

Analysis and Design

5.1 Introduction

The main focus of discussion in this chapter is how the problem domain analysis was conducted in order to gather software requirements, model it with UML, identify entity classes by conducting grammatical analysis, Analyse and design activities of the proposed software and arrive at the class diagram, database design and user Interface design.

5.2 Analysis of Existing system

In order to identify the requirements of the existing system a detail study at each user category was carried out. User Interviews, process observation, study of relevant documents and forms were the techniques used to gather requirements of the existing system

5.2.1 Functional requirements

Receive/ Issue clerk

1. system shall ensure the availability of required documents in the Notification
2. system shall validate the documents submitted in the Notification
3. system shall update the II database with received Notification details

5.2.2 Non functional requirements

1. system should not accept notifications before 09 00 hrs
2. system should not accept notifications after 15 45 hrs

(For the complete list of software requirements, refer appendix C)

5.2.3 Overview of existing system

The overview of the existing manual system is described in the figure 5.1

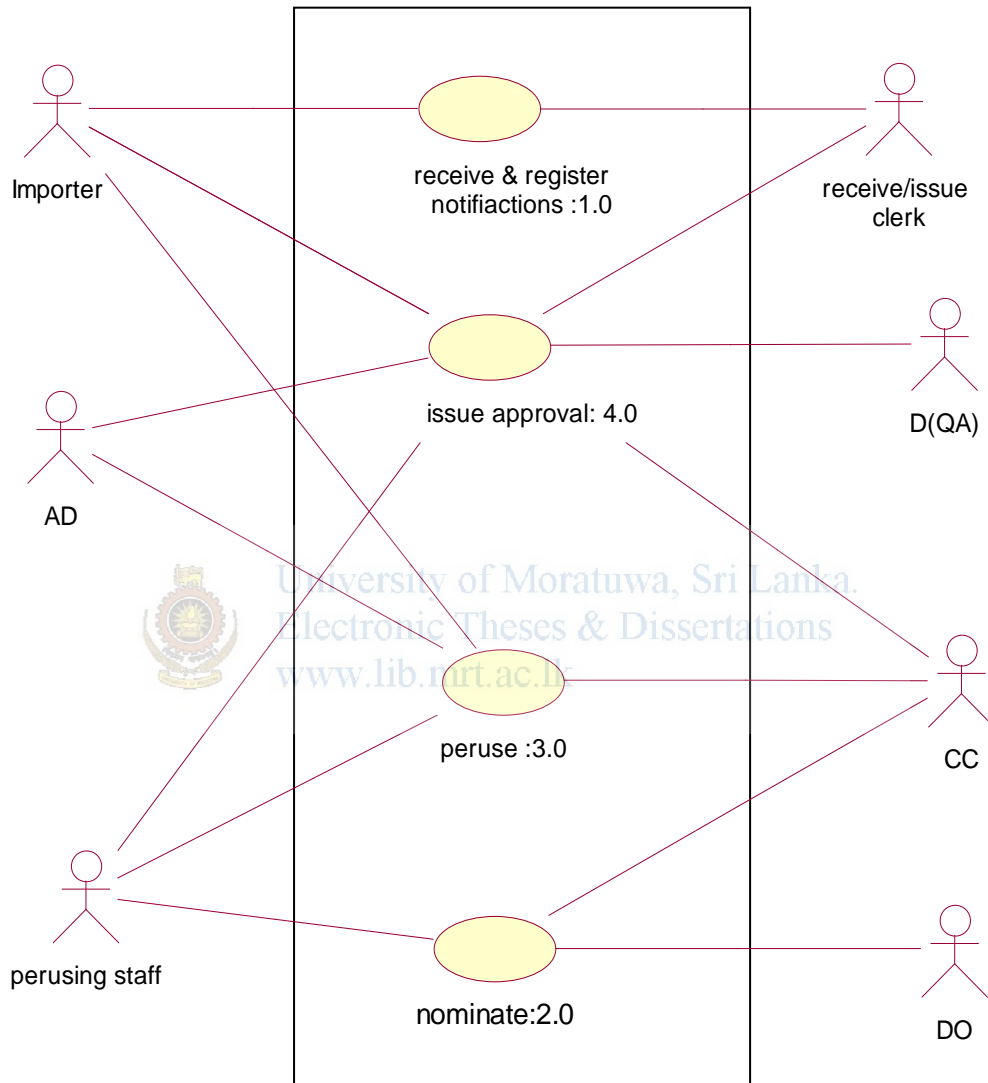


Figure 5.1 – Overview of the existing system

(For more detail level analysis – refer appendix C)

5.2.4 Use case descriptions of the existing system

System: Entry processing of compulsory import inspection scheme (CIIS)

Use case: receive & register notifications (1.0)

Actors: importer, receive/issue clerk

Data:

Receive/ issue clerk at the counter verifies the availability of the form FM-II-01 in three copies, a copy of bank stamped invoice, packing list, B/L in the Notification and ticks the checklist of section A1 of FM-II-GN-03. After that, the clerk validates the FM-II-01 for the completion of the required fields. If satisfactory, the Notification is registered after entering the following information, in the database. Else, return it to importer for the corrections.

- Name and address of the consigner
- Name and address of the consignee
- Country of origin
- Number and date of invoice
- Number and date of B/L
- Total net weight
- Description of goods(product, brand, type, sizes, quantity, etc)

Also the following information will be entered in the database if available only.

- Customs Entry number
- Shipping marks and container numbers
- Organization that has issued the quality certificates

Stimulus:

The importer submits a notification at the counter and requests SLSI decision for the consignment.

Response:

Entry is registered in the system. System will assign an Entry No.

The assigned Entry No. is printed on the FM-II-GN-03 along with the date of receipt, time of receipt, name of the importer, Name of the exporter, are printed on the FM-II-GN-03. Also manually, print the Entry No on rest of the pages in the Entry. After all, the Entry will be placed in the relevant tray.

Comments:

(Other use case descriptions are given in the appendix C)



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5.2.5 Dynamic behavior view of the existing system

Figure 5.2 shows the different activities taking place when receiving a notification in the manual system



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Figure 5.2- Activity diagram for receive & register notifications

(Other activity diagrams and use case descriptions are given in the appendix C)

After modeling the different views of the existing system, a check list was prepared to ensure that all the identified software requirements were covered by the use cases and activity diagrams

In the next stage a grammatical analysis was conducted in order to identify entity classes.

Table 5.2 describes the way the grammatical analysis was conducted. Nouns, noun phrases and verbs, verb phrases were separated initially. In the next stage carefully identify the candidate entity classes and methods ignoring just language expressions [7, 19]. In this effort a good understanding in the problem domain is very useful

Table 5.1 shows the use case checklist of the existing system

Use case number	Software requirement number	Use case description number	Activity diagram number
1	1,2,3,4,5,6,7,8,35,36	01	01
2	10,11,12,16,17,18,19	02	02
3	13,20,21,22,23,24,31,37	03	03
4.1.1	25,26,27,28,29,30,32,33,34	04	04
4.1.2	14,15,9	05	05

Table 5.1 – use case checklist of the existing system
(Please refer Appendix C for further information)

5.2.6 Grammatical Analysis of the existing system

C – Class, a – attribute, m – method

Nouns, Noun phrases	type		Verbs or verb phrases	type
Receive/ issue clerk	c		Verifies	m
the counter	c		Ticks	m
form FM-II-01	c		validates	m
bank stamped invoice	a		is registered	m
packing list	a		Else return it to importer	m
B/L	a		submits a notification	m
the Notification	c		System will assign an Entry No	m
the checklist of	a		Entry will be placed	m
Form FM-II-GN-03	c			
the database	a			
Name and address of the consigner	a			
Name and address of the consignee	a			
Country of origin	a			
Number and date of	a			
Number and date of B/L	a			
Total net weight	a			
Description of goods	a			
invoice	a			
Customs Entry number	a			
Shipping marks	a			
container numbers	a			
Organization that has issued the quality certificates	a			
The importer	c			
SLSI decision				
Entry	c			
date of receipt	a			
time of receipt	a			
name of the importer	a			
Name of the exporter	a			
tray.	a			
items in the invoice	a			
standards	a			
the corrections.	a			

Table 5.2 – Grammatical analysis of the existing system
(For complete grammatical analysis refer appendix C)

5.3 Proposed system

5.3.1 Functional requirements

Importer

1. Importer shall have a facility to submit notifications online
2. system shall validate the contents of FM-II-01 before accepting it into the system

Receive /issue clerk

3. Receive/issue clerk shall be able to print invoices
4. receive/issue clerk shall be able to view the pending Entry for issue

5.3.2 Non functional requirements

1. The importer should receive a message for successful submission within 12 seconds
2. system should be unavailable from 23 00 h - 00 00 h for backups
3. system should not allow importers to gain access to others' Notifications

(For complete list of software requirements refer appendix D)



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5.3.3 System Architectural design

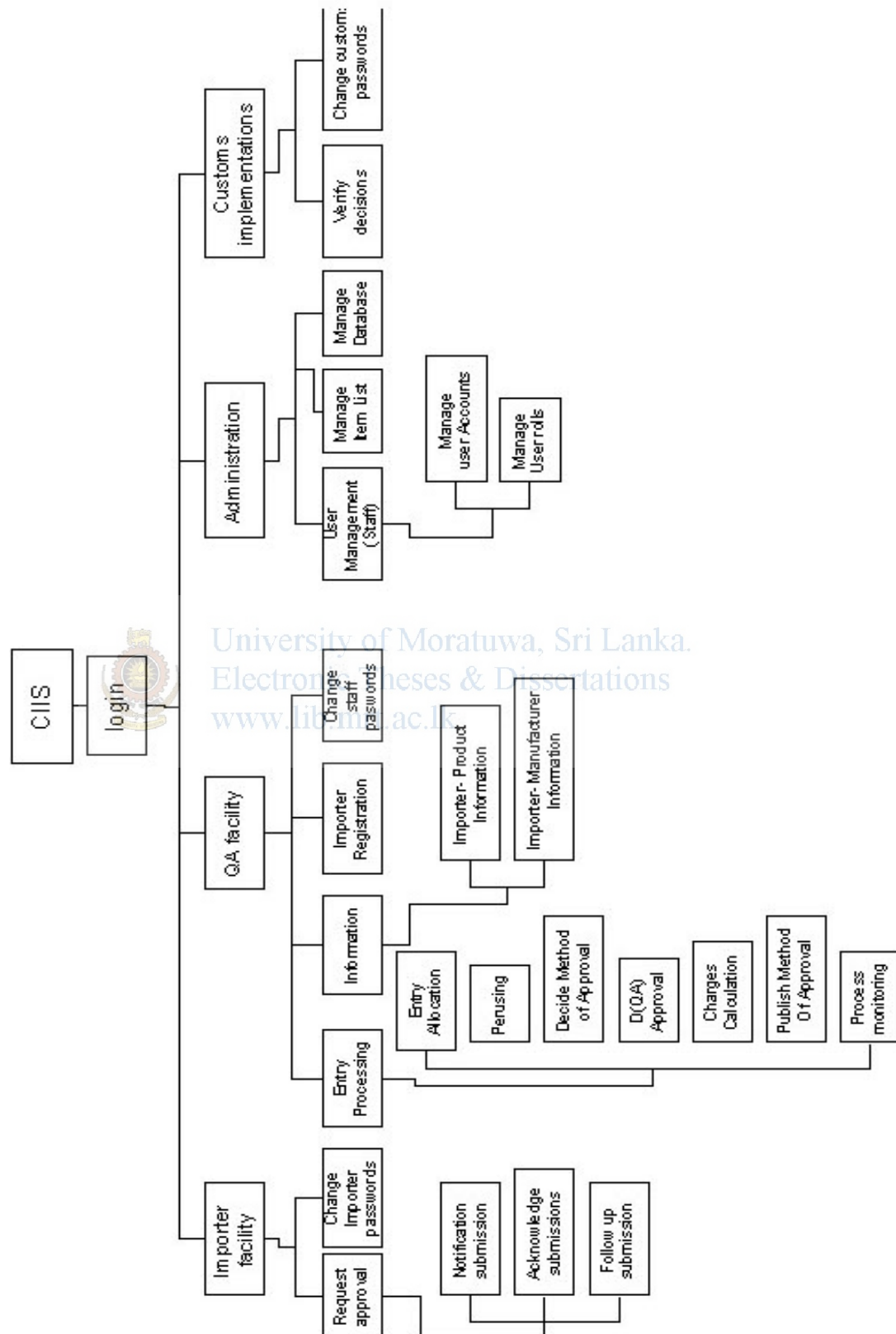


Figure 5.3 - System Architectural design

5.3.4 Proposed system overview

Overview of the proposed system is shown in the figure 5.4

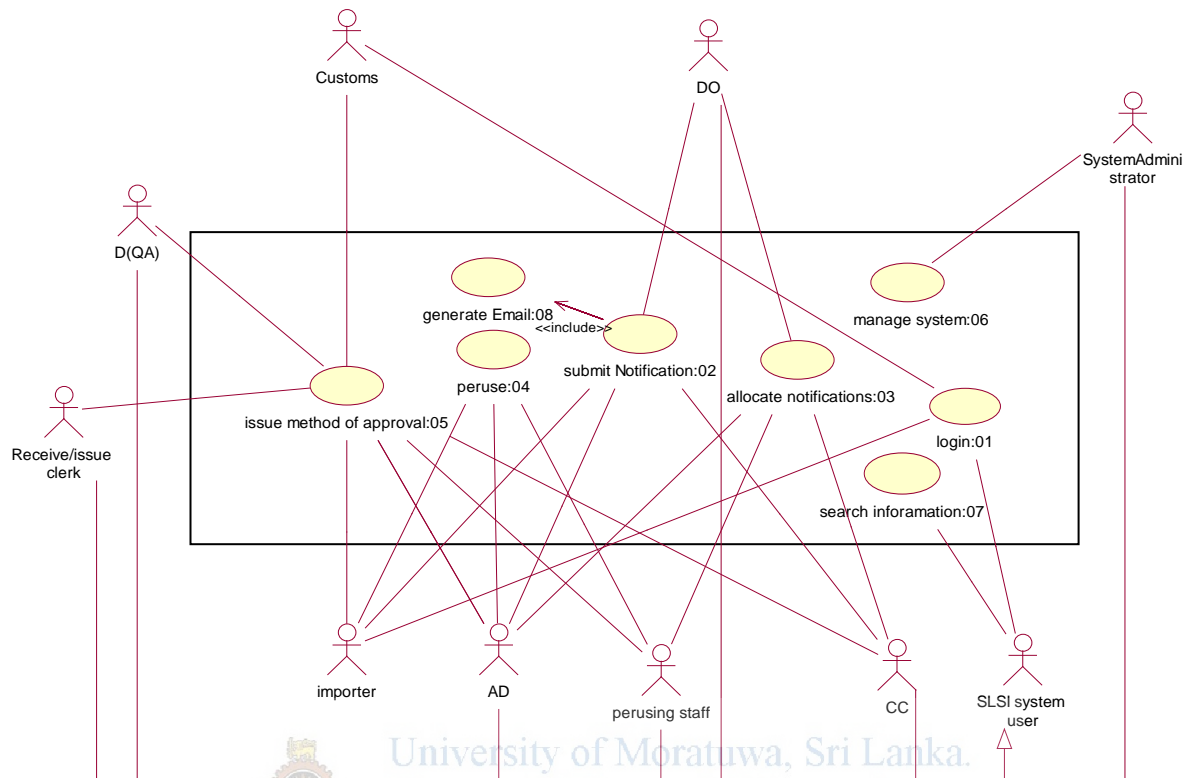


Figure 5.4 –proposed system overview

(For more detailed analysis refer appendix –D)

As the First step of using the system, all users are required to login to the system properly with their user IDs, Passwords and roles. Only the SLSI users can have more than one role. The Use case description of the login process is given in the table 5.3

5.3.5 Use case descriptions of the proposed system

Use case name	1:0	Login
Description	This use case is started by the system user. Once a system user is login to the system with his username , password and role the system allows to use all the privileges given to him or her.	
Actors	All system users.	
Pre conditions	System must be available to users System users have been added to the system by the administrator	
Post conditions	User has logged into the system and relevant user interface appeared.	
Flow of events	<ol style="list-style-type: none"> 1. user requests login in to the system login interface is appeared and user enters his username and password 3. system validates username , password and role 	



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Table 5.4 given below is the use case check list prepared for the proposed system

Use case number	Software requirement number	Use case description	Activity diagram number
1	35	1 -login	01 –Login process
2	1,2,3,4,5,6,28,40,41	2 -submit notifications,	02- submitting notifications,
3	39,40,41,16,27,6	3 –Allocate notifications	03- Allocating notifications
4	18,21,25,28,29,40	4 - peruse	04 – perusing Notifications,
5.1.1	18,19,20,22,33,34,40	5.1.1-Decide Method of approval	05- Deciding method of approval
5.1.2	13,14,15,9,10,11,7,40,41	5.1.2 – Publish Method of approval	06- publishing method of approval
5.1.3,	7,23,26,41	5.1.3 – publish final decision,	07- publishing final decision,
6.1.1	31,32	6.1.1 – maintain database	08 - Maintaining database – Record management
6.1.2	33	6.1.2 – print management reports	09 – printing management reports
6.1.3	30	6.1.3- Manage users	10 – Managing users
7	37	7- search information	11- Searching Information
8	5,15,24,25,26	8 – Generate Email	12 – sending Acknowledgement Email

Table 5.4 – use case checklist of the proposed system

As the next step in the process a grammatical analysis as indicated in the table 5.5 was conducted to find major system classes. Also initial understanding of possible interface classes were obtained by looking at the use case diagrams boundaries and crossing points of swim lanes of activity diagrams . Preparation of sequence diagrams was very helpful in identifying the most appropriate interface classes and control classes of the proposed system. Also the communication takes place among various objects in the proposed system.

5.3.7 Grammatical analysis of the proposed system

Noun or Noun phrase	Type		Verb or Verb phrase	Type
login interface	c			
username	a		user requests login	m
password	a		user enters his username and password	
privileges	a		validates username and password	m
Importer	c		message for successful submission is displayed	m
message for successful submission	a		acknowledgement Email has sent to the importer	m
acknowledgement Email	c		Summery of received Entries displayed at CC, AD& DO is updated	m
Entry No	a		Importer opens the web form of FM-II-01	m
time of submission	a		importer completes the form	m
importer's name	a		He moves in to the attachment page	m
item	a		Bank stamped invoice, packing list and B/L in PDF format is attached .	m
invoice number	a		quality certificates, test reports, importer's guarantee letter and catalogues are attached as optional documents	m
relevant AD's name	a		Importer submits the completed document	m
Summery of received Entries	a		System validates the notification	m
web form of FM-II-01	c		System verifies in the database for duplicate submissions	m
attachment page	c		System updates the processing stage shown to importer	m

Table 5.5 – Grammatical analysis of the proposed system

(Refer appendix D for the grammatical analysis conducted on use case descriptions of the proposed system)

5.3.8. Object Interaction view of the proposed system

Figure 5.6 shows the sequence diagram for login process

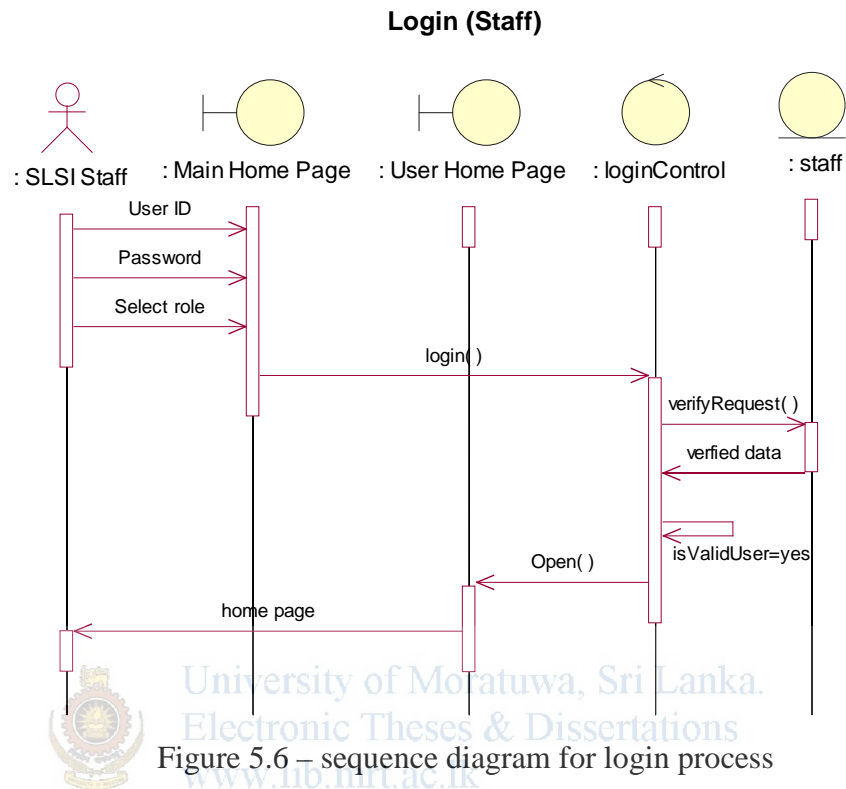


Figure 5.6 – sequence diagram for login process
(For more sequence diagrams refer appendix E)

5.3.9 Class diagram

In preparation of the class diagram, first it is needed to find the communication among the classes. At this point sequence diagrams are very useful to identify how the communication among System, Boundary and control classes take place. Please refer appendix F – Class diagram.

5.3.10 Database design

In designing the database, it is very important to understand what data is going to be stored in the database, what applications are going to be built on top of it and what operations are most frequent. Therefore, the requirements analysis was started with the aim of collecting information for the above basic questions. The selected approach for requirement analysis involved discussions with users, studying the forms, formats and different register books used in the current system. Also the personal experiences with the manual system were very useful in this aspect. Further, future possible expansions of the system were also considered.

After the requirement analysis, the Entity Relationship Model (ERM) based on the identified data requirements was prepared. This model is an abstract conceptual representation of structured data for CIIS. Based on the ER diagram, initial database table structure was prepared. In the next stage, the table structure was normalized up to the third normal level in order to overcome insertion, deletion & updation anomalies in the data handled by the database. Please refer Appendix G – Entity Relationship Diagram, ER mapping.

The database was designed using MySQL 5.0.5. The name of the database is ‘ciis’.

5.3.11 Graphical user interface design (GUI)

Proper Graphical user interface design ensures that users work with the system in a convenient manner in order to achieve their performance objectives. In order to produce a good GUI it is important to decide as per Human Computer Interaction concepts, the amounts of “knowledge in the Head” and “knowledge in the world” for a user interface.

Therefore in deciding these factors, users’ educational levels, their experience with other systems, computer literacy, level of interaction with the system, agronomical factors such as Eye fatigue, physical stress due to too much of typing etc. were considered.

5.3.12 User interface design decisions

- I. A simple navigation structure using html anchor tag “<a href >” is used for the purpose of interacting and navigating among user interfaces. When a user logged through the log-in interface, his page is displayed. Home page contains all the names of user interfaces which are linked to relevant user interface using “<a href >” tag. (Please refer fig H.1 of appendix H)
- II. Use of a single user interface in order to perform Add, Edit & Delete tasks on the same dataset. For example, “ItemList.php”. This approach was mainly used in GUIs for data entry tasks in order to achieve high user productivity and accuracy of data being entered. (Please refer fig H.2 of appendix H)
- III. Two different background colors are used to differentiate adjacent records in the captured data display tables (e.g. itemList) and other processing progress display tables (e.g. DQA_Home_Page, AD_Home_Page etc.)(Please refer fig H.3 of appendix H)
- IV. System dynamically highlights the records being referenced in the above mentioned tables in III, by red color when pointed by the mouse pointer. This feature was added to the GUI in order to avoid users’ eye fatigue, and to reduce the time taken for locating a record. (Please refer fig H.4 of appendix H)
- V. Disable the “DELETE” button in “ItemList” GUI when performing an Editing task of a record in order to avoid accidental deletion. (Please refer fig H.5 of appendix H)
- VI. Use of dropdown lists, checkboxes, radio buttons at every possible place in order to minimize the “knowledge in the Head” for the user. Thereby it was expected to achieve higher Operability and Efficacy. (Please refer fig H.6 of appendix H)
- VII. Every stage of Entry processing is performed using a single user interface created by combining all required forms and relevant documents in a three pane HTML frame. Therefore the user can refer all the documents that are required to complete the processing form, in the same screen that will in turn increase the Entry processing efficiency. (Please refer fig H.7 of appendix H)

VIII. All the forms used in different stages of Entry processing have been designed similar to the relevant parts of the processing form used in the manual system. This approach will increase the understandability and operability of the software.

E.g., PO_ProcessingForm, AD_ProcessingForm, D (QA)_ProcessingForm

All the interfaces have a common format, fonts, font styles, font sizes and other font formatting and a common template for all the data entry and reports interfaces. A cascading style sheets were used to control these properties of the interface. Every interface has a header which shows the heading of the interface.

The System will be used by different users who have different preferences and wishes. Thus, it was decided to use very few numbers of colors when designing user interfaces. Colors used in the interfaces can be very easily changed using the style sheet. Table 5.5 describes some important tags of the style sheet used in Interface designing.



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Feature	Design details
Main Page background table properties (Relevant CSS tag is '.background')	margin-left: 5% ; margin-top: 5% ; margin-bottom: 5% ; margin-right: 5% ; width : 90% ; height : 90% ; border : 2 ; cellpadding : 0 ; cellspacing : 0 ; background-color : #ffffff; bordercolorlight : #000066 ; bordercolor : red ;
All data entry pages background table properties (Relevant CSS tag is '.bgEntryTable')	margin-left :5% ; margin-top :2% ; margin-right:25 ; width :90% ; background-color :#999999 ; border-left: 3px solid #55634f; border-right: 3px solid #55634f; border-top: 3px solid #55634f; border-bottom: 3px solid #55634f; font-size : 09pt; color : #000000; font-family : sans-serif, arial,verdana;
All Home pages background table properties (Relevant CSS tag is".searchTable")	.background-color : #D9D9D9 ; /* #999999 #CCFFFF */ border-left: 3px solid #666666 ; border-right: 3px solid #666666; border-top: 3px solid #666666 ; border-bottom: 3px solid #666666 ; cellpadding : 0 ; cellspacing : 0 ; font-size : 09pt; color : #000000; Font-family : sans-serif, arial,Verdana; /*bordercolor : #0066CC;*/ }
Background of all pages (Relevant CSS tag is '.bgColor')	background-color : #cccccc;

Table 5.6 - Interface design details

5.4 Problems faced during analysis and design

- Difficulty to balance office work and project work because of the shorter Period I had for the project
- Scheduled meetings were postponed many times due to user's other engagements.
- From time to time some users come up with new requirements to be added
- Sometimes users are not certain about the practices of the current process (i.e. inconsistent ideas from different users)
- Also, at the beginning I was confused of representing “extend” and “include” relationships in the use case model. This was resolved with the supervisor's guidance
- At the beginning, I didn't have a clear idea about what to capture in to use cases. As a result, too many use cases were created complicating the model unnecessarily. However, supervisor's guidance was very helpful at this stage to come up with a very concise use case diagram.



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5.5 Summary

The key points of discussion in this chapter are analysis of the existing system, finding software requirements and model the existing system for further understanding of its implementation.

Based on these findings, software requirements of the proposed system were defined and designed, the proposed system and modeled it with UML, to have better in-depth understanding of static and dynamic behaviors of the system.

As a major result of the analysis phase system architecture was designed and also at the end of design phase class diagram was produced

In the next chapter, implementation of the proposed system, will be discussed