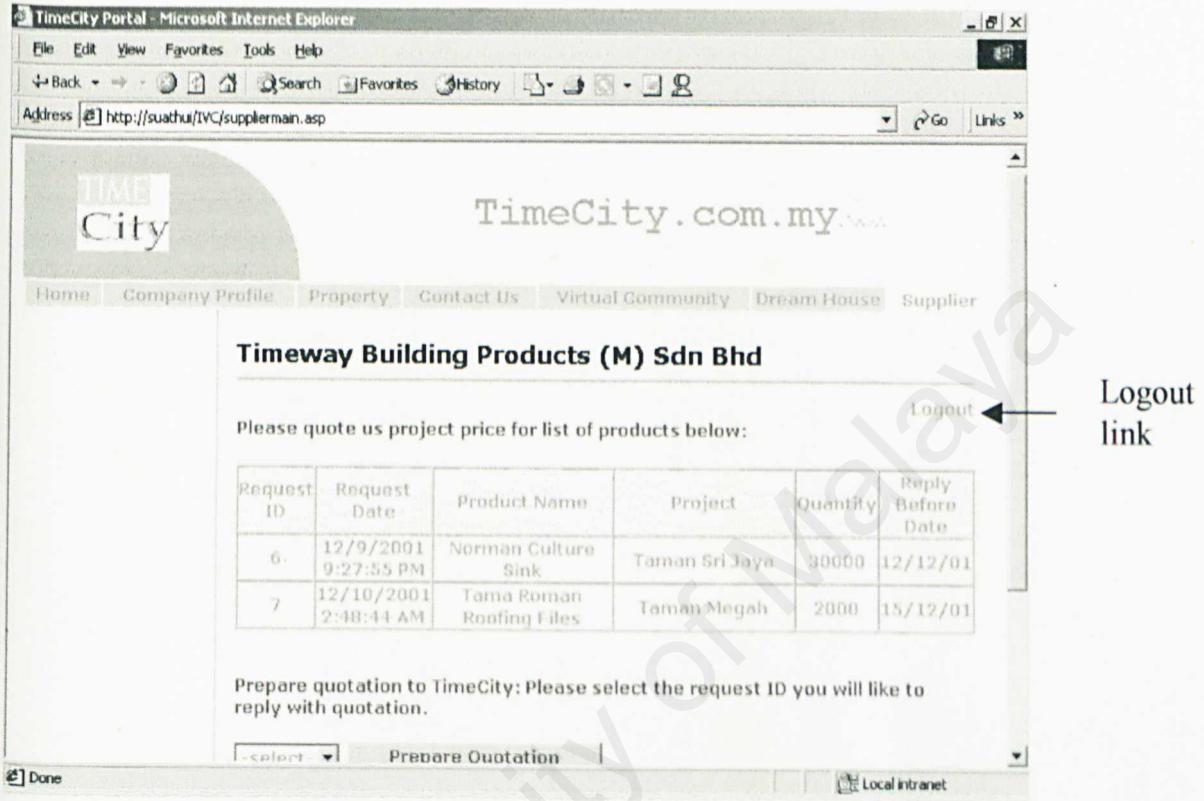

Logout link

Figure 4.5: Supplier Logout