

CHAPTER 4 : SYSTEM DESIGN

4.1 Design of Travel Management System

Functionalities of the components in the system are determined by a good systems design. The selection of a better modeling technique is important at this stage.

There are several models including behavioral model, data model and object-oriented model. Since the project is a real-time system, the O-O (Object-Oriented) modeling is the most effective way to represent its behavior. This model expresses the system requirements using an object model, designs using objects and develops the system in an O-O programming language. O-O programming language, like Java is a better language to develop a real-time system. The O-O modeling can be used to break down this complex system into more simple and manageable components. This approach also improves reusability of the system.

The UML was chosen to design the system, as the purpose of the UML is visualizing, specifying, constructing, and documenting O-O systems.

Initially the existing manual requirements were gathered from the Marakanda Staff using the requirement gathering methods such as Interviewing, manual documents etc. Then the UML system requirements model was created with no implementation constraints for the Travel Management system. Designed the UML system requirements model consisting of the system requirements statement (text), system collaboration diagram showing inputs and outputs, use case diagram, sequence diagram for each use case scenario, and finally the Class Diagram.

There was a great deal of feedback between stages of the design process. Also, iteration from one stage to another was carried out at the design process.

4.2 UML visualization

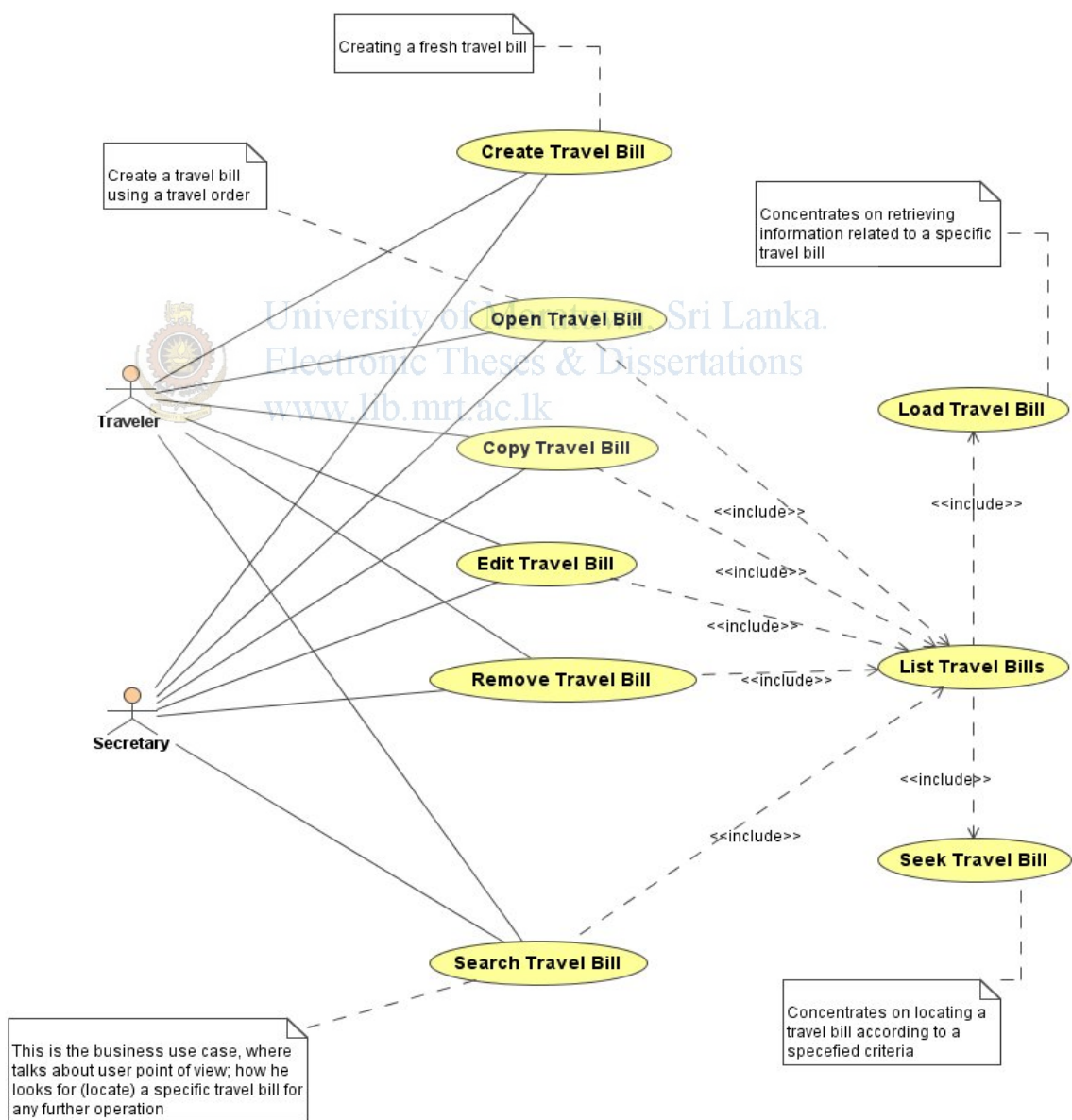
Unified Modeling Language version 2.0 is the designing mechanism used for the initial designing of dynamic and logical views of the system. Rational Rose 2000 is the tools used in order to design the necessary diagrams relate to each view of the system.

4.2.1 Use Case Diagrams

The main use case diagram shown in Figure 4.1 provides a picture of the system boundary and the general functionality. Main users of this diagram are identified as the traveler, secretary, reviewer and approver.

The other use cases were documented with flow of events. The flows of events documents and the use cases are given in Appendix A.

Figure 4-1 Create Travel Expense



4.2.1.1 Claim Travel Expenses

Brief Description

This use case allows a traveler to create travel bill based on trip.

Flow of Events

Basic Flow

When the traveler is logged in and can create travel bill based on travel information.

Alternative Flows

When the secretary is logged in and can create travel bill based on travel information.

Special Requirements

None

Pre-Conditions

Subscriber has to have a valid login session.

Post-Conditions

None

Extension Points

None

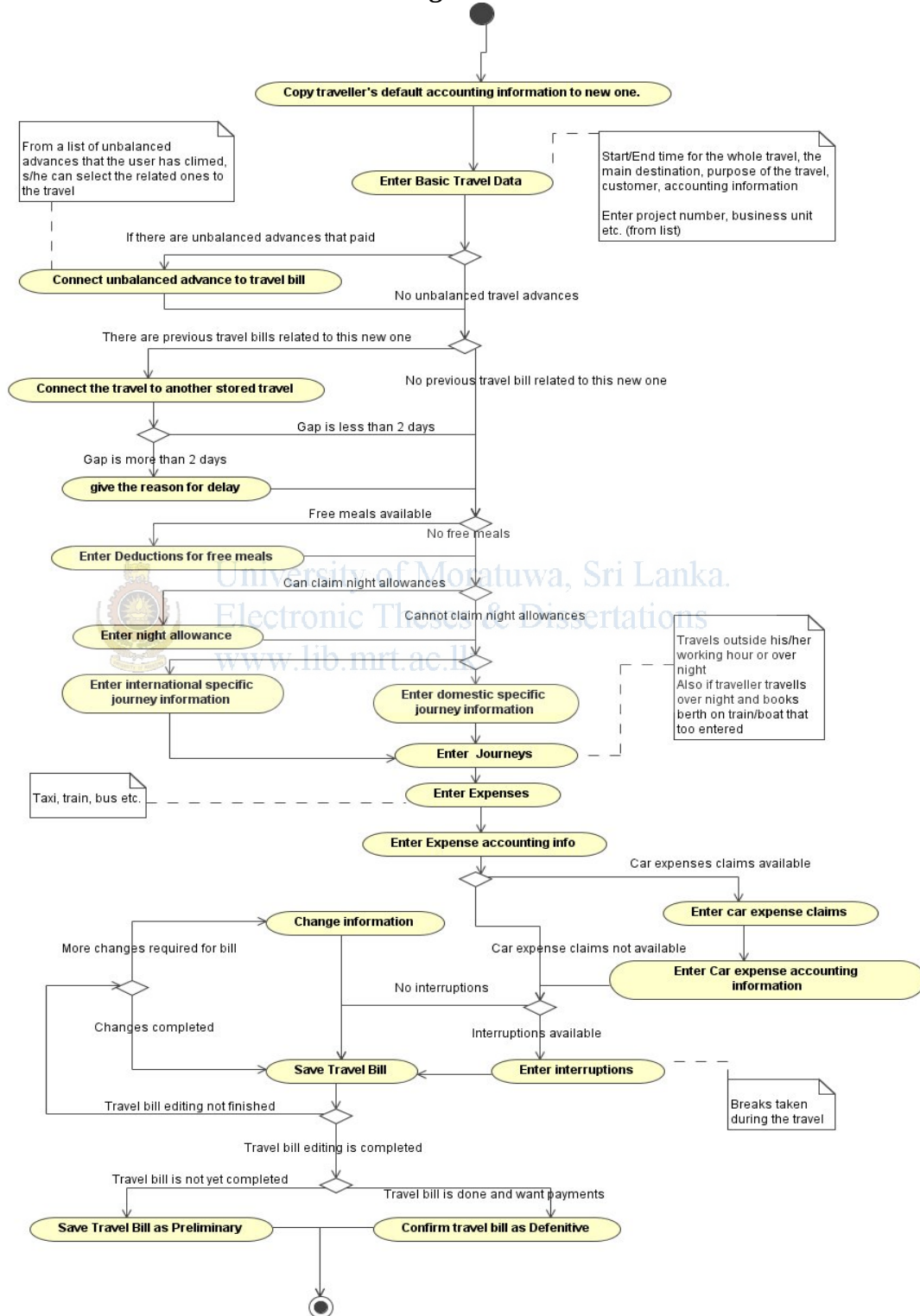


University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk

4.2.2 Activity Diagram

4.2.2.1 Activity Diagram – Create Travel Bill

Figure 4-2



Scenario Summary

The following flows are included in this use case.

Basic Flow: User Creates Domestic Travel Bill

Sub Flow A: Connect unbalanced travel advances to the bill

Sub Flow B: Connect the newly created travel bill to another old travel bill.

Sub Flow C: Enter deductions for free meals and night allowances

Sub Flow D: Enter journey information

Sub Flow E: Enter interruptions

Sub Flow F: Enter Car Expenses

Sub flow G: Enter other expenses information

Sub flow H: Enter other expenses' accounting information

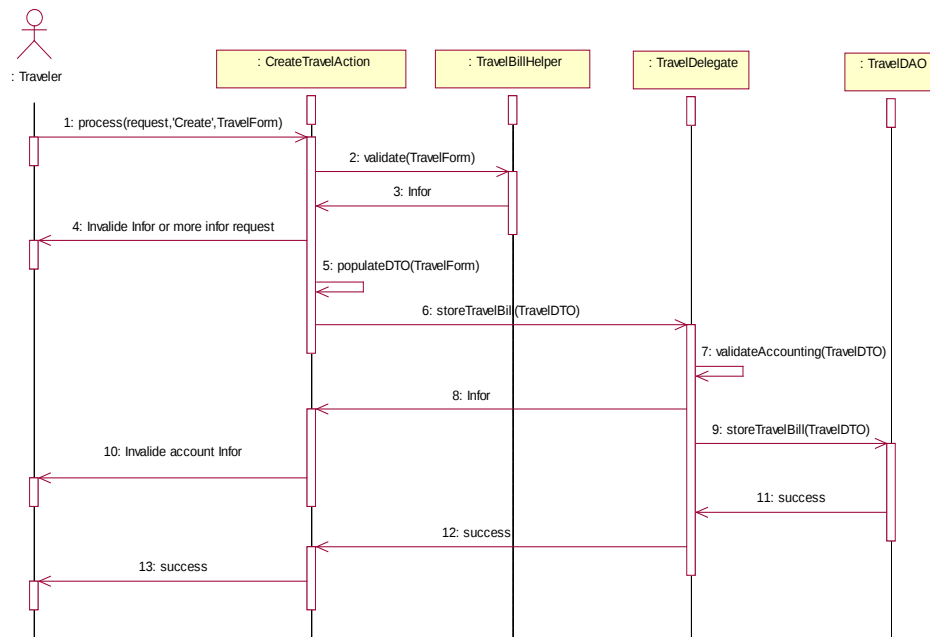
Sub flow I: Car accounting information updating/entering

Activity diagram shows use case realization and given in Appendix A.

4.2.3 Sequence Diagram Designing

4.2.3.1 Create Travel Bill

Figure 4-3



Sequence diagram shows object interactions arranged in time sequence. The sequence diagrams of the system are given in Appendix B.

4.2.4 Designing of Classes

The Travel Management System is developed under the J2EE technology using main components of J2EE framework. Following J2EE components, which are defined J2EE specification, are used in the system

- Java Servlets and Java Server Pages (JSP) technology components, which describes as web components run on the server.
- Enterprise JavaBeans (EJB) components define business components run on the server.

J2EE components are written in the Java programming language and are compiled in the same way as any program in the language. The difference between J2EE components and “standard” Java classes is that J2EE components are assembled into a J2EE application, are verified to be well formed and in compliance with the J2EE specification, and are deployed to production, where they are run and managed by the J2EE server.

Since the total system is designed according to the concepts of Object Oriented Design and Analysis methodology, it functions under the concept of classes in various layers of the system, using the instances created at those stages. Those main layers can be listed as the Presentation layer, Business layer and the Persistence layer.

Most importantly the business layer of the system is designed using the EJB classes as described above. Due to this reason the final representation of the main classes of the system are consisting of Session Beans classes and Entity Beans classes.

System is only accessible using a web browser through web interfaces, which are identified as boundary classes. These presentation layer components can be identified as the JSP pages those are defined as web pages.

The middle layer server process is broken down into several layers, which consist of several java classes. Business logic and the database handling part are done using those

middle layer classes. J2EE application server is running in order to process this middle layer functionality and database server is running for the storage purpose.

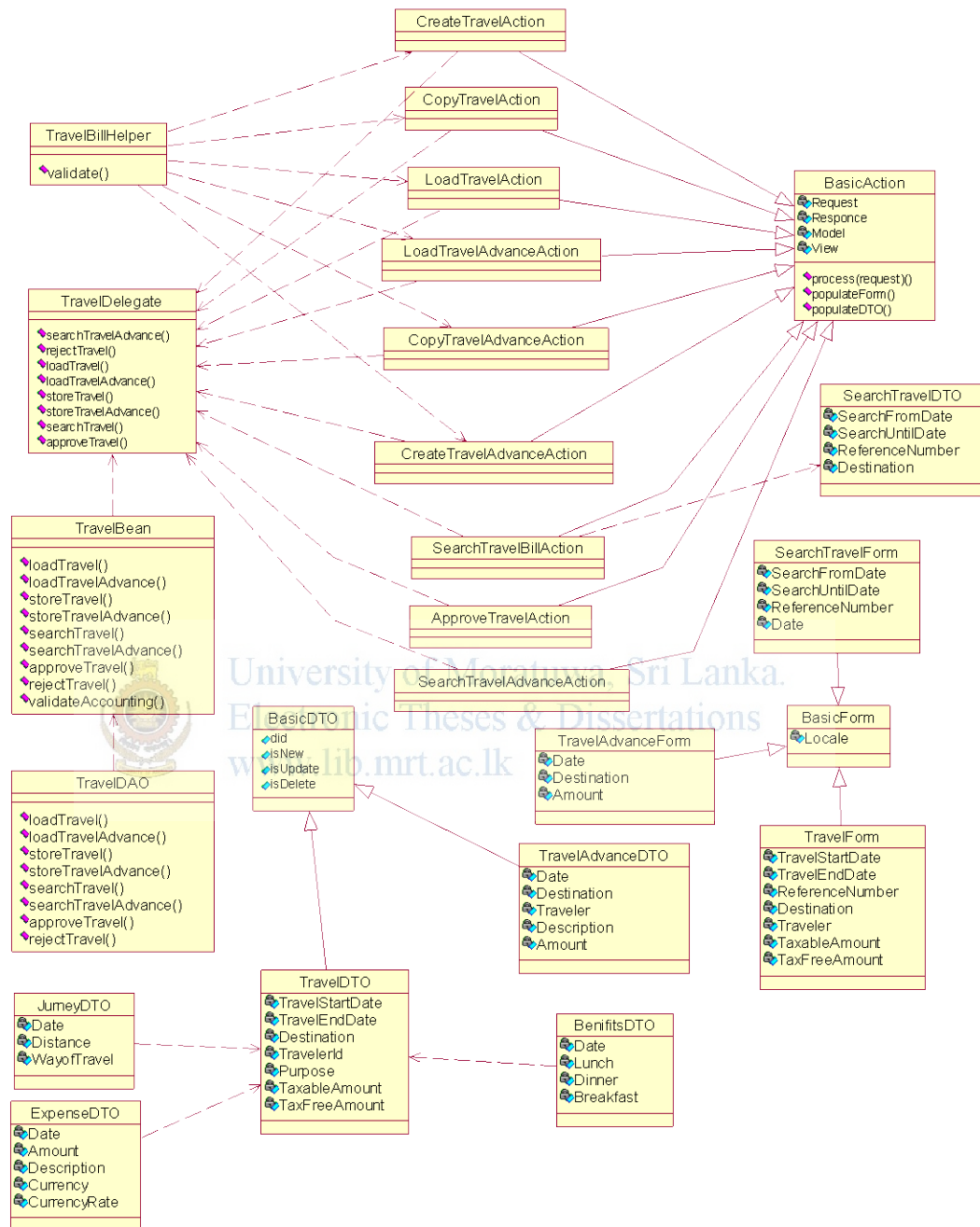
Business logic part is handled by the functionalities provided by the Session bean classes where as the database handling functionalities are handled using the DAO classes. All these business layer classes are designed as container managed persistence mechanism. So it uses the facilities provided by the EJB and J2EE server in manipulating business logic functionalities as well as database access processors.

Following figure shows the classes designed according to the EJB specification and some of the main classes are shown in this diagram. Example of some Session bean classes and Entity bean classes are shown in this diagram together with the other classes of the system.



University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk

Figure 4-4 Class diagram



4.3 Database Design

4.3.1 Obtaining the ER diagram

Procedures and steps followed during the physical design of the Travel Management System can be listed as follows.

- Gathering requirements and write the requirements document.
- Extracting appropriate use cases and creates use case diagrams.
- Create business use case diagram and complete the description of all use cases in the document.
- Finding business entities and their relationships.
- Identifying the classes required according to the requirements gathered and draws the initial view of the class diagram.
- Designing process of interaction diagrams – entity sequence diagrams.
- Identifying the interaction between classes and obtaining the final class diagram with the properties and actions.
- Starting from the final class diagram obtain the DB tables.
- Connected entities (DB tables) in the similar way as class diagram would be connected.

After following the procedure described above, it has arrived the final structure of all entities and their relationships as shown in the following diagram.

Only the main entities such as TravelDTO, TravelAdvanceDTO, TravelSearchDTO, etc. have derived as accordance to the final class diagram as described above. Other supporting entities such as Expense, Journeys, etc are derived from the entity relationship diagram it self, after identify such entities necessary for keeping the entities in a formal manner.

Figure 4-5



4.4 Design of User Interfaces

Since the system is designed in the form of dynamic web application, all the user interaction screens are web pages. One of the main components of J2EE framework, the JSP technology, is used as for this web page design.

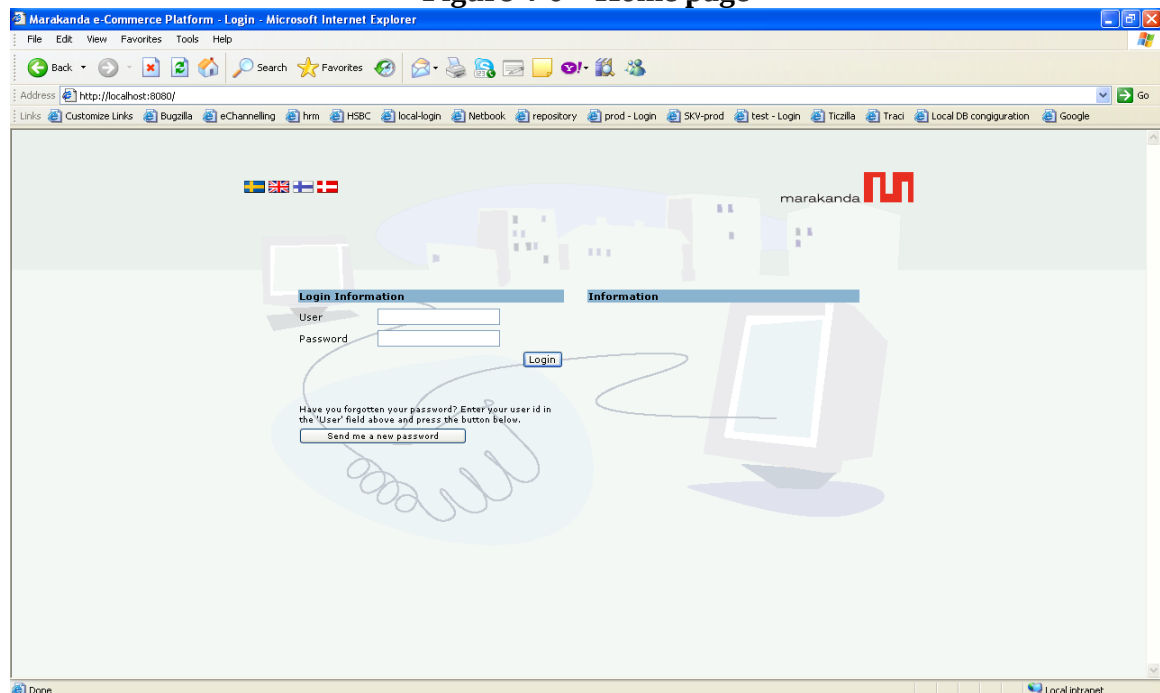
JSP technology allows to easily handling content that has both static and dynamic components. JSP technology makes available all the dynamic capabilities of Java Servlet technology but provides a more natural approach to creating static content. The main features of JSP technology are as follows:

- A language for developing JSP pages, which are text-based documents that describe how to process a request and construct a response.
- An expression language for accessing server-side objects
- Mechanisms for defining extensions to the JSP language

4.4.1 Home Page

Initial home page of this web application is showing in the following figure. This page also can be considered as the login screen for all user types.

Figure 4-6 – Home page



Users who intend to login to the system have to provide valid user name and a password in the spaces provided on this screen. Users are allowed to enter into the system after validating such user id and the password. Any messages relating to the login process also will display in this page.

4.4.2 Main Pages for Traveler and Administrator Users

Depending on the type of the user logged into the system, main pages appearing for each type of user are different from each other. This page contains the available system functionalities for each user group.

Following figures display the main screen for admin user followed by the main screen for the traveler user.

Figure 4-7 - Admin User Page

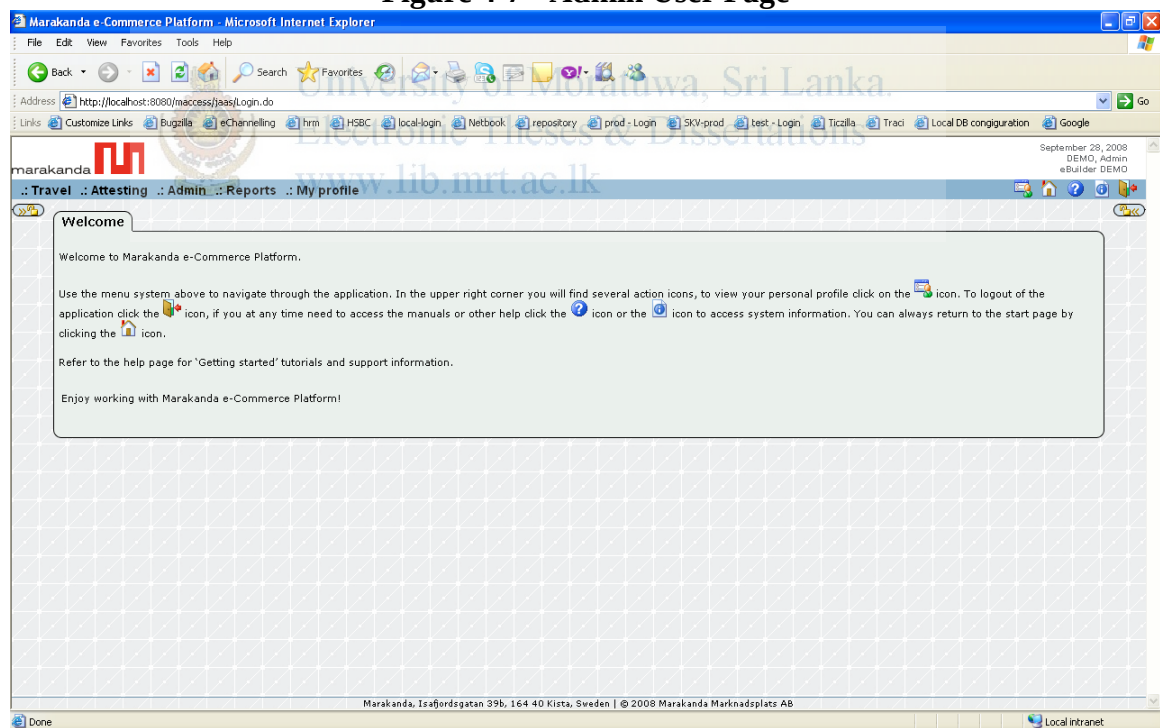
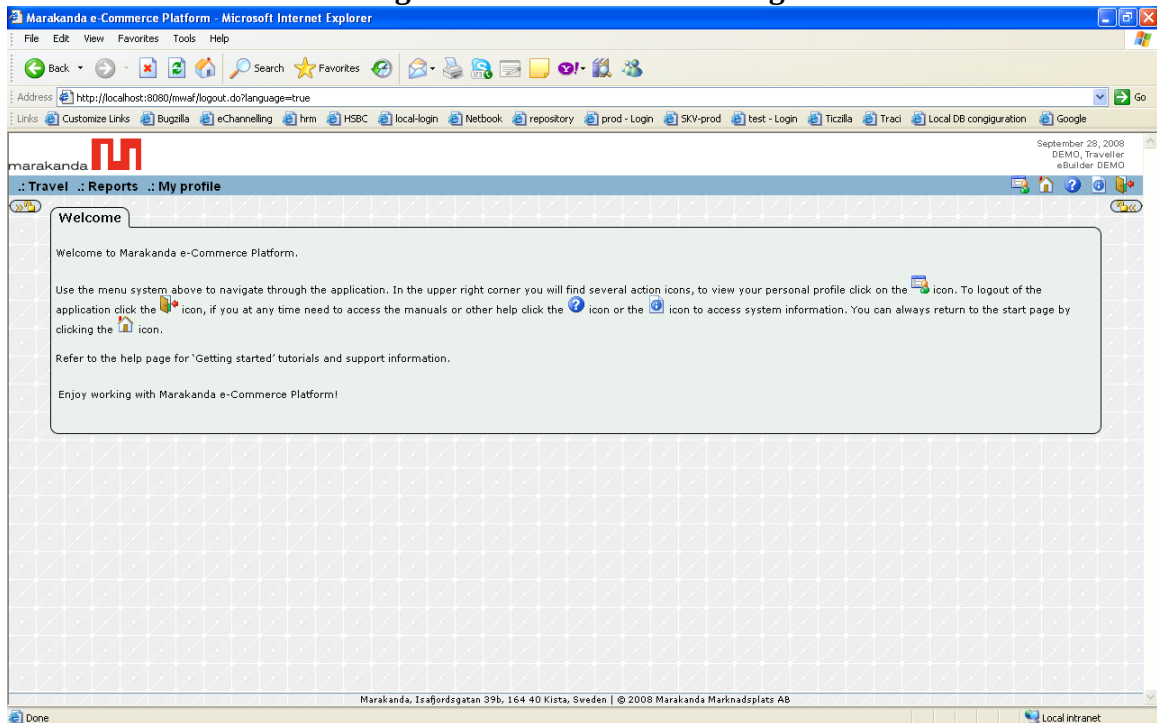


Figure 4-8 - Traveler User Page

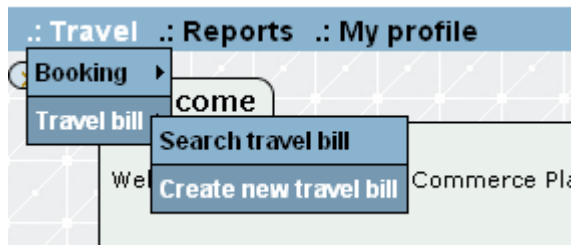


Both the main screen has the facility of viewing the welcome message in the main body of the screen. And messages will be displayed in the left hand side of the screen. This message board is a dynamic component.

Menu bar of each screen shows the available options for each type of user providing the navigation to each page of such functionality.

4.4.3 Menu Navigation Screen

Figure 4-9 - Menu navigation bar

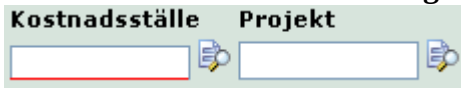


As it shown in the Figure 4.6, all the application navigation handles by menu tool bar.

4.4.4 Data Entry Screen

Some of the data entry screens in the system have the same behaviors. But most of the screen has its own ways depending on the usage. These data entry screens may include all the master data entry screens such as agreement master, policy master, etc and the transaction data entry screens such as travel bill data screen etc. Common behavior of these screens is described in the following paragraph.

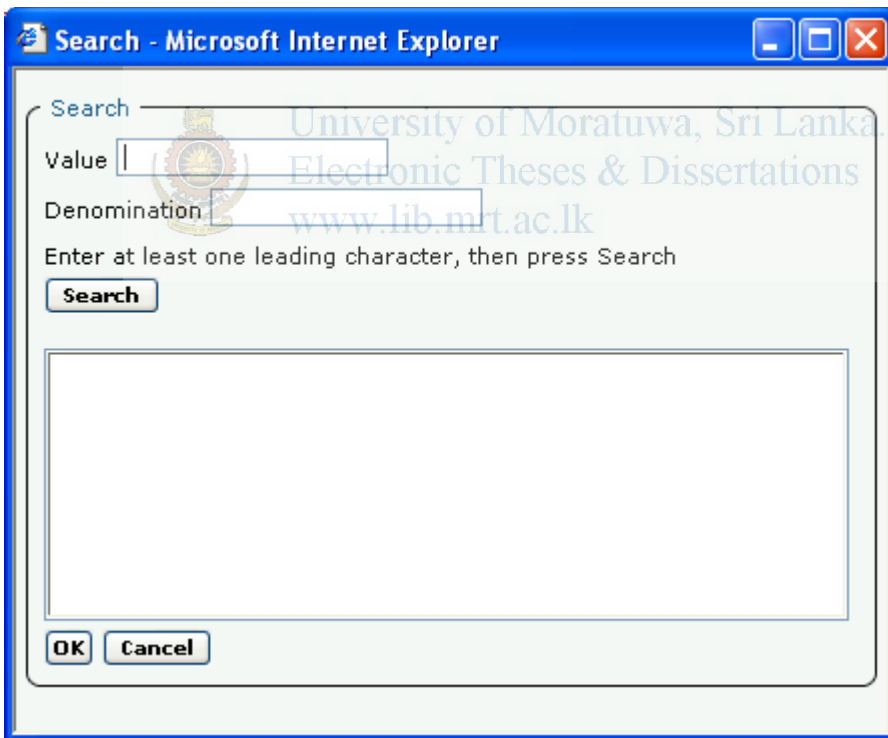
Figure 4-10 – Input Search



The image shows a data entry form with two input fields. The first field is labeled 'Kostnadsställe' and the second is labeled 'Projekt'. Both fields have a small magnifying glass icon to their right, indicating a search function. The fields are empty and have a light blue border.

By clicking on the icon showed in the Figure 4.7, which appears in the data selection shown in figure 4.8,

Figure 4-11 – Search Popup



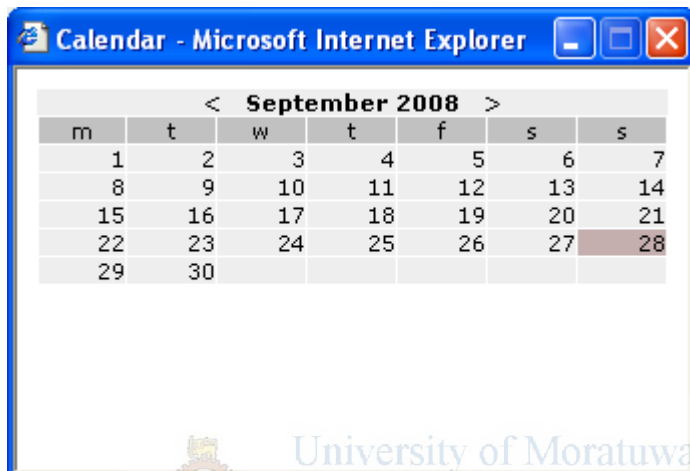
The image shows a 'Search - Microsoft Internet Explorer' window. It contains a search form with two input fields: 'Value' and 'Denomination'. Below the fields is a 'Search' button. A large empty text area is present below the search button. At the bottom of the window are 'OK' and 'Cancel' buttons. A watermark for the University of Moratuwa, Sri Lanka is visible in the background.

Figure 4-12 – Calendar Selector



By clicking on the icon showed in the Figure 4.9, which appears in the date selection shown in figure 4.10,

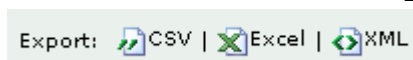
Figure 4-13 - Calendar



In the places where the user wants to enter and date values, it has given the facility to select a particular date using a graphical screen as shown in the Figure 4.10 above.

4.4.5 Search Screen

Figure 4-14 - Export icons



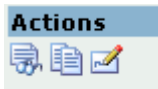
In the place where user wants to export to some search results, it has given a facility to select particular formats to export.

Figure 4-15 - Search

Bill no	Travel starts	Travel ends	Destination	Status	Actions
2004000030	12/16/04 12:00 AM	12/16/04 12:00 AM	Kristianstad	Approved	  

As it shown in the above Figure 4.12, the bottom part of each search screen contains the list of records for the corresponding data set. All the available records for the option is list here and with the assistance of “Next 10” and “Previous 10” buttons underneath the records, it is possible to navigate through all the records accessible for the option.

Figure 4-16 - Edit, Copy, Add Notes



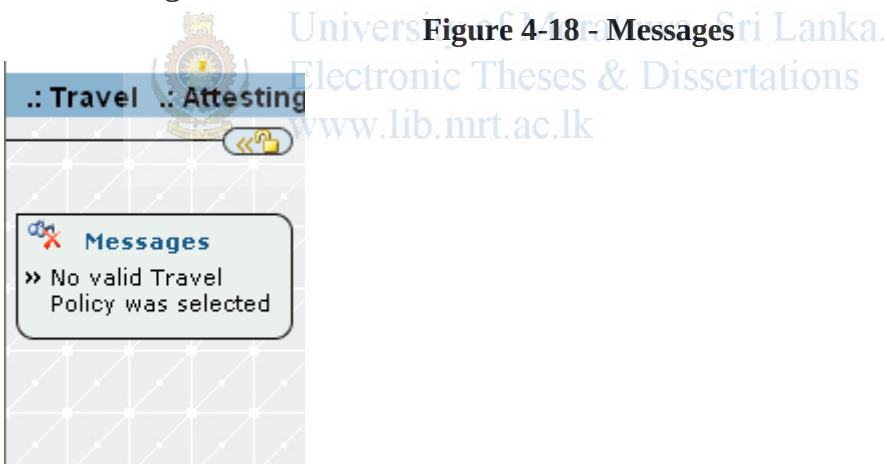
By clicking on the icons showed in the Figure 4.13, which appears in the end of each record, user can select the required record to the entry area of the screen for the purposes such as viewing more detail of the record, editing existing contents of the record or for deleting the record, coping data, add notes.

Figure 4-17 Search and Clear



By clicking on the search button will display the result list and clicking on the clear button will clear the search criteria.

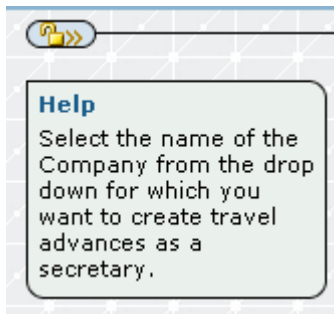
4.4.6 Messages



Data entry validation and the other login messages are display in the left panel on the system.

4.4.7 Help Text

Figure 4-19 - Help



Help text are displayed in the right panel of the system and whenever the user clicks on the input field caption, help text will be populated.

4.5 Summary

The design process of the system is explained step by step giving necessary diagrams. The selection of modeling techniques is argued giving reasons. Design of main components such as dynamic web pages, Enterprise Java Bean classes, other web components also discussed in detail.

Following chapter will discuss more detail about implementation.