References

[1] http://bioinformatics.oxfordjournals.org/cgi/content/abstract/23/18/2504

[2] http://www.selectscience.net/lims/product-directory

[3] http://www.ebiosys.com/Products.aspx

[4] http://www.maxima.co.uk/mfgpro

[5] http://www.starlims.com/STARLIMS_V10_Brochure.pdf

[6] http://www.reuters.com/article/pressRelease/idUS222836+09-Jan-2008+PNW20080109

[7] Ian Sommerville (2009), Software Engineering, 7th Edition, Software Process P 86-110

[8] http://atlas.kennesaw.edu/~dbraun/csis4650/A&D/UML_tutorial/what_is_uml.htm

[9] http://en.wikipedia.org/wiki/Structured_Systems_Analysis_and_Design_Methodology

[10] http://eliw.wordpress.com/2006/11/14/php-editor-choice/

[11] http://scitec.uwichill.edu.bb/cmp/online/cs22l/waterfall_model.htm

[12] http://www.westga.edu/~bquest/1997/object.html

[13] www.cs.umb.edu/~dqg/papers/uml.doc

[14] http://www.unilever.com.lk

Appendix A

Terms and Acronyms

Test Request	A request sent by the user departments to the QA and Laboratory department, requesting a Laboratory Test to be performed
Product Variant	Variations of a product by means of weight, size and appearance
Product Specification Chart	A standard document, listing all products and the product variants available under each product. Each product variant has a list of test parameters
User Role	Represent the User Type which were identified during the analysis
OOP	Object Oriented Programming
OOAD	Object Oriented Design
UML	Unified Modeling Language
PHP	Server side scripting language which was used to develop the software and stands for "PHP: Hypertext Preprocessor"
Load balancing	Evenly distribution of inward requests, in a multi server environment
Fault tolerance	Fault-tolerant describes a computer system or component designed so that, in the event that a component fails, a backup component or procedure can immediately take its place with no loss of service
Entities	Things about which a business needs to record information
Relationships	The associations between the entities
Process	Activities that transform data from one form to another
Data stores	The holding areas for data
External entities	What sends data into a system or receives data from a system
Data flows	Routes by which data can flow
SQL	Structured Query Language
SRS	Software Requirement Specification

Table A.1: Terms and Acronyms

Appendix B

Feasibility study of the proposed solution

B.1 Economic Feasibility

B.1.1 Cost of Resources needed for Development

For the development of the system, the estimated time for requirement gathering, analysis, system design, DB design, system development and testing of each module are as follows;

Task Description	Man days
• User Management Module	10
• Laboratory Information Management Module	14
• Workflow Module	8
• Product Specification Management Module (Interface)	7
• Test Report Search Module	7
• Test Report Archiving Module	10
Total Man Days	56
Cost per man day (8 man hours) is estimate to be (USD)	125
Total estimated cost (USD)	8, 400

Table B.1.1: Estimated timelines for the proposed solution

B.1.2 System Requirements

- **Web Server Software** – Apache Tomcat (Open source software)
- **Data Base Server Software** – Oracle Database (The system will be developed on Oracle XE version, which is available FOC (Free Of Charge)
- **Internet Web Browser Software** – Internet explorer will be used by the system users to access the system and is installed by default with the Windows OS.
- **Intranet** - System will be a Web enabled and it is to e used over an intranet connected through a Local Area Network (LAN) which is already available at Unilever premises.
- **Hardware** - One Server to host the Intranet Application, 1 PC for the Lab Manager, PCs for Chemist and QA personnel who will be using the system, Printer/s to print reports and CD burner to take system backups. Management has agreed to allocate a server to host the system and other required hardware is currently available at Unilever.

Therefore, the cost involved with this proposed project is the cost for Human resources and hence the development will be done the candidate, there will be no cost for the client.

B.1.3 Training

The users who are going to interact with this system have computer knowledge of using MS Office products and accessing the internet using the web browser. However the system specific training needs to be done for all the users in each "user type" separately and will be scheduled in 5 working days. The User Trainings will be done Free of Charge by the candidate.

B.2 Technical Feasibility

B.2.1 Development Risk

- The estimate time for module development may not be accurate as there is lot of technological R&D to be undertaken to provide the expected features/ functionalities, hence the completion date might be extended.
- Changes in management decisions will change internal processes and hence the system might have to be modified accordingly, and hence the expected timelines would not be achieved.
- New people who might get involved due to the changes in the positions of key people, who got involved throughout the initial Requirement gathering process, might come up with different set of functionality, which may lead to a scope creep and extend the project duration.
- The development will be done by the candidate alone and he's currently working for a company. There might be projects which will need candidate's involvement on day and night basis and continuously on weekends. This might again affect the development timelines.
- Developments will be done on the PC owned by the candidate and there can be risks of loosing work due to hard disk failure. A backup procedure, after completing each day developments, to be adopted.

B.2.2 Resource Availability - Hardware & Software

H/W for development

Candidate's laptop will be used for developments and is powerful enough to run a DB server, Web Application server and the IDE simultaneously.

S/W for development

- **Macromedia Dreamviewer** will be used to design the GUIs.
- **PHP** will be used as the development language and is Open Source.
- **Macromedia Dreamviewer** will be used as the Interactive Development Environment (IDE) for PHP programming
- **MySQL/Oracle XE** will be used as the back end Database which is also available Free of Charge.

- **Developer level testing on multi user distributed environment -** This will be done at the Uniliver premises using the intranet, once the completion of the development of the system. A date to be fixed with the Unilever management.

B.2.3 Technical Know-how

- Candidate is competent in system designing, database designing, installing and configuring databases, application servers and IDEs, Structured Query Language (SQL) and database functions.
- However there is a challenge of learning PHP for development of web enabled interactive applications. Candidate is in the process of learning PHP. Also the skills in GUI designing have to be further improved.

B.2.4 Technology

- The technologies that will be used for this project are PHP, MySQL/ Oracle XE, HTML, Apache / Apache Tomcat which are industry standards for development of lightweight scalable web enabled software.

B.3 Legal Feasibility

B.3.1.1 License

Since we are using open source or FOC (free of charge) software for the development as well as the deployment, there is no need to obtain license from the vendors.

B.3.1.2 Agreement

An agreement will be signed between the Unilever Sri Lanka and the candidate, granting permission to analyze internal processes which will be useful in developing the system and to keep and maintain system related documents and candidate to handle them with confidentiality among the competitors.

B.4 Cost Benefit Analysis

B.4.1 Time

With the proposed system, it is expected to reduce the delays which occur due manual delivery of Test requests and Reports between the users involved in

the process through the intranet communication, which will drastically improve the decision making process.

Reduce the time taken to communicate the Test results of Semi-finished products over the phone, which was done by each chemist. With the introduction of the new system, chemist will be able to save time to perform more tests and to allocate their time for more productive work.

B.4.2 Information Storing

Loss / misplacement of paper work will not occur as all the data will be kept and maintained centrally and backups will be taken on to CDs on daily basis.

The recurrent cost spent on papers will be reduced as only the most needed reports to be printed on paper and others data/reports to be viewed by log-in to the system on-line. Information can only be accessed by the relevant parties and will prevent reports/data being exposed to the others.

B.4.3 Data Quality

The system will have the most up to date Test Requests that are visible to the relevant chemist based on the Test category at the prioritized order.

QA personnel will have all the completed list of Test report to perform compliance tests. Auditors will have the test results upfront to perform their audits without wasting extra time on finding them.

Factory users will be able to retrieve the most up to date Tests results on the Semi-finished products, avoiding the ambiguity that might occur through verbal communications over the phone.

Appendix C

Activity Diagram of the Existing System

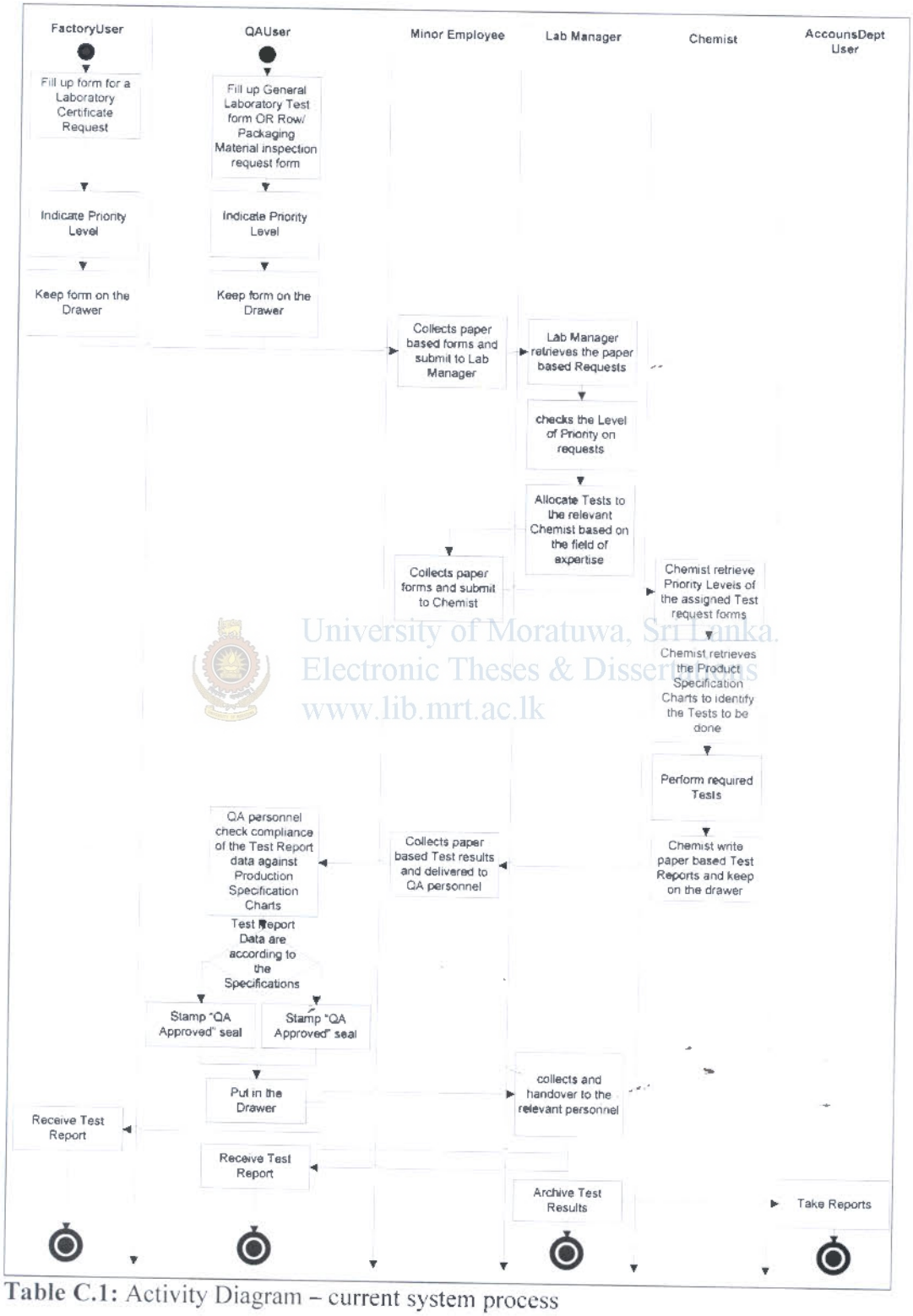

Table C.1: Activity Diagram – current system process

Appendix D

Analysis of current manual process

D.1 Use Case Diagram for the existing (manual) system

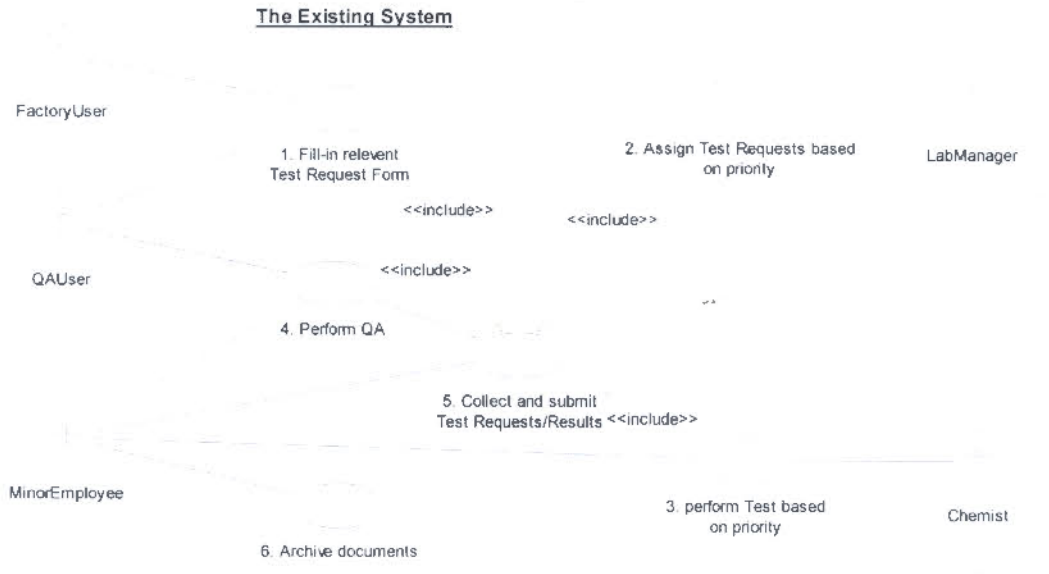

Figure D.1: Overview use case diagram for existing system

D.2 Use Case Descriptors for the existing (manual) system

Use Case #	1
Name	**Fill-up the relevant Test Request Form**
Actors	QAUser/ FactoryUser
Pre-Condition	Availability of paper based Request form
Post-Condition	A complete Test Request form is created and kept on the desk
Flow	- select the relevant Test Request form (Certificate Request, General Laboratory Test request, Row Material Inspection Report Request, Packaging Material Inspection Report Request) - Either QAUser or FactoryUser to fill-up the form with data, for the Test Request

	- Either QAUser or FactoryUser specify priority level, based on the criticality of the Test Results - keep the filled-up form on the desks to be collected by minor employee
Exception	If the data is written wrong, user another paper based form

Table D.2.1: Fill-up TEST Request Form

Use Case #	2
Name	**Assign Test Requests based on priority**
Actors	Lab Manager
Pre-Condition	Test Requests received from QAUser / FactoryUser
Post-Condition	Test Request assigned to a Chemist
Flow	- check for the availability of all the necessary information - check for the nature of the test - write chemist's name on the form - keep the assigned form on the desks to be collected by minor employee
Exception	If required data are not there in the form, send the form back to the requested person

Table D.2.2: Assign Test Requests based on priority

Use Case #	3
Name	**Perform Test based on priority**
Actors	Chemist
Pre-Condition	Test Requests received from Lab Manager
Post-Condition	If the use case is successful, Chemist fill-up Test result form with results
Flow	- chemist finds the highest priority Test Request - search for Product on paper based Product specification chart for a particular product out of 21 products - search for product variant out of 240 product variants - select the required Product Specification Chart - chemist views the paper based Product Specification Chart for the

	Test to be performed (Test parameters) for the particular Product Variant - chemist fill-up the forms with the Test Result for each relevant Test parameters - keep the form on the desks, with the Tests Results, to be collected by minor employee
Exception	If Product Specification chart is not available get assistance of minor employee

Table D.2.3: Perform Test based on priority

Use Case #	4
Name	**Perform QA**
Actors	QAUser
Pre-Condition	Test Results attached to the Test Requests are on the desk for compliance test
Post-Condition	Compliance Test results (QA approved or QA filed) are filled-up
Flow	- get a Test Results together with the Test Request - search for paper based Product specification chart for a particular product out of 21 products - search for product variant out of 240 product variants - select the required Product Specification Chart - view Test parameters and values - compare them with parameters and values of the particular product variant from Standard Product Specification chart - stamp with QA approved, if comply or QA Failed, if not comply - keep on the desk to be taken by the minor employee and hand over to the requested person
Exception	If Product Specification chart is not available get assistance of minor employee

Table D.2.4: Perform QA

Use Case #	5
Name	**Collect and submit Test Requests/Results**
Actors	MinorEmployee
Pre-Condition	Documents available with the collecting employee
Post-Condition	Documents delivered to the relevant employee
Flow	- if Test Requests exists with QAUser/FactoryUser, Test Requests forms will be collected from QAUser/ FactoryUser and handover to Lab Manager - if Test Requests exists with Lab Manager, they will be collected and handover to relevant Chemists - if Test Results are available with Chemist, they will be collected and handover to QAUser. - if Test Request available after completing the Compliance Test, they will be collected and handover to the relevant person
Exception	Delays occurred and Misplacement of documents take place

Table D.2.5: Collect and submit Test Requests/Results

Use Case #	6
Name	**Archive documents**
Actors	MinorEmployee
Pre-Condition	Documents used by QAUser and Factory users
Post-Condition	Documents are archived
Flow	- Documents are categorized based on Request Type - index documents - bundled on daily basis - stored in a separate storage space
Exception	Delays occurred and Misplacement of documents take place

Table D.2.6: Archive documents

Use Case #	7
Name	**Prepare Reports**
Actors	AccountsDeptUser
Pre-Condition	Archived documents available
Post-Condition	Monthly report
Flow	- search Test Results together with the Test Request - gather information - prepare the required paper based report
Exception	Delays occurred and not accurate

Table D.2.7: Prepare Reports

D.3 Activity Diagram for the existing (manual) system

Use Case # : 1
Use Case Name : Fill-up the relevant Test Request Form

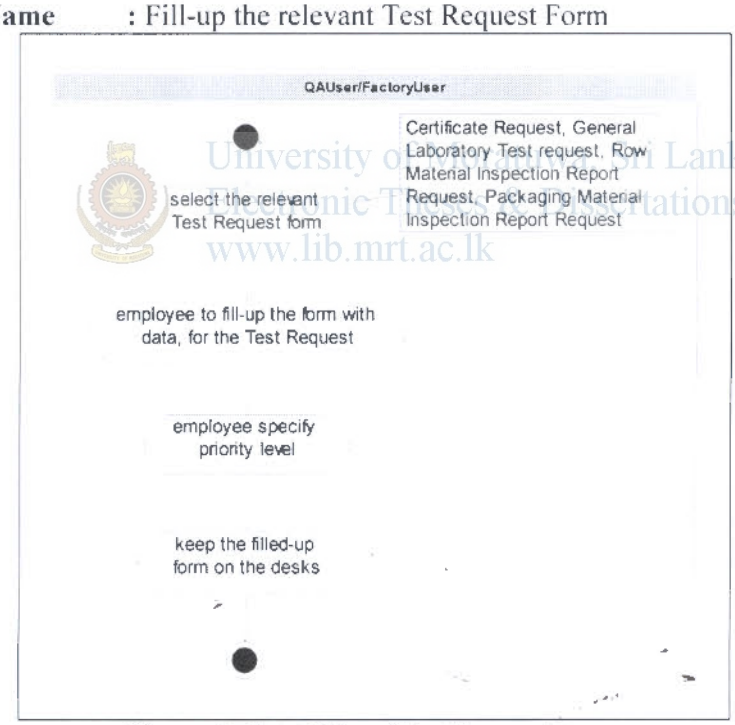

Figure D.3.1: Fill-up Test Request Form

Use Case # : 2
Use Case Name : Assign Test Requests based on priority

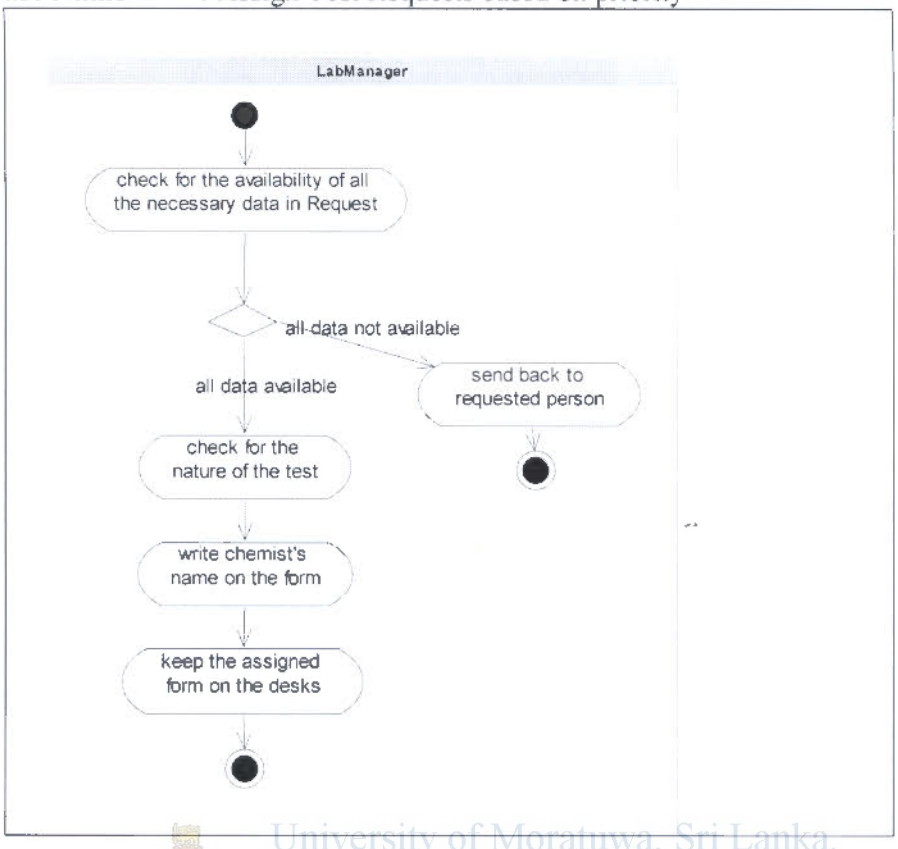

Figure D.3.2: Assign Test Requests based on priority

Use Case # : 3
Use Case Name : Perform Test based on priority

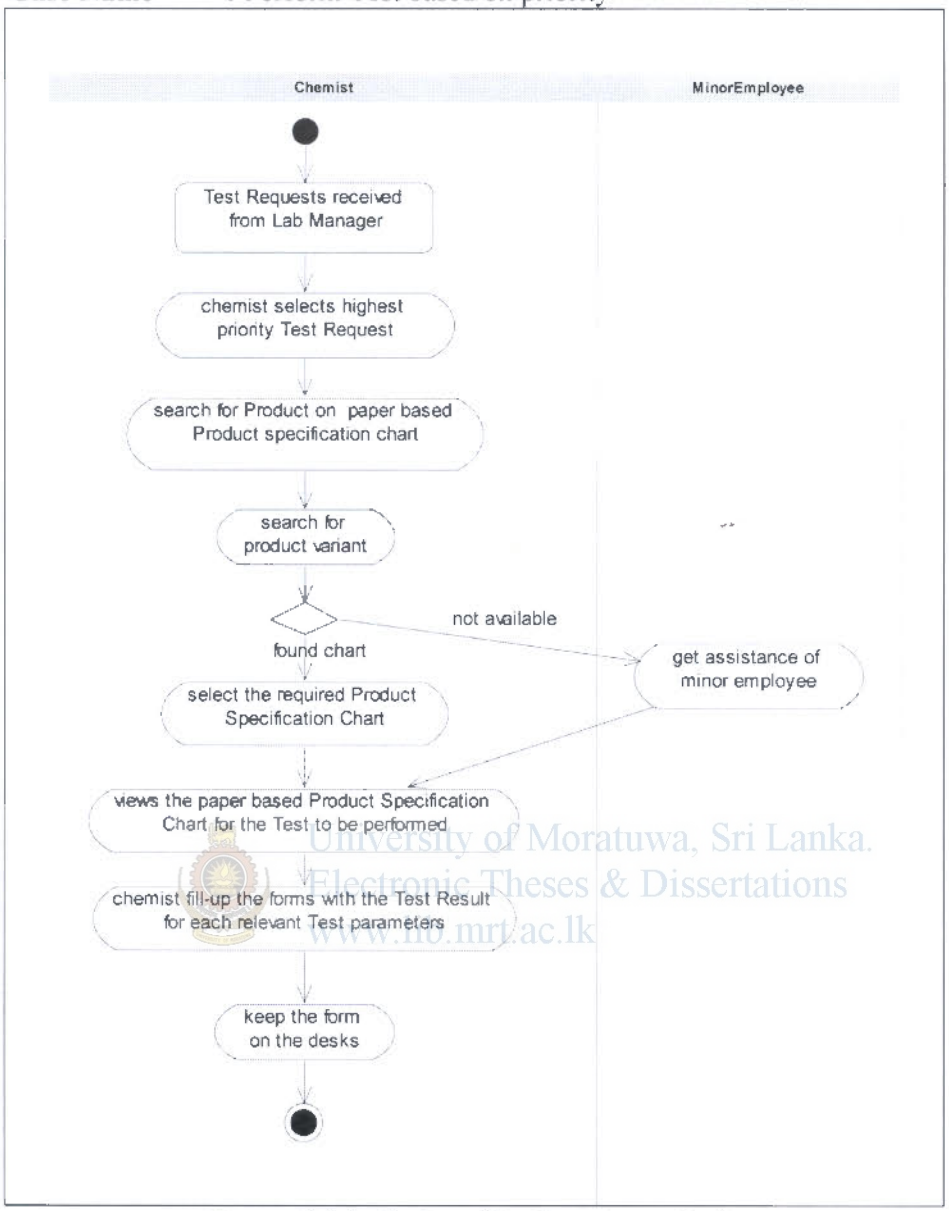

Figure D.3.3: Perform Test based on priority

Use Case # : 4
Use Case Name : Perform QA

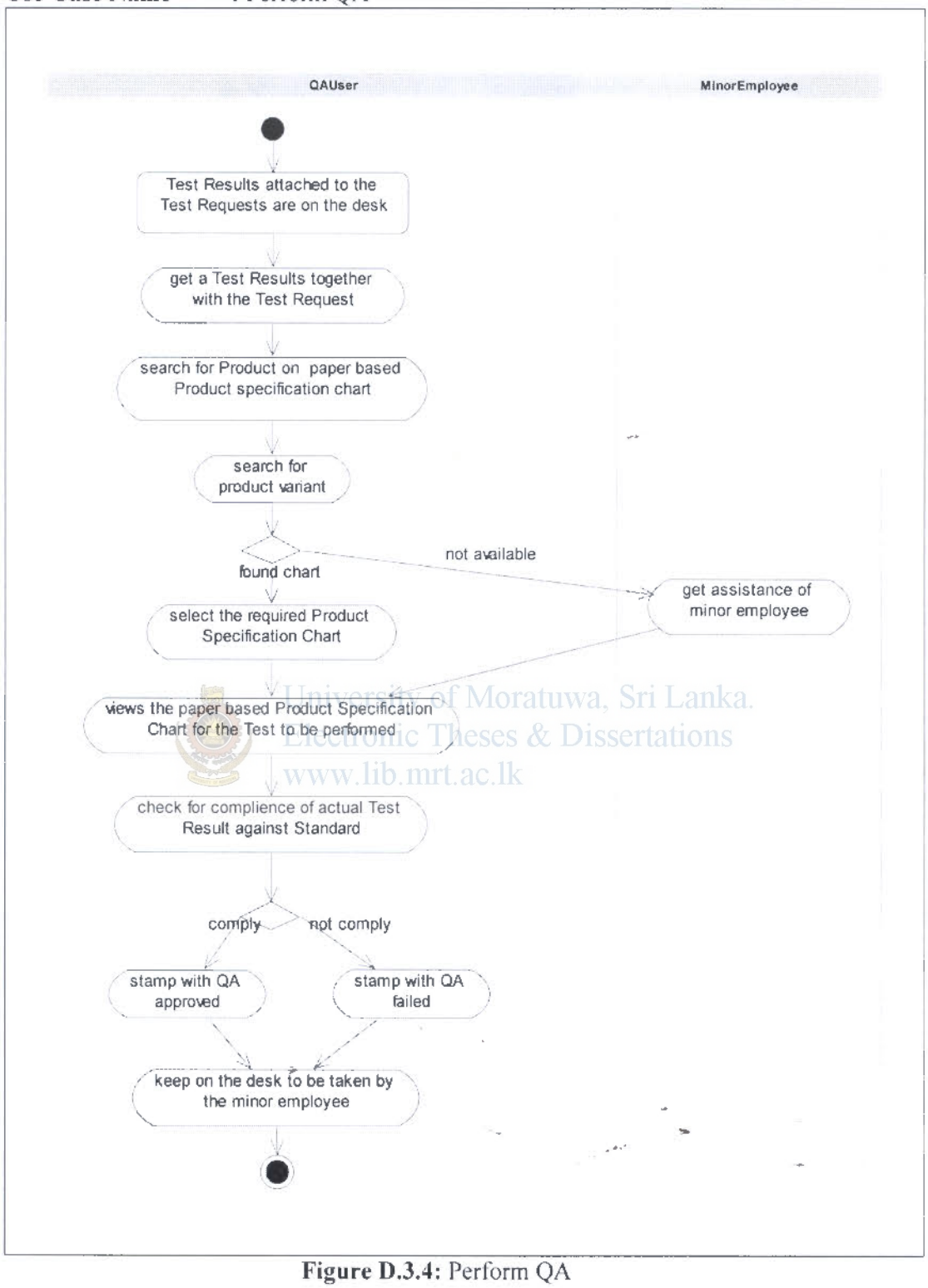

Figure D.3.4: Perform QA

Use Case # : 5
Use Case Name : Collect and submit Test Requests/Results

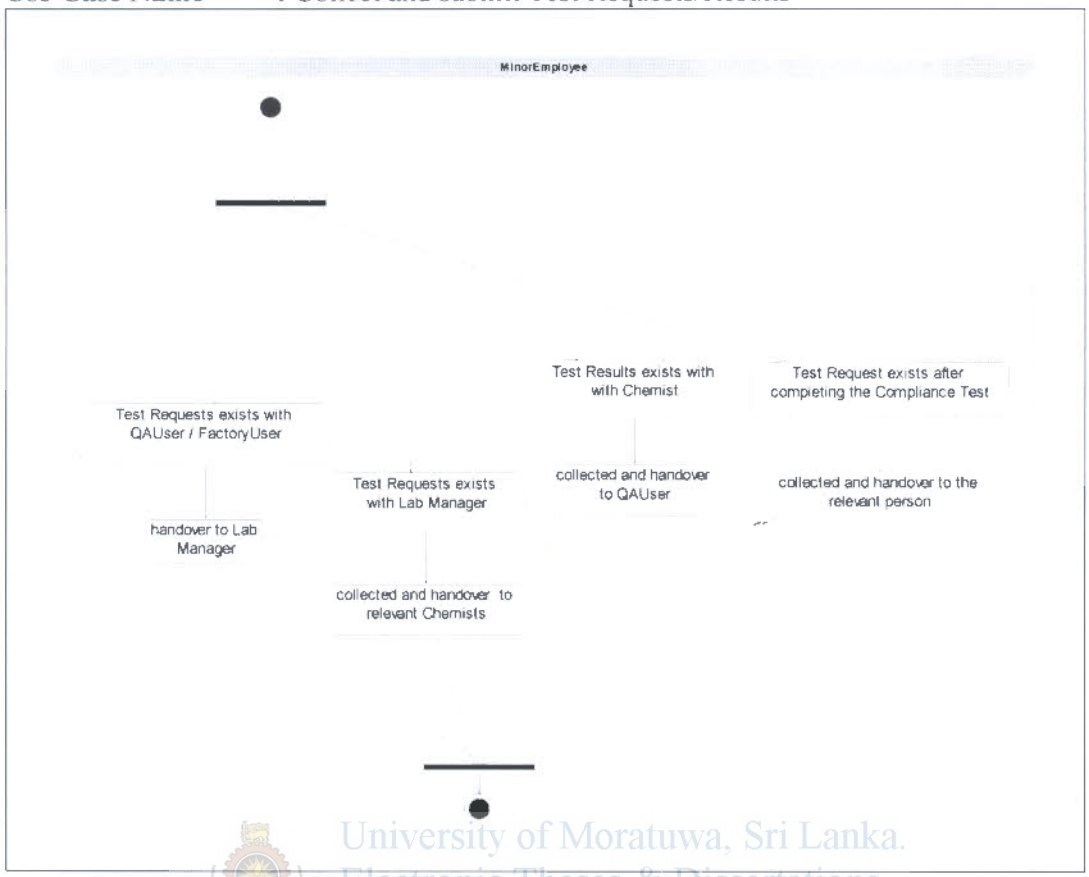

Figure D.3.5: Collect and submit Test Requests/Results

Use Case # : 6

Use Case Name : Archive documents

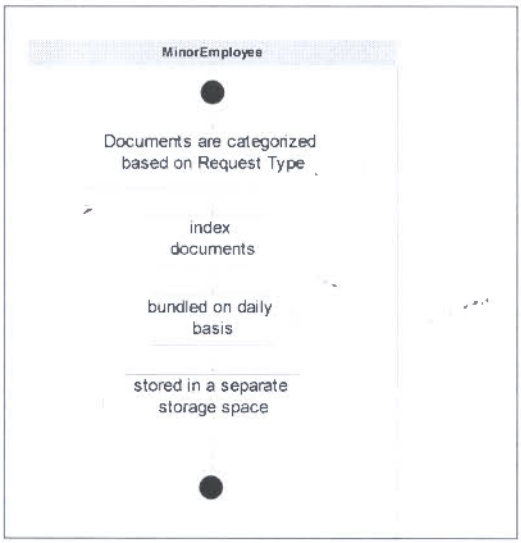

Figure D.3.6: Archive documents

Use Case # : 7
Use Case Name : Prepare Reports

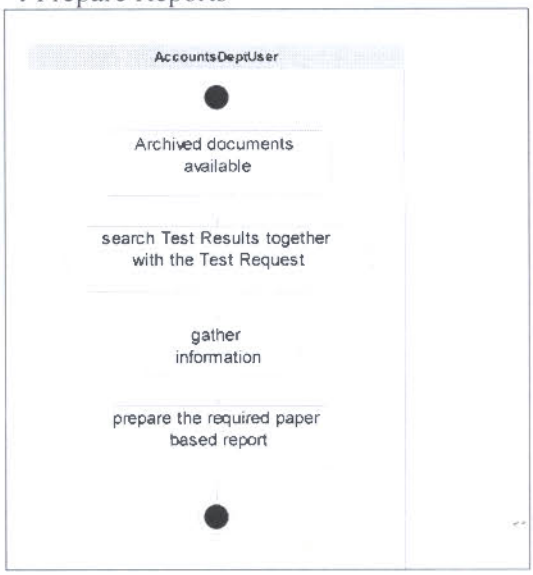

Figure D.3.7: Prepare Reports

D.4 Sequence Diagram for the existing (manual) system

Use Case # : 1
Use Case Name : Fill-up the relevant Test Request Form

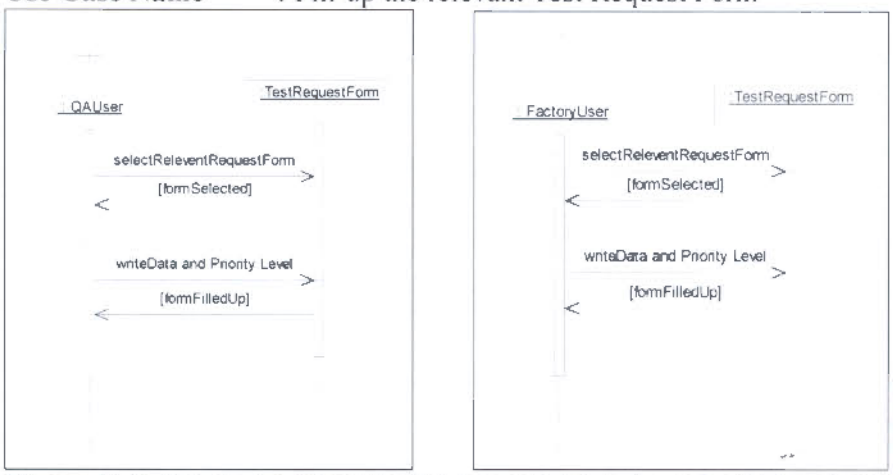

Figure D.9: Fill-up the relevant Test Request Form by either QA or Factory User

Use Case # : 2
Use Case Name : Assign Test Requests based on priority

Figure D.4.1: Assign Test Requests based on priority

Use Case # : 3
Use Case Name : Perform Test based on priority

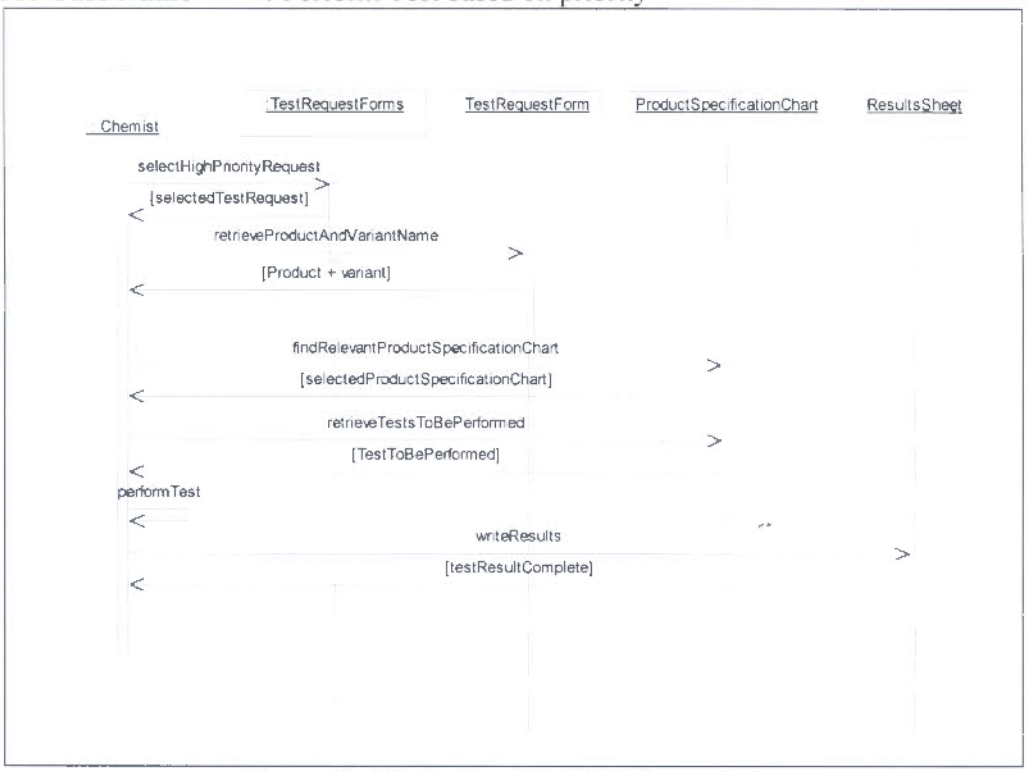

Figure D.4.2: Perform Test based on priority

Use Case # : 4
Use Case Name : Perform QA

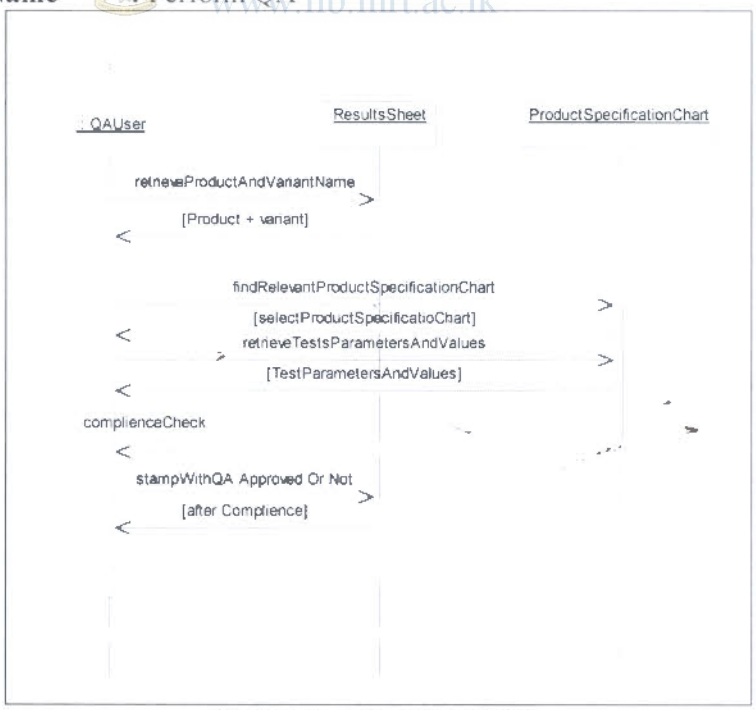

Figure D.4.3: Perform QA

Use Case # : 5
Use Case Name : Collect and submit Test Requests/Results

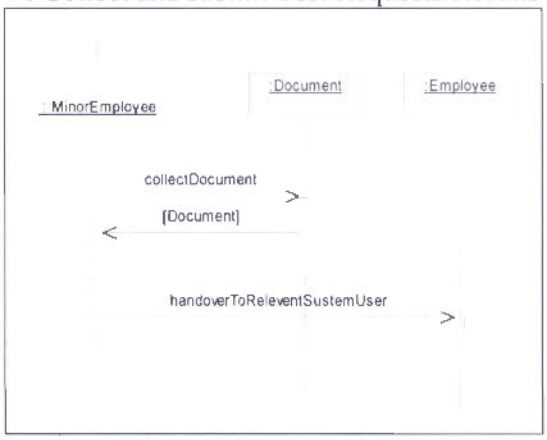

Figure D.4.4: Collect and submit Test Requests/Results

Use Case # : 6
Use Case Name : Archive documents

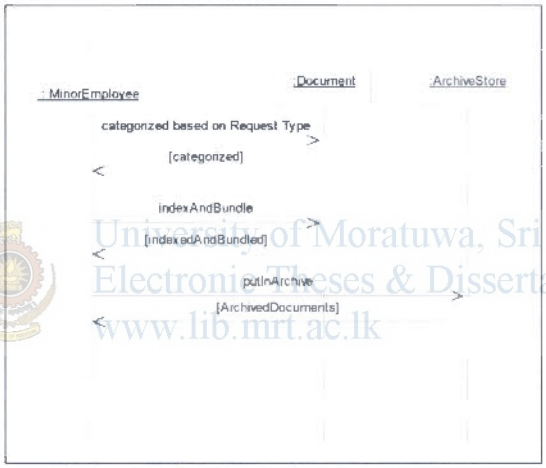

Figure D.4.5: Archive documents

Use Case # : 7
Use Case Name : Prepare Reports

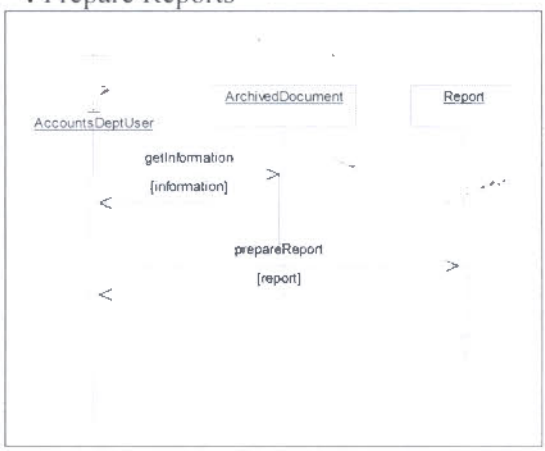

Figure D.4.6: Prepare Reports

D.5 Entity Class Diagram for the existing (manual) system

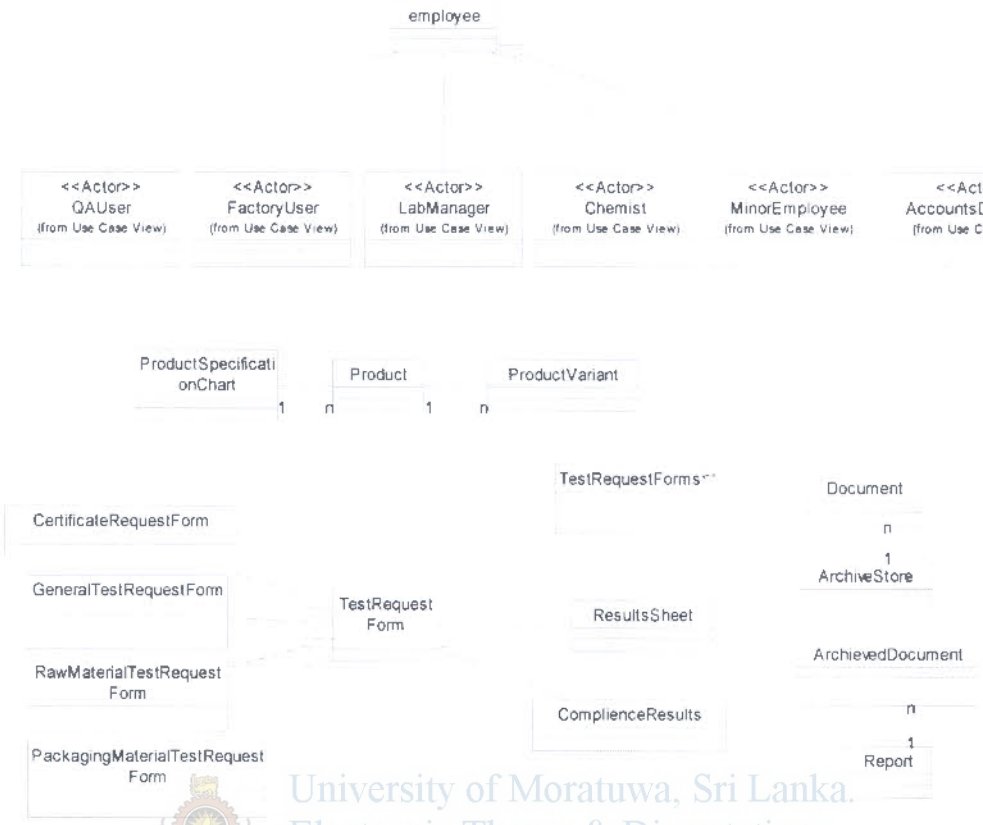

Figure D.5.1: Entity Class Diagram for the existing (manual) system

Appendix E

UML Artifacts - User Case Diagrams, Use Case Descriptors and Activity Diagrams for the proposed system

E.1 System Level Use Case Diagram for the proposed system

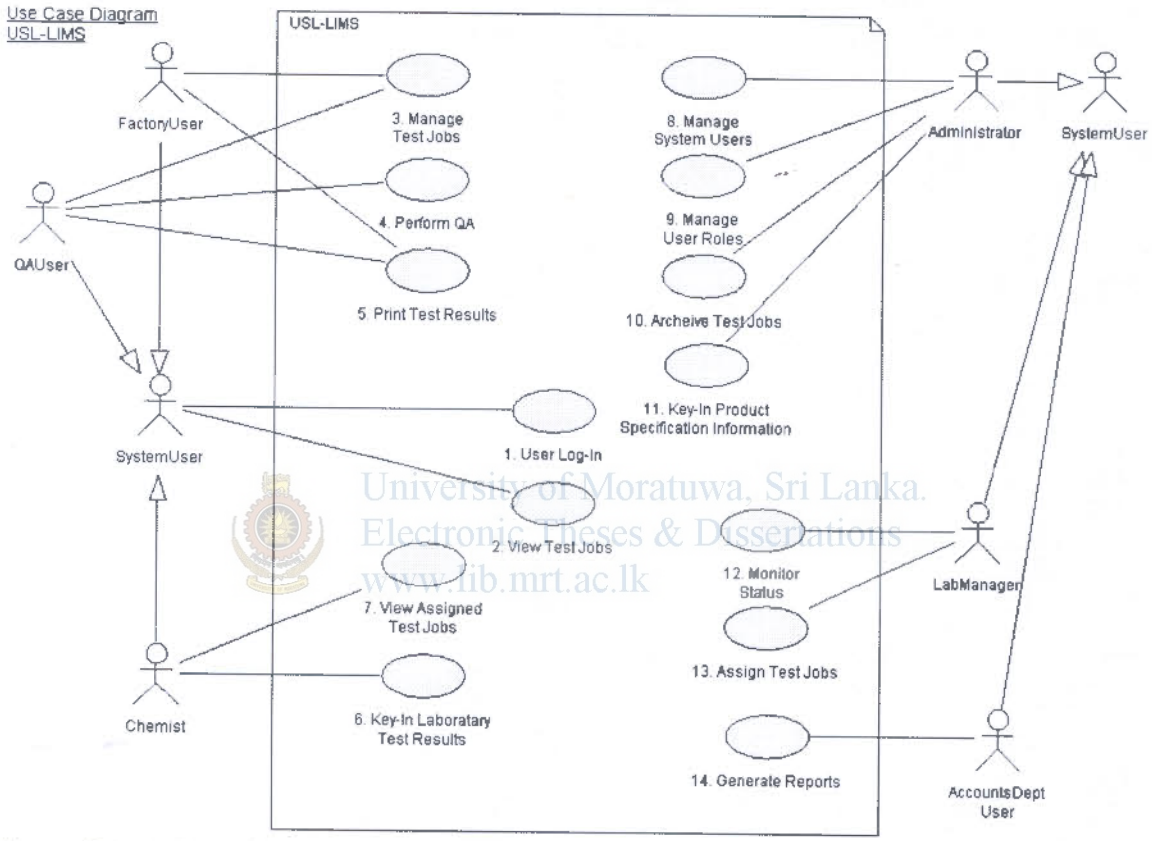

Figure E.1.1: Overview Diagram for the proposed system

E.2 Use Case Diagrams for the proposed system

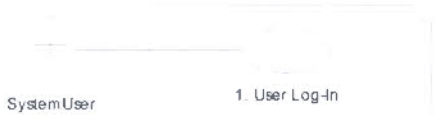

Figure E.2.1: User Log-in

Figure E.2.2: View Test Jobs

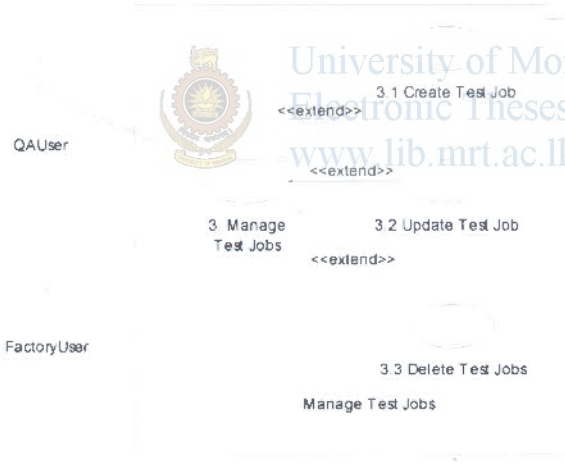

Figure E.2.3: Manage Test Jobs

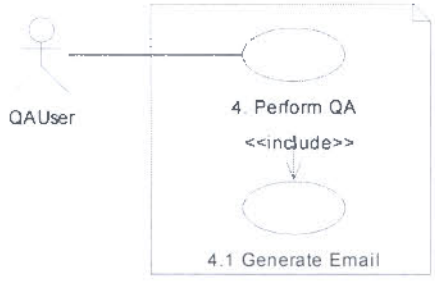

Figure E.2.4: Perform QA

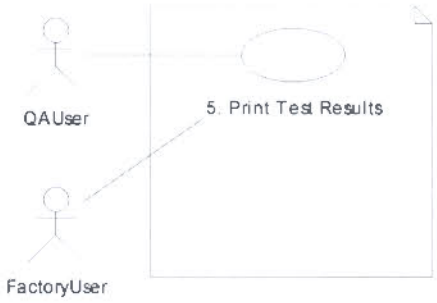

Figure E.2.5: Print Test Results

Figure E.2.6: Key-in Laboratory Test Results

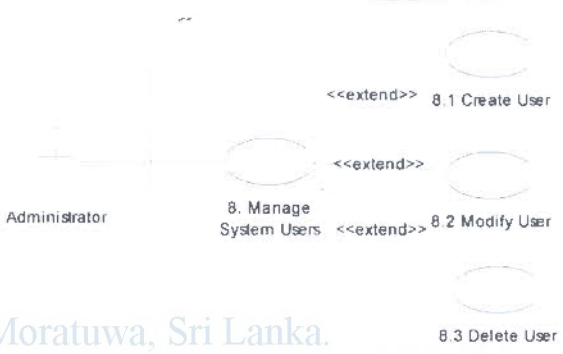

Figure E.2.7: Manage System Users

Figure E.2.8: Key-in Laboratory Test Results

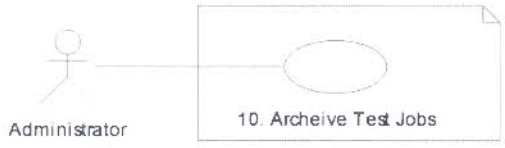

Figure E.2.9: Achieve Test Jobs

Figure E.2.10: Key-in product specification Information

Figure E.2.11: Monitor Status

Figure E.2.12: Assign Test Jobs

Figure E.2.13: Generate Reports

E.3 Use Case Descriptors for the proposed system

Use Case #	1.0 - i
Name	User Log-in
Actors	SystemUser
Pre-Condition	User with a valid user account
Post-Condition	If the use case is successful, the actor is in the system. If not, no change of system state.
Flow	- The system facilitates the system user to enter the User Name and the Password - SystemUser Key-in the User Name and Password and enter - System validates whether the User Name is available in the system and if so it verifies that the Password is correct - If correct, system prompts the user to the relevant Post Log-in screen
Exception	If the User Name and/or Password are invalid, re-direct the user to the Log-in screen.

Table E.3.1: User Log-in

Use Case #	2.0 - vii
Name	View Test Jobs
Actors	SystemUser
Pre-Condition	Logged-in user
Post-Condition	System user now should be able to retrieve a list of Test Jobs with the header information for each Test Job, ordered by the Priority Level and the Test Job Created Data.
Flow	- User to click on the View Test Jobs function. - System will provide a list of Test Jobs with the header information for each Test Job, ordered by the Priority Level and the Test Job Created Data.
Exception	If there is no Test Job results to be fetched, system will prompt and error message "No Test Jobs found"

Table E.3.2: View Test Jobs

Use Case #	2.1 - xvi
Name	Search Test Jobs
Actors	SystemUser
Pre-Condition	Logged-in user
Post-Condition	If the use case is successful, it will fetch results for the performed search criteria with the header information of each Test Job in terms of a list. User will be able to retrieve the header information such as Test Job ID, Product sample code, Test Job created Date:Time, Requested by (system user name), product sample description and the Test Job status
Flow	- System facilitates the user to enter the search criteria to search for Test Jobs in terms of the product sample code, Type of Test Request, Test Job Created Date range (from - to), the Test Priority Level of the Test Job and Test Job status. - If there is a Test Job/s for the search criteria, system searches and display header information of the resulting Test Job in terms of a list. - Each Test Job result will contain a link, which load the whole Test Job.
Exception	If there is no Test Job results to be fetched, system will prompt and error message "No result found for the search criteria"

Table E.3.3: Search Test Jobs

Use Case #	2.2 -
Name	**View test Jobs assigned for each Chemist**
Actors	Lab Manager
Pre-Condition	Logged-in user with Lab Manager User Role
Post-Condition	If the use case is successful, Lab Manager can view list of Test Jobs assigned to each Chemist
Flow	- Lab manager selects the function - System returns a list of the names of Users with the user role "Chemist" - Lab manager to click on each Chemist name to see the list of Test

	Jobs assigned to Chemists - system display Test Jobs
Exception	If there is no Test Job results to be fetched, system will prompt and error message "No Test Jobs currently assigned for the Chemist"

Table E.3.4: View test Jobs assigned for each Chemist

Use Case #	7
Name	**View assigned Test Jobs**
Actors	Chemist
Pre-Condition	Logged-in user with Chemist User Role
Post-Condition	If the use case is successful, Chemist can view list of Test Jobs assigned to him/her.
Flow	- Chemist selects the function - System returns a list of test Jobs assigned, to him to perform relevant tests, by the Lab Manager - Lab manager will be able to load each Test Job to continue with his Tests
Exception	If there is no Test Jobs assigned to a Chemist, system will prompt and error message "No Test Jobs assigned"

Table E.3.5: View assigned Test Jobs

Use Case #	3
Name	**Manage Test Jobs**
Actors	QAUser, FactoryUser
Pre-Condition	Logged-in user with relevant User Role
Post-Condition	If the use case is successful, relevant user can create/ update or Delete a Test Job
Flow	- Either QAUser or FactoryUser selects Manage Test Job feature - System prompts the user to a sub panel, with facilities to either Create a Test Job, Modify a Test Job, or to delete a Test Job
Exception	If the features could not be loaded, them the system will return an error message "system could not load the feature"

Table E.3.6: Manage Test Jobs

Use Case #	3.1 – **iv, vi**
Name	**Create a Test Job**
Actors	QAUser, FactoryUser
Pre-Condition	Logged-in user with relevant User Role
Post-Condition	If the use case is successful, relevant user can create successfully Create a Test Job in the system
Flow	- Either QAUser or FactoryUser will be able to select a Test Job Type namely Certificate Request, General Laboratory Test request, Row Material Inspection Report Request, Packaging Material Inspection Report Request - system loads the relevant Form for the Requested Test Type - User to key-in the data about the Test - User to set a Priority Level out of Critical, High, Normal, Low indicating the urgency of the Test Results - Click "Create Test Job" to save the Request - System performs a validation to ensure all the mandatory data are filled-up, if not prompt with alerts to fill-up or else proceed. - System saves the Test Job with the additional data such as User Name of the test Job created user, Date:Time of creation, Test Job Id which will be unique to a Test Job and expected completion date, calculated based on the priority level - System will set the newly created Test Job status to "Open" which indicates and unattended Test Job - System gives a "Success" message, if the Test Job was successfully created
Exception	If the Test Job is not created, there will be an error message "Test Job not created"

Table E.3.7: Create a Test Job

Use Case #	3.2 - vi
Name	**Update Test Job**
Actors	QAUser/ FactoryUser
Pre-Condition	Logged-in user with relevant User Role and a Test Job is loaded

Post-Condition	If the use case is successful, relevant user can create successfully Updated a Test Job in the system
Flow	- Either QAUser or FactoryUser selects edit option - system loads the Test Job in editable mode - user change Text and/or change Test Job "Status" - system to accept the changes and update the system, and if successful, show a message "Successfully updated"
Exception	If the Test Job is not updated, there will be an error message "Test Job not updated"

Table E.3.8: Update Test Job

Use Case #	3.3 - vi
Name	**Delete Test Job**
Actors	QAUser, FactoryUser
Pre-Condition	Logged-in user with relevant User Role and a Test Job is loaded
Post-Condition	If the use case is successful, relevant user can create successfully Delete a Test Job in the system
Flow	- Either QAUser or FactoryUser selects delete option - system to prompt a reconfirmation message with the question "do you want to delete the Test Job" - checks for created user equals deleted user and status is still Open - if select "Yes" the system will delete Test Job and gives the message "Successfully deleted"
Exception	If the Test Job is not deleted, there will be an error message "Test Job was not deleted due to an error"

Table E.3.9: Delete Test Job

Use Case #	4 – x, xi
Name	**Perform QA**
Actors	QAUser
Pre-Condition	Logged-in user with QA User Role
Post-Condition	If the use case is successful, a Test Job will be Tagged as QA approved or QA filed.

Flow	- QAUser selects the function "Perform QA" - system lists Test Jobs with the Status "Test Complete" - QAUser selects a Test Job - system loads the Product Specification Cart (parameters and standard set of values) for the relevant Product Variant - QAUser compares the test results values with standard values - QAUser change the Test Job Status to QA approved, if comply or QA Failed, if not comply, after performing the compliance test - User to save Test Job - system will return a "Success" message if successfully changed the Status - if successful, system will generate an email to the Test Job created user
Exception	1. If a Test Job with Status "Test Complete" is accessed by another QAUser, then system will alert the user, that the Test Job is locked by another user 2. If the Status change is unsuccessful. System will return an error message "Status Change Unsuccessful"

Table E.3.10: Perform QA

Use Case #	4.1 - xiii
Name	**Generate e-mail**
Actors	QAUser
Pre-Condition	QAUser to change the Test Job Status to "QA approved" or "QA failed"
Post-Condition	Test Job creator will receive an eMail, informing the Test Job is done
Flow	- system will search and find the eMail address of the Test Job created user - system to open a connection with the mail server - if connection successful, send the mail - close connection with the mail server - "is mail delivered" flag is updated to TRUE in the Test Job

Exception	If the mail could not be sent, "is mail sent" flag is updated to FALSE

Table E.3.11: Generate e-mail

Use Case #	5 - xii
Name	**Print Test Result**
Actors	QAUser, FactoryUser
Pre-Condition	Logged-in user with relevant User Role, Test Job loaded
Post-Condition	A generated print out for the Test Results together with the Test Request and Compliance Test Results
Flow	- system will facilitate print option in a Test Job - Either QAUser or FactoryUser selects the Print option - system generates a document with Test results in the Test Job, together with the Request and the Compliance check results - system sends the document to the printer
Exception	If there is a problem of generating the document with the Test Results, system will return "document generation failed"

Table E.3.12: Print Test Result

Use Case #	6 - ix
Name	**Key-in Laboratory Test Results**
Actors	Chemist
Pre-Condition	Logged-in user with Chemist User Role, Test Job loaded
Post-Condition	If the use case is successful, Chemist key-in results and saves successfully
Flow	- system load relevant test parameters for the Product Variant, with editable fields for the values - Chemist fills-up the editable fields with the values obtained from the Test performed - user save Test Results - system returns "Successfully saved" message
Exception	If error occurs "save unsuccessful" message is returned and re-direct to enter the Test Result values

Table E.3.13: Key-in Laboratory Test Results

Use Case #	8 - iii
Name	**Manage System users**
Actors	Administrator
Pre-Condition	Logged-in user with Administrator User Role
Post-Condition	New User created or an existing user modified or a user is deleted
Flow	- Administrator selects Manage system User feature - System prompts the user to a sub panel, with facilities to either create a New User or modify an existing user or delete a system user
Exception	If the features could not be loaded, them the system will return an error message "system could not load the feature"

Table E.3.14: Manage System users

Use Case #	8.1 - iii
Name	**Create user**
Actors	Administrator
Pre-Condition	Logged-in user with Administrator User Role
Post-Condition	New User created
Flow	- system loads the create user panel with required fields to enter user specific information including User name, password, email address - Administrator keys-in data, selects the relevant UserRole (Administrator, QA user, Lab manager, Chemist, Auditor, Factory user) and Save the information - system validates the entered user name with system usernames and if not already exits, then creates the new user in the system - System saves the user with the additional information such as created user and Date:Time of creation
Exception	If user Name already registered in the system, system will prompt the user to re-enter a new user Name

Table E.3.15: Create user

Use Case #	8.2 – iii
Name	**Modify user**
Actors	Administrator
Pre-Condition	Logged-in user with Administrator User Role
Post-Condition	Existing user modified
Flow	- system displays a list of existing system users - system loads the modify user panel with editable fields to modify user specific information other than User name - Administrator modifies data and Save the information - System saves the user with the additional data such as username of the modified user, Date:Time of modify
Exception	If user modification fails, system returns "failed to modify the user" message

Table E.3.16: Modify user

Use Case #	8.3 – iii
Name	**Delete user**
Actors	Administrator
Pre-Condition	Logged-in user with Administrator User Role
Post-Condition	Existing user deleted
Flow	- Administrator selects the user to be deleted in a list of users - Administrator delete the system user - system prompts for a confirmation - Administrator confirms deletion - system checks whether active Test Jobs are assigned to the user - system deletes the user
Exception	If there are active Test Jobs assigned to that user, system returns "there are Test Jobs assigned to the user- can't delete the user"

Table E.3.17: Delete user

Use Case #	9 - ii
Name	**Manage User Roles**
Actors	Administrator
Pre-Condition	Logged-in user with Administrator User Role
Post-Condition	Either Add a new user role/ modify n existing user Role/ delete User Role
Flow	- user selects Manage User Role feature - System prompts the user to a sub panel, with facilities to either create a New User Role or modify an existing User Role or delete a User Role
Exception	If user role Name already registered in the system, system will prompt the user to re-enter a new user role Name

Table E.3.18: Manage User Roles

Use Case #	9.1 - ii
Name	**Create User Roles**
Actors	Administrator
Pre-Condition	Logged-in user with Administrator User Role
Post-Condition	Add a new user role
Flow	- system loads the create User Role panel to enter User Role Name and the description - user key-in data and Save the information - system validates the entered user role name with existing user role names and if not already exits creates the new user role in the system - System saves the user with the additional information such as created user and Date:Time of creation
Exception	If the features could not be loaded, then the system will return an error message "system could not load the feature"

Table E.3.19: Create User Roles

Use Case #	9.2 – ii
Name	**Modify user role**
Actors	Administrator
Pre-Condition	Logged-in user with Administrator User Role
Post-Condition	Existing user role modified
Flow	- system displays a list of existing system users roles - system loads the modify user role panel with editable fields to modify information - user modify data and Save the information - System saves the Test Job with the additional data such as username of the modified user, Date:Time of modify
Exception	If user modification fails, system returns "failed to modify the user role" message

Table E.3.20: Modify user role

Use Case #	9.3 – ii
Name	**Delete user role**
Actors	Administrator
Pre-Condition	Logged-in user with Administrator User Role
Post-Condition	Existing user role deleted
Flow	- user select the user role to be deleted in a list of users - user delete the user role - system prompts for a confirmation - user confirms deletion - system checks whether the user roles are assigned to the user - delete the user
Exception	If there are user role is assigned to a user, system returns "there are users with the user role assigned to them assigned to them

Table E.3.21: Delete user role

Use Case #	10 – vi, xv
Name	**Archive Test Jobs**
Actors	Administrator
Pre-Condition	Logged-in user with Administrator User Role
Post-Condition	Selected Test Jobs will be achieved.
Flow	- system will display a list of Test Jobs with the Status "Archived " - user will be able to filter the Test Jobs based on the Test Job created date range (from - to) - system will filter accordingly and display the Test Job list - user to select the required Test Job/s and select achieve function - system archive the Test Jobs, so it cannot be searched with normal search option - system provides a list of archived Test Job, if the operation is successful
Exception	If there is a problem in archiving, then system returns an error message "could not complete the operation"

Table E.3.22: Archive Test Jobs

Use Case #	11
Name	**Key-in Product specific Information**
Actors	Administrator
Pre-Condition	Logged-in user with Administrator User Role
Post-Condition	Product specification for each Product Variant is loaded into the system
Flow	- system will facilitate entering Product Variant details including Product code, Product Variant code, Standard Test Parameters, Test Parameter Standard Values - user to enter information - save product specification information - system returns "Success" message
Exception	If there is problem of loading the product, then system returns "product specification could not be loaded"

Table E.3.23: Key-in Product specific Information

Use Case #	12
Name	**Monitor Status**
Actors	Lab Manager
Pre-Condition	Logged-in user with Lab Manager User Role
Post-Condition	Display Statistics
Flow	- select the date range (from - to) to display the summary information - system counts the number of Test Jobs for the specified period categorized in to Test Job Status - numbers will be represented graphically with Status - system will calculate the number of Test Jobs assigned to each chemist and the number of completed Jobs - system returns a list with Chemist name, Test Jobs assigned and completed - If a Test Job is outstanding (if already passed the excepted completion date) it will come under a separate category
Exception	If the summary information is not available, returns a error message

Table E.3.24: Monitor Status

Use Case #	13
Name	**Assign Test Jobs**
Actors	Lab Manager
Pre-Condition	Logged-in user with Lab Manager User Role
Post-Condition	Test Job is assigned to a Chemist
Flow	- check the number of Jobs assigned to each Chemist - select the Chemist name and select assign button - Test Job Status will be changed from "Open" to "Assigned"
Exception	If there is a problem when assigning the Test Job, error message "could not assign" will be returned

Table E.3.25: Assign Test Jobs

E.4 Activity Diagrams for the proposed system

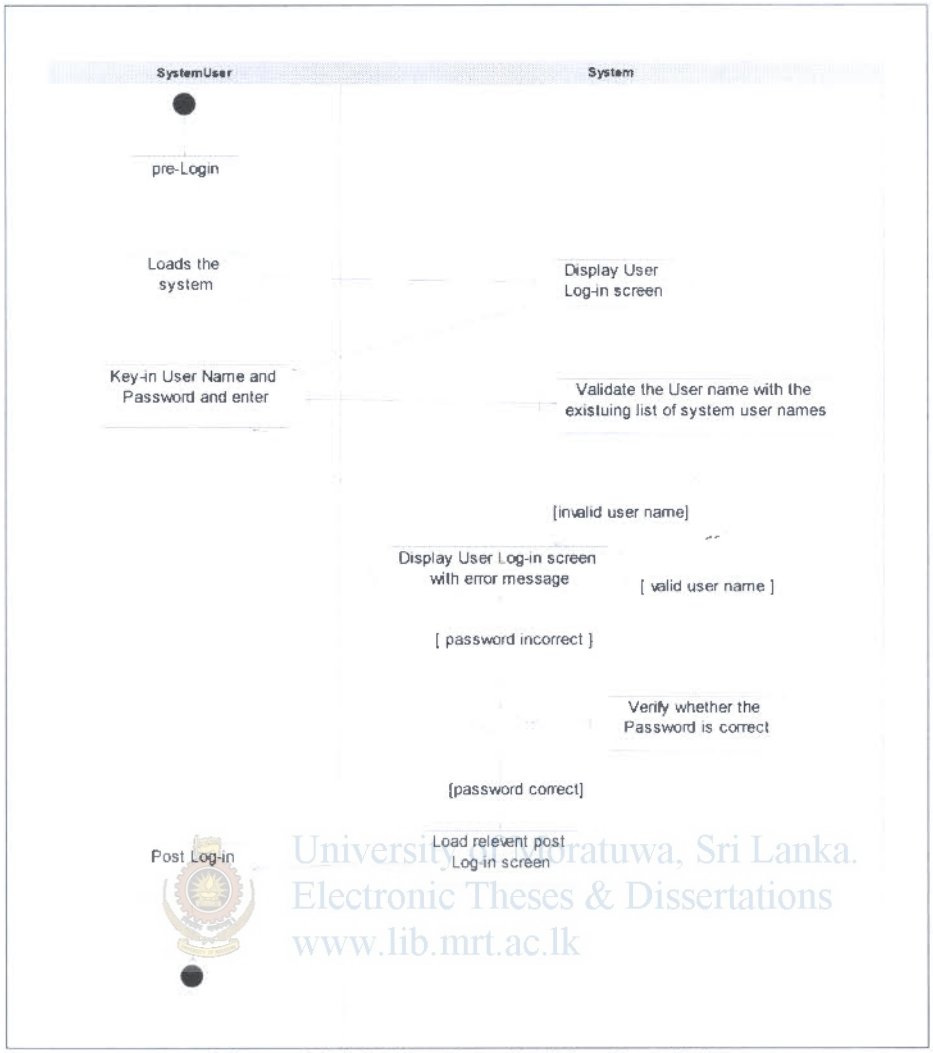

Figure E.4.1: User Log-in (Use Case # 1)

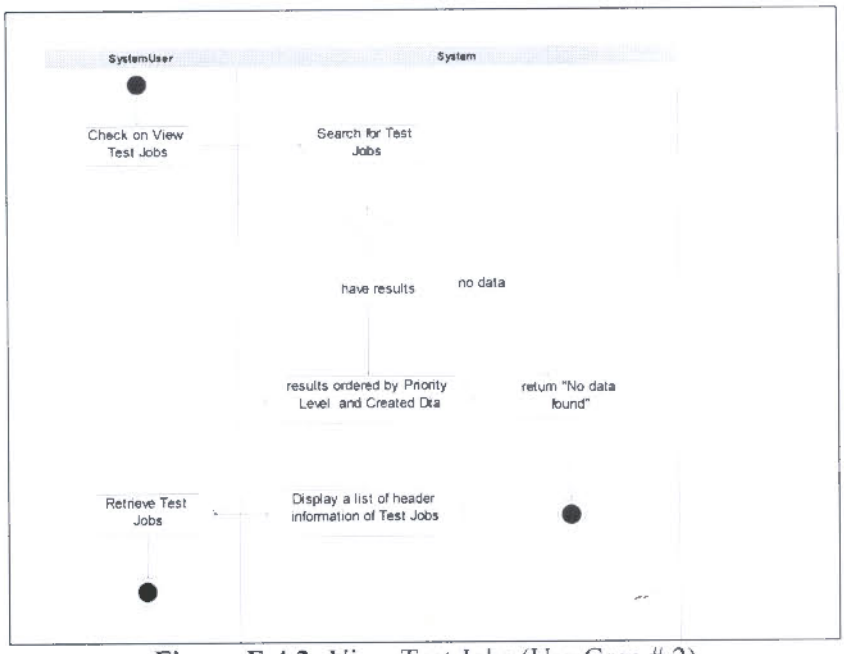

Figure E.4.2: View Test Jobs (Use Case # 2)

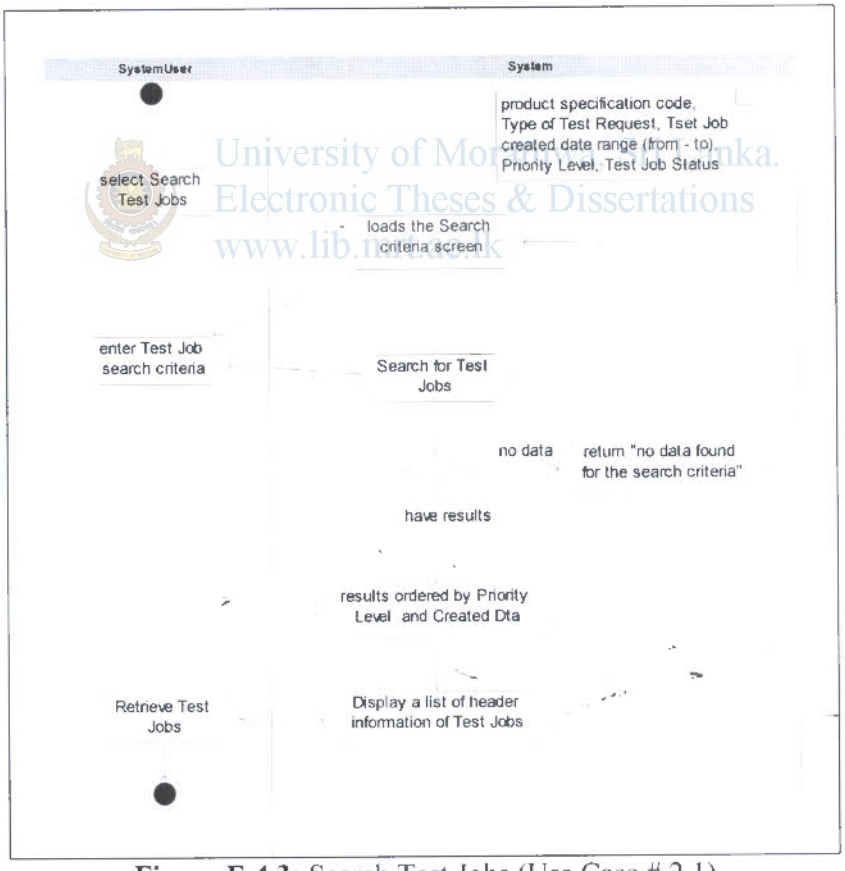

Figure E.4.3: Search Test Jobs (Use Case # 2.1)

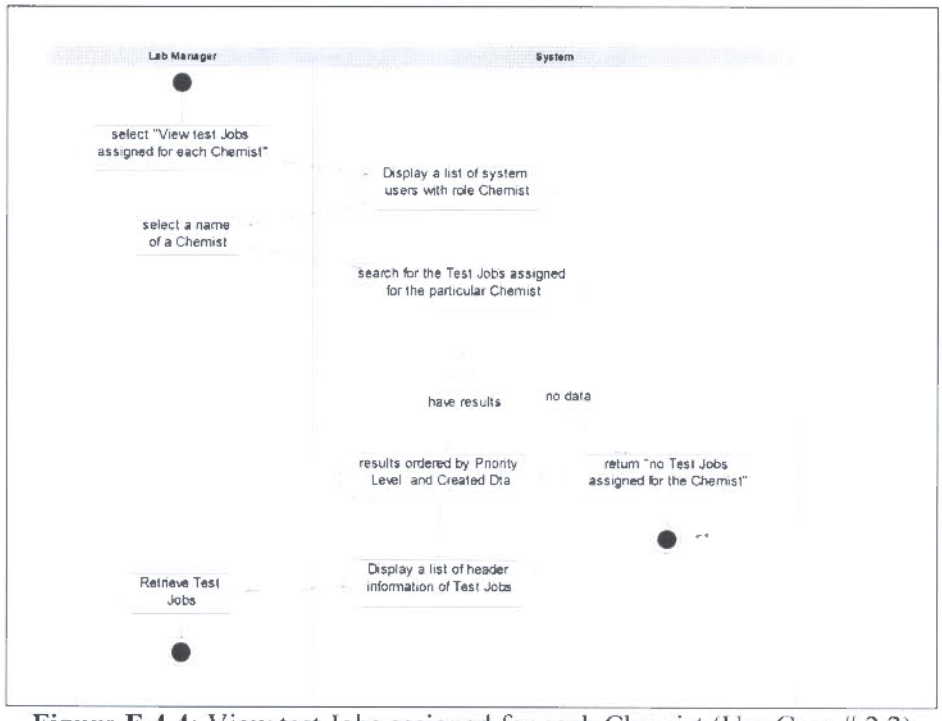

Figure E.4.4: View test Jobs assigned for each Chemist (Use Case # 2.2)

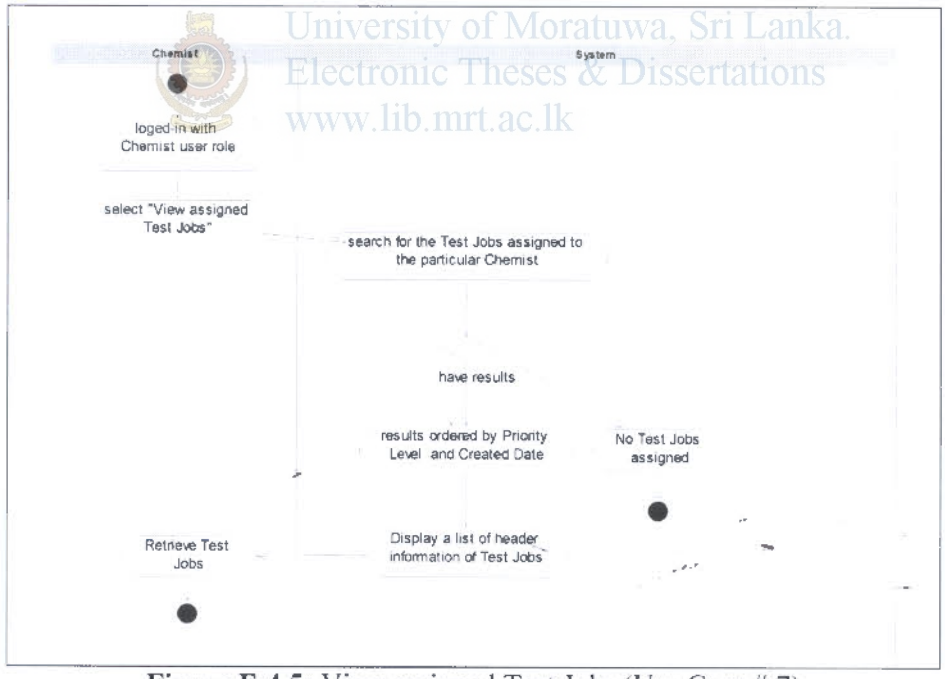

Figure E.4.5: View assigned Test Jobs (Use Case # 7)

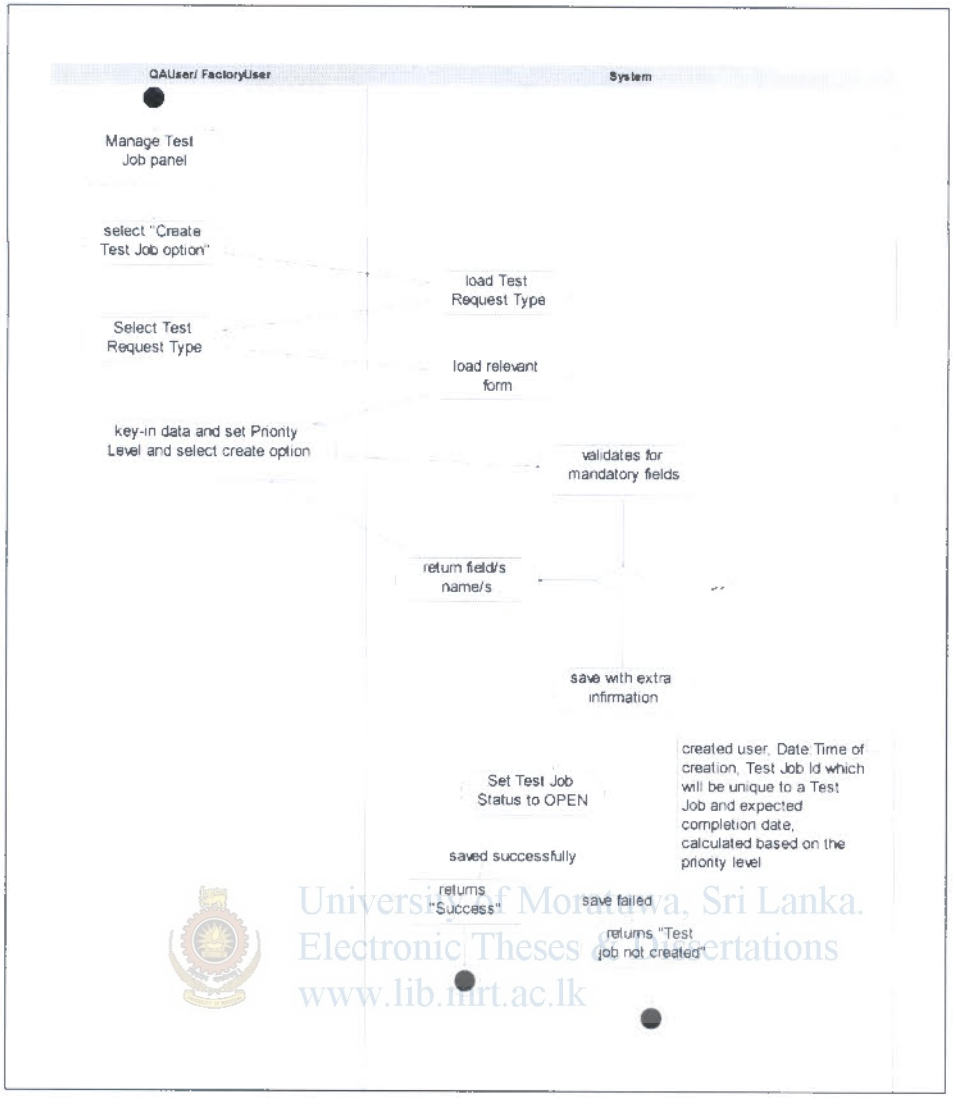

Figure E.4.6: Create a Test Job (Use Case # 3.1)

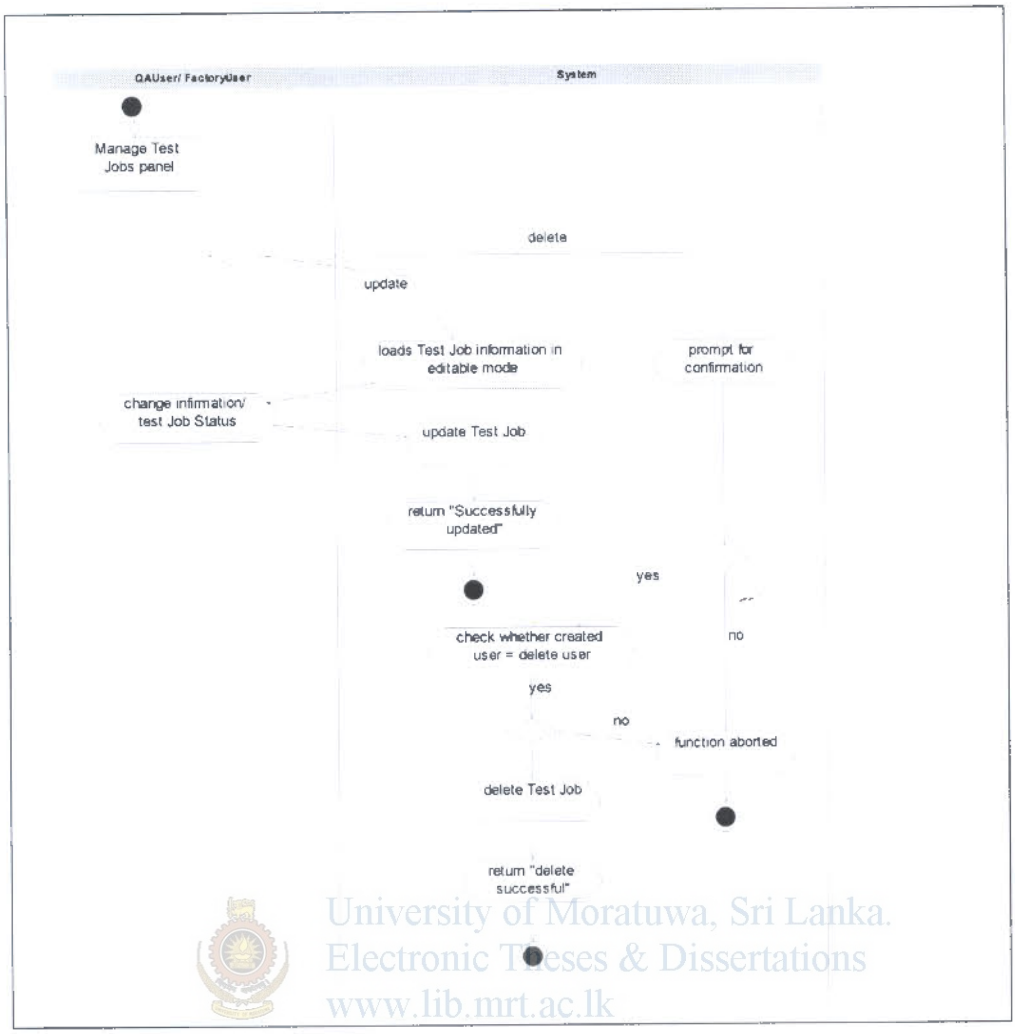

Figure E.4.7: Update Test Job and Delete Test Job (Use Case # 3.2 and 3.3)

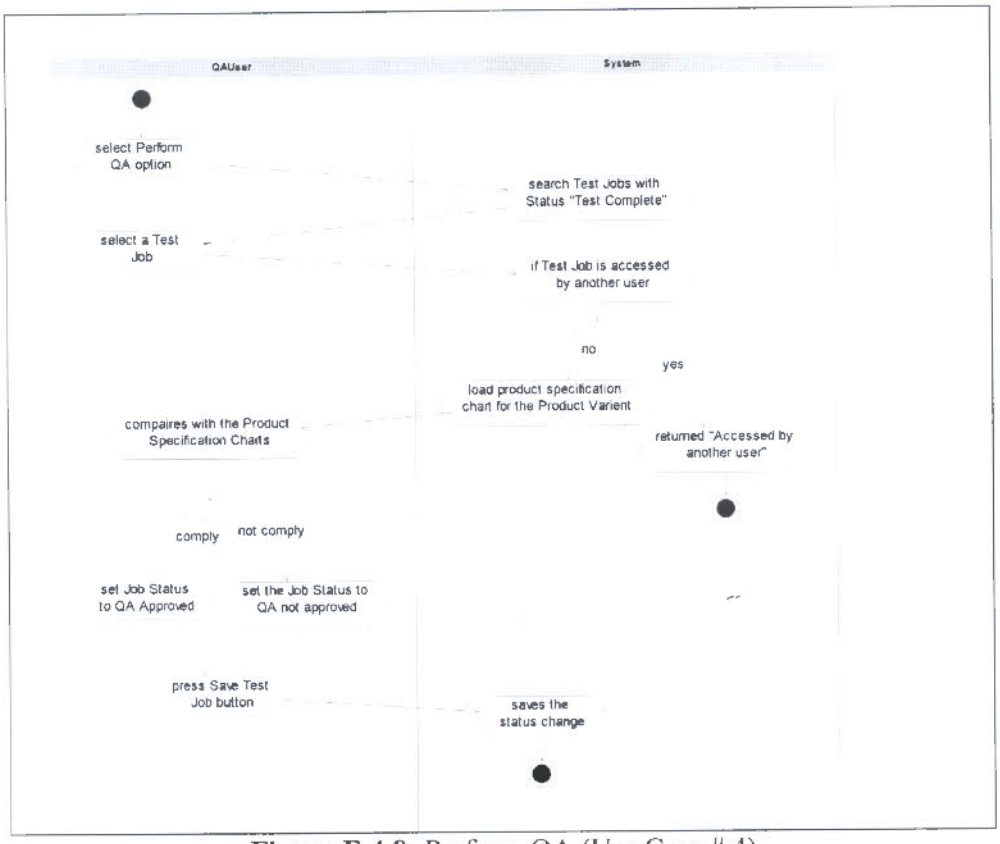

Figure E.4.8: Perform QA (Use Case # 4)

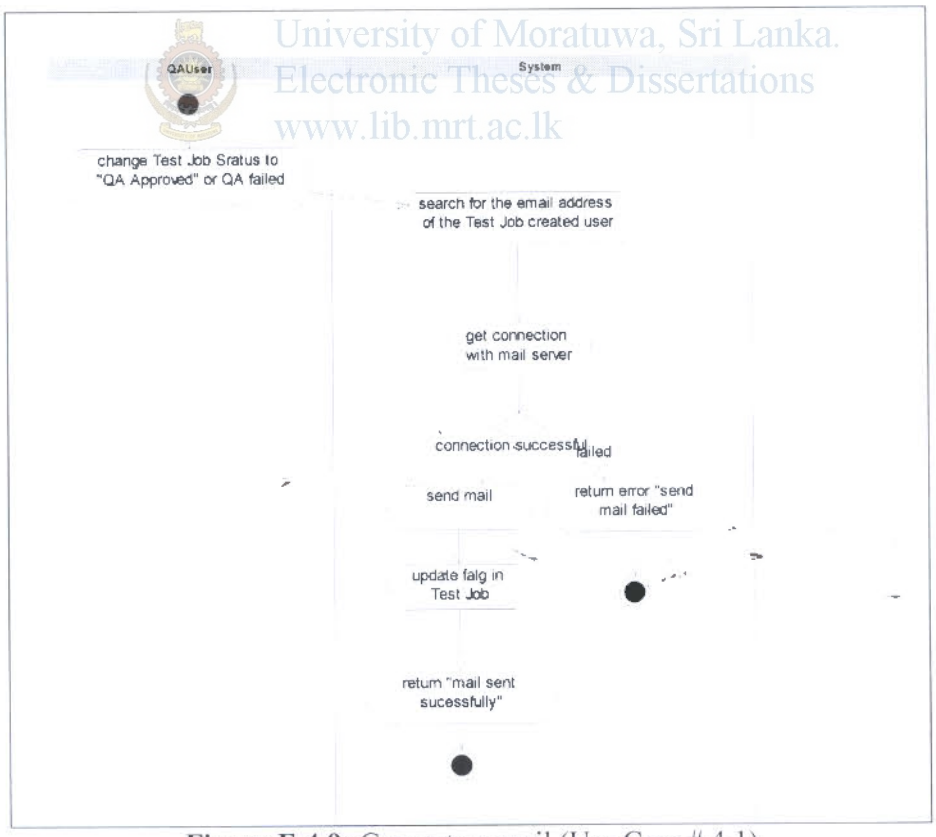

Figure E.4.9: Generate e-mail (Use Case # 4.1)

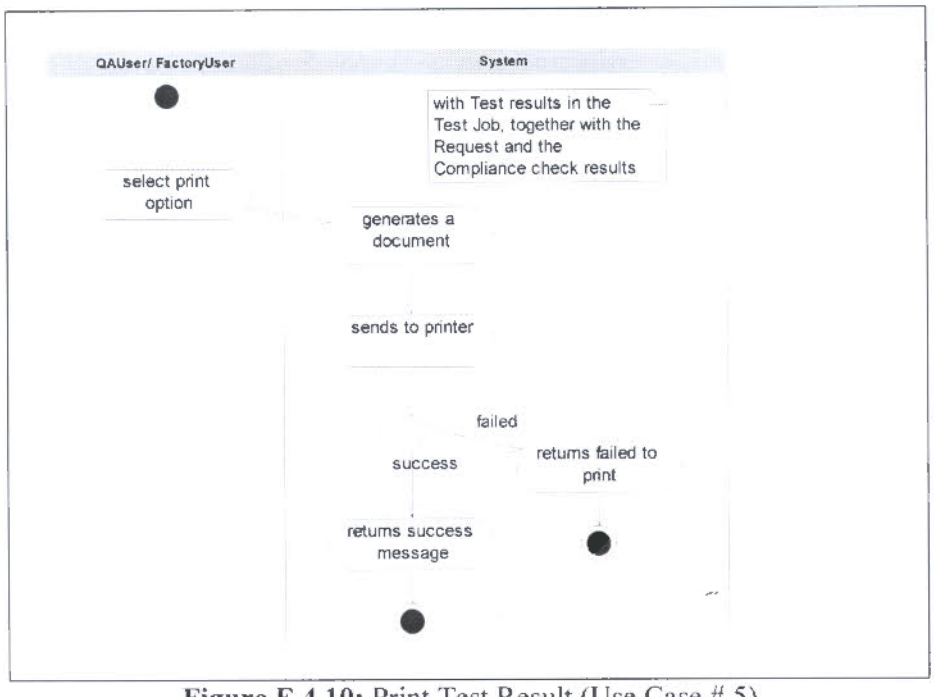

Figure E.4.10: Print Test Result (Use Case # 5)

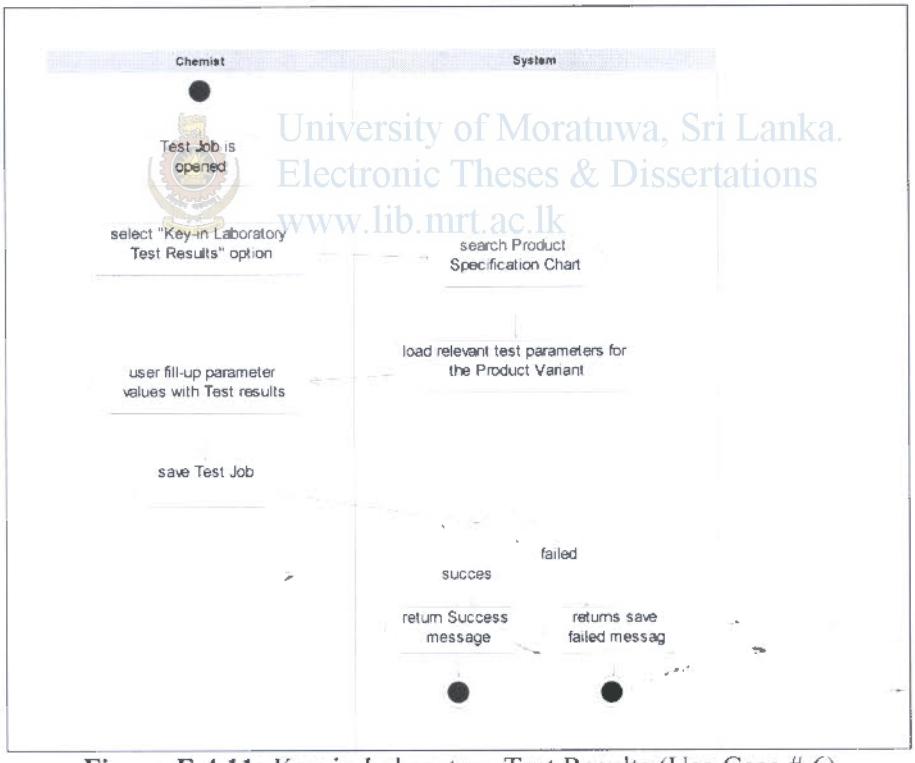

Figure E.4.11: Key-in Laboratory Test Results (Use Case # 6)

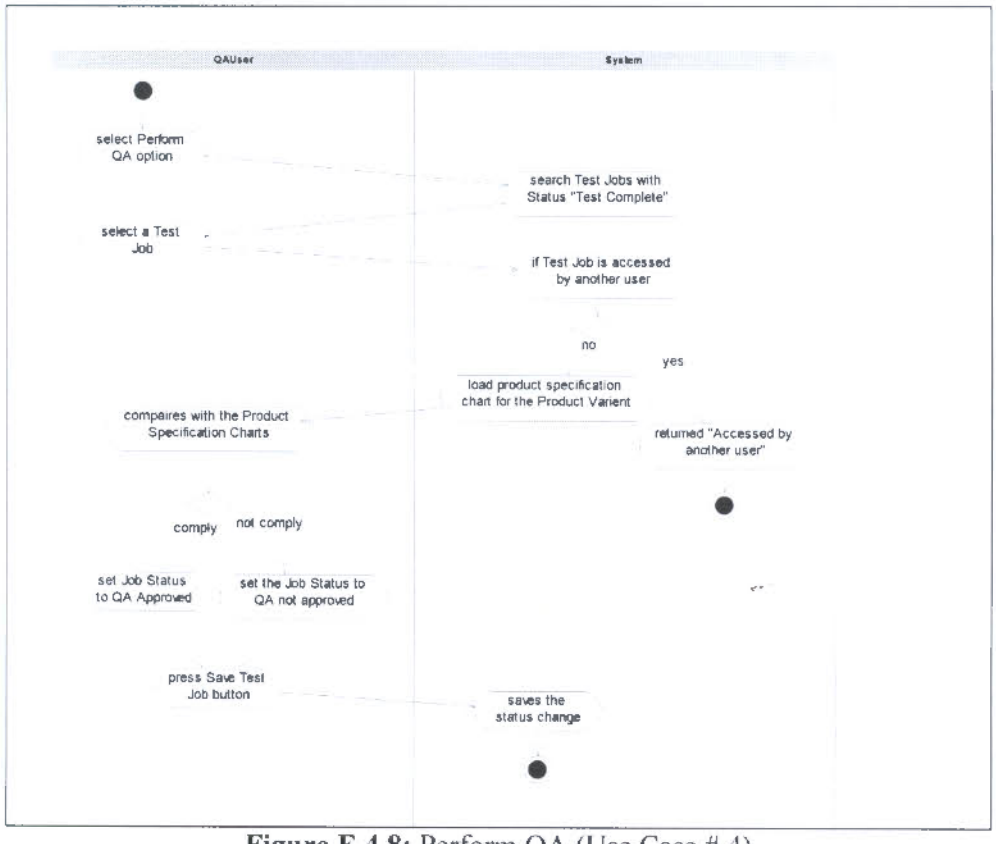

Figure E.4.8: Perform QA (Use Case # 4)

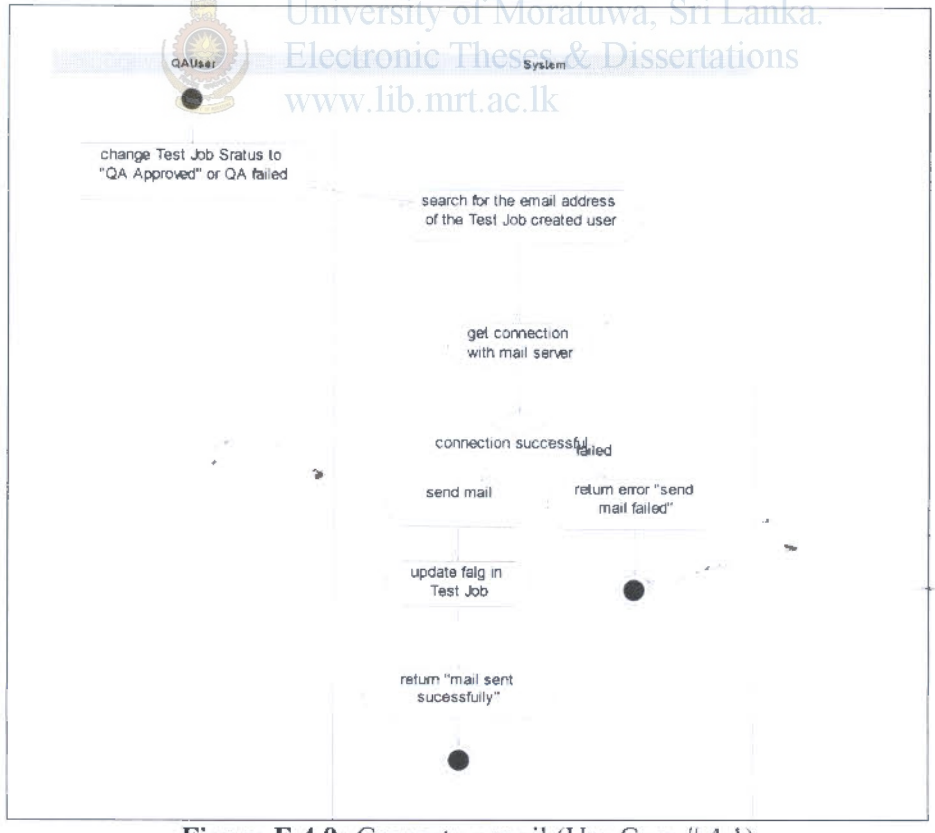

Figure E.4.9: Generate e-mail (Use Case # 4.1)

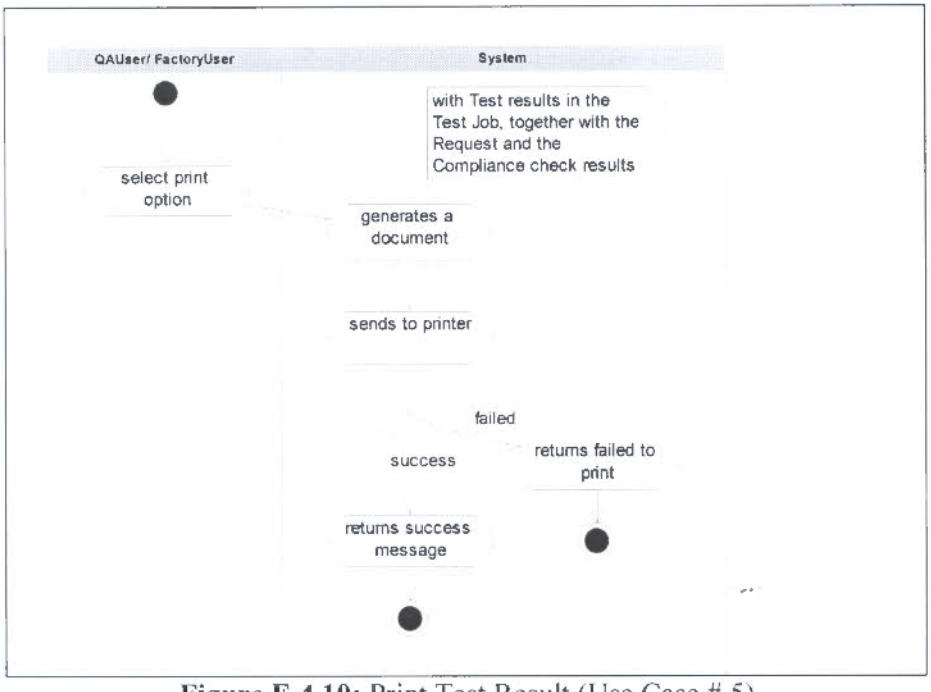

Figure E.4.10: Print Test Result (Use Case # 5)

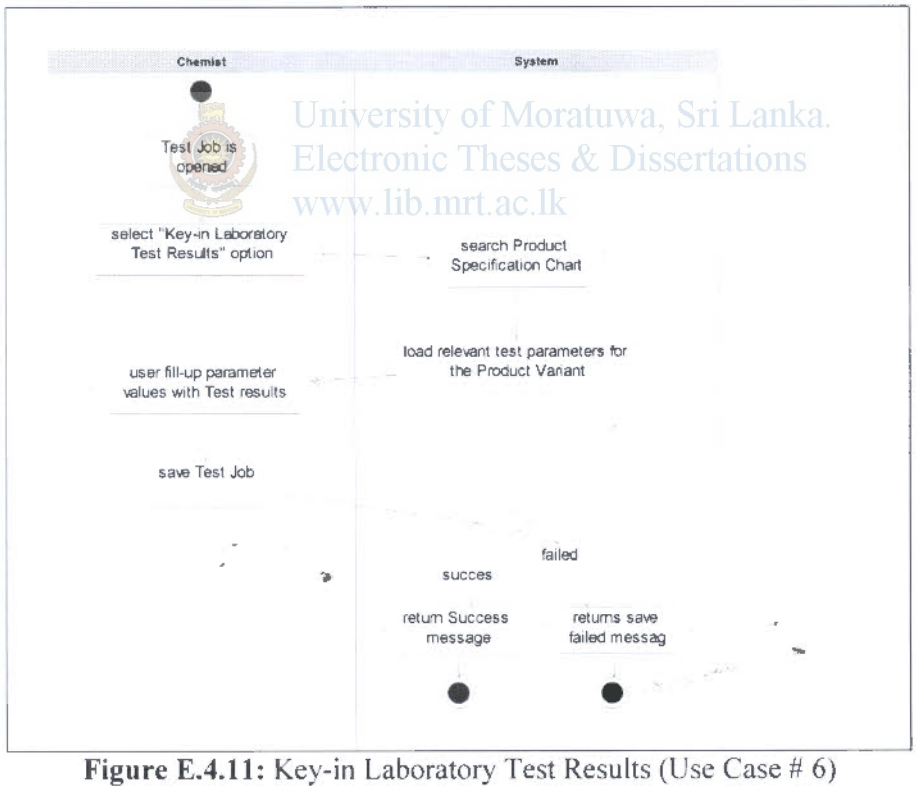

Figure E.4.11: Key-in Laboratory Test Results (Use Case # 6)

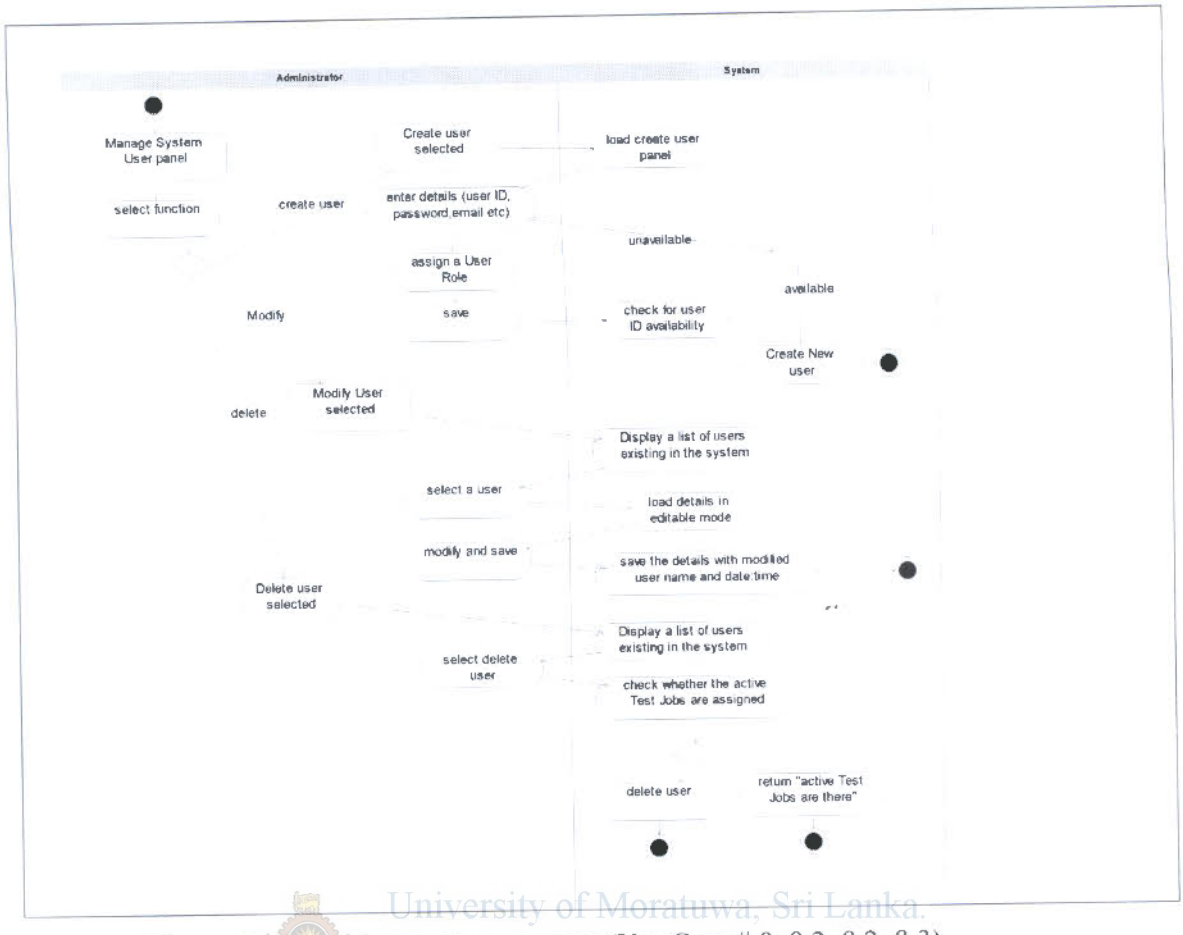

Figure E.4.12: Manage System users (Use Case # 8, 8.2, 8.2, 8.3)

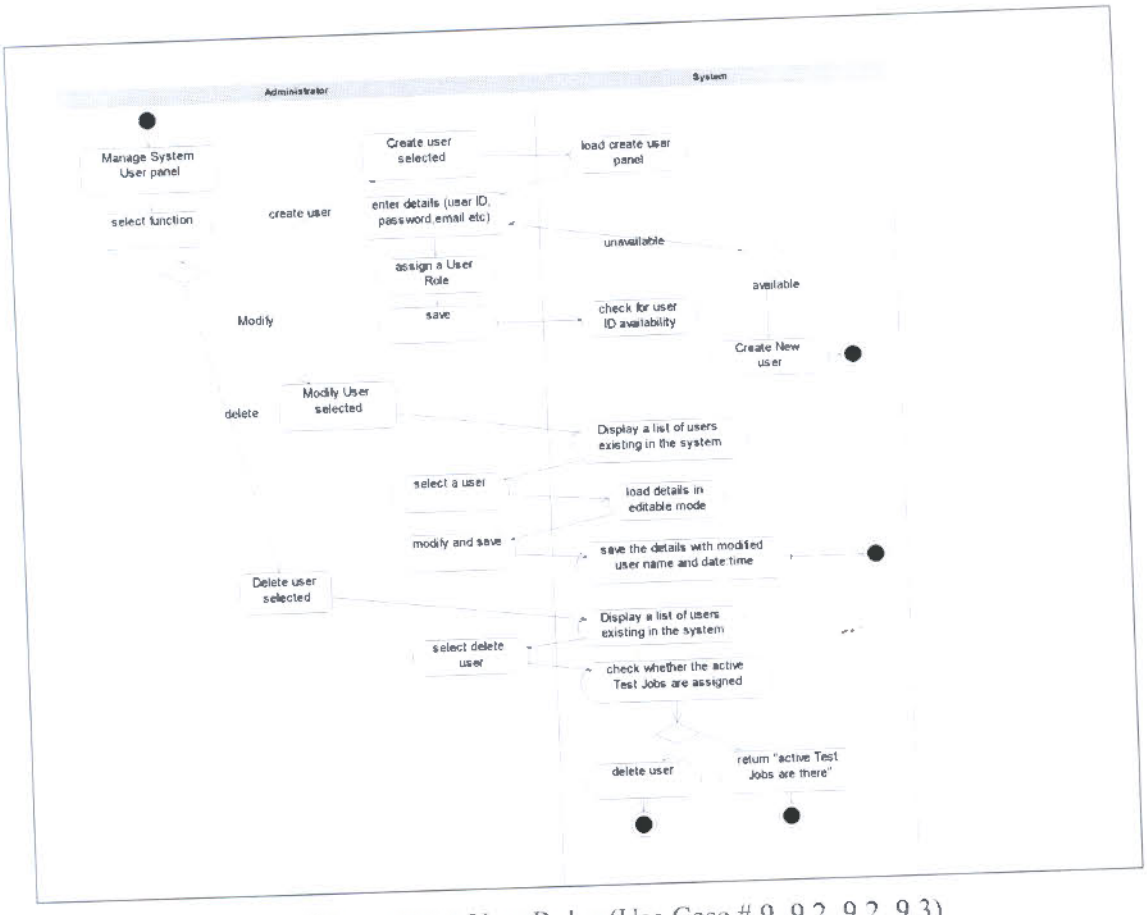

Figure E.4.13: Manage User Roles (Use Case # 9, 9.2, 9.2, 9.3)

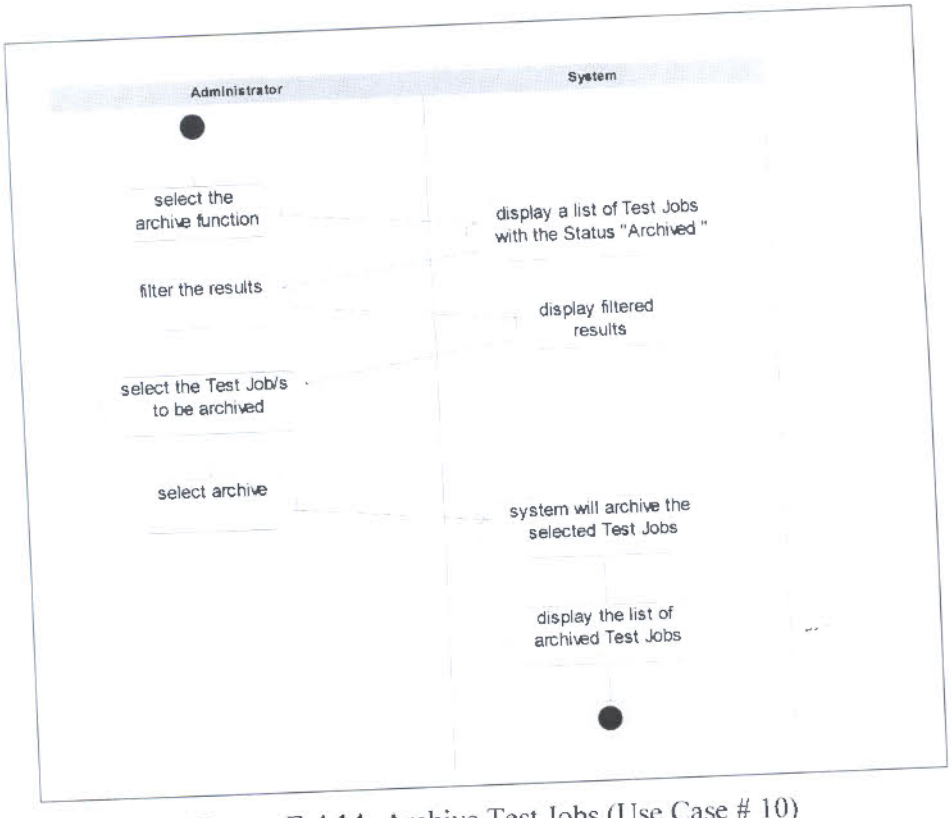

Figure E.4.14: Archive Test Jobs (Use Case # 10)

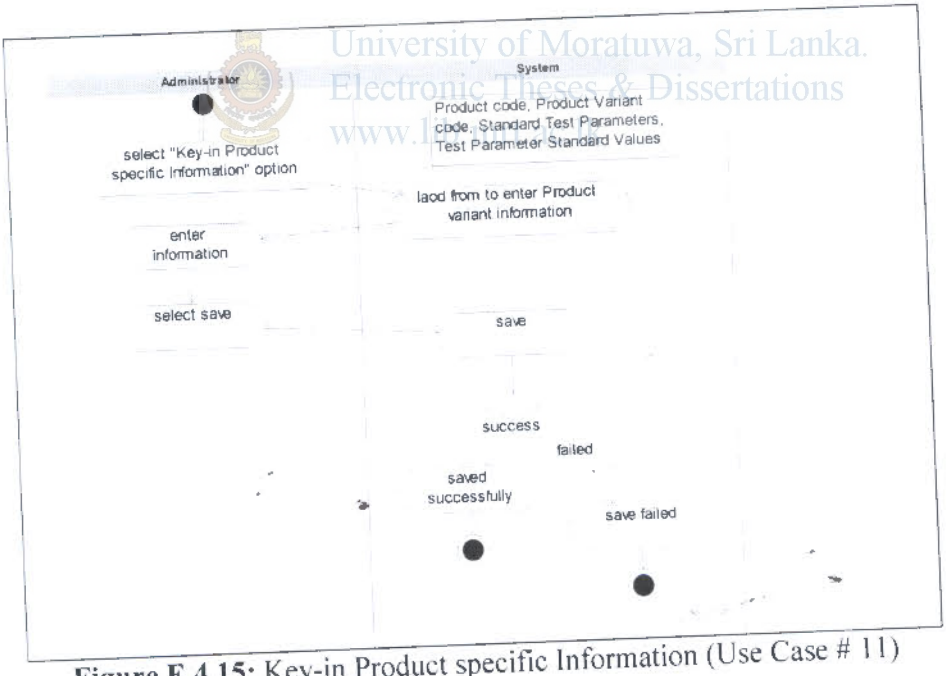

Figure E.4.15: Key-in Product specific Information (Use Case # 11)

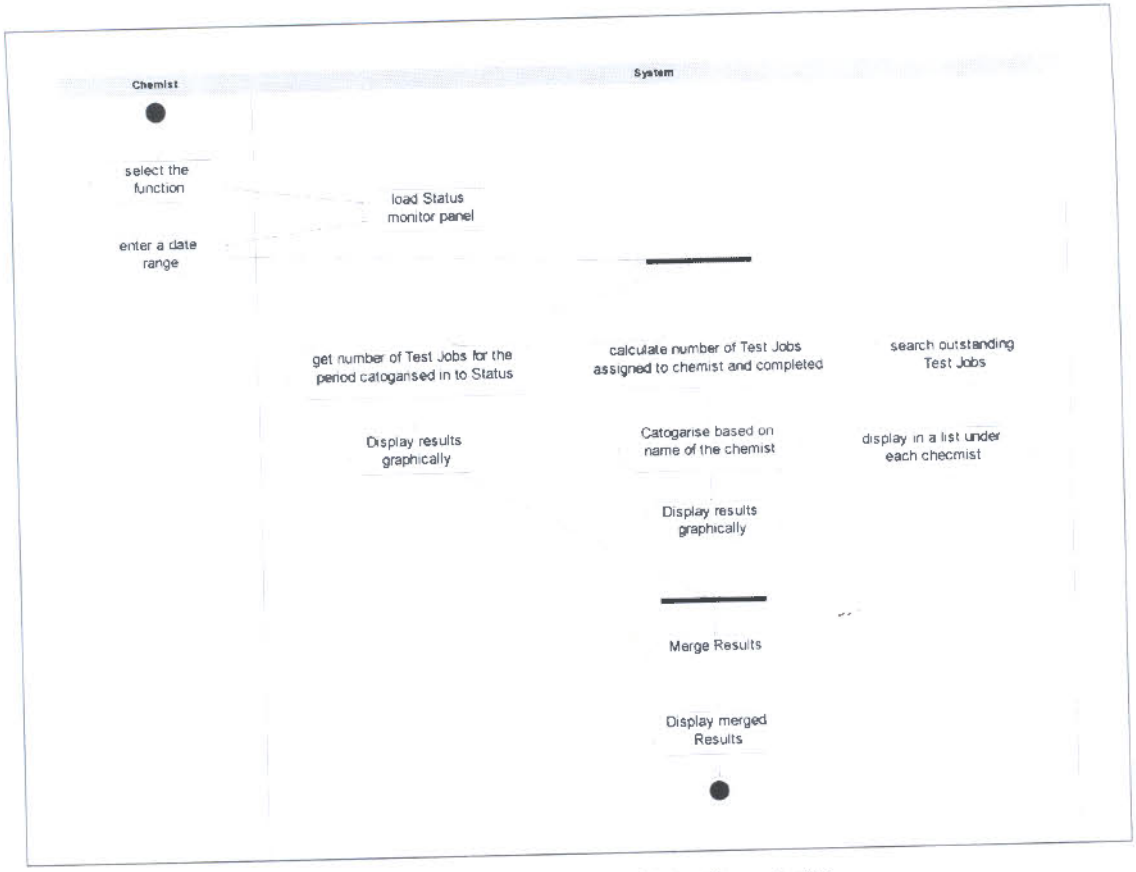

Figure E.4.16: Monitor Status (Use Case # 12)

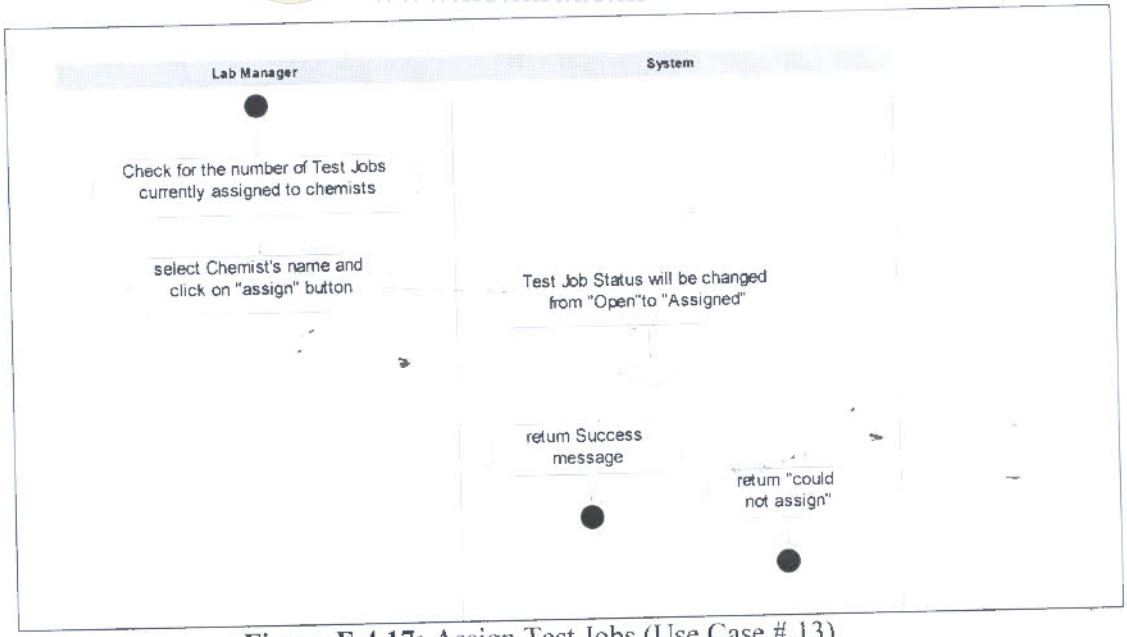

Figure E.4.17: Assign Test Jobs (Use Case # 13)

Sequence Diagrams for the proposed system

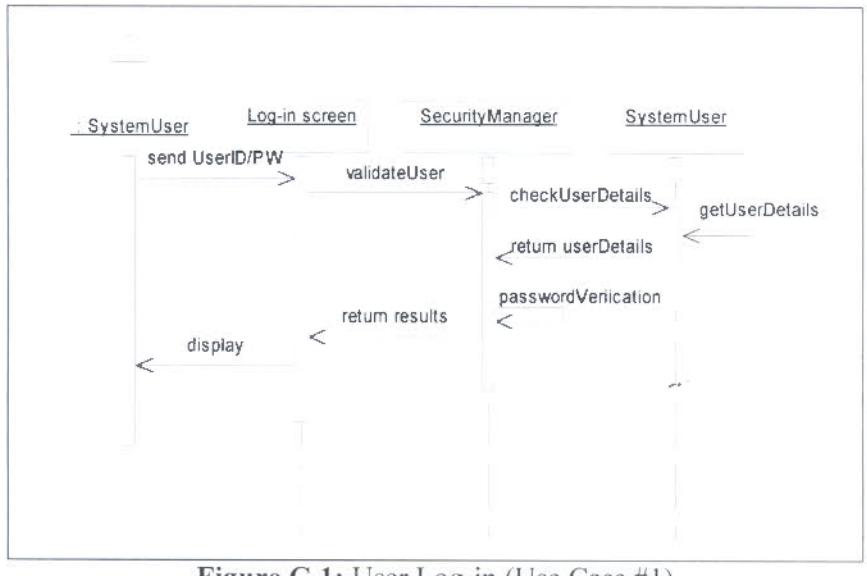

Figure G.1: User Log-in (Use Case #1)

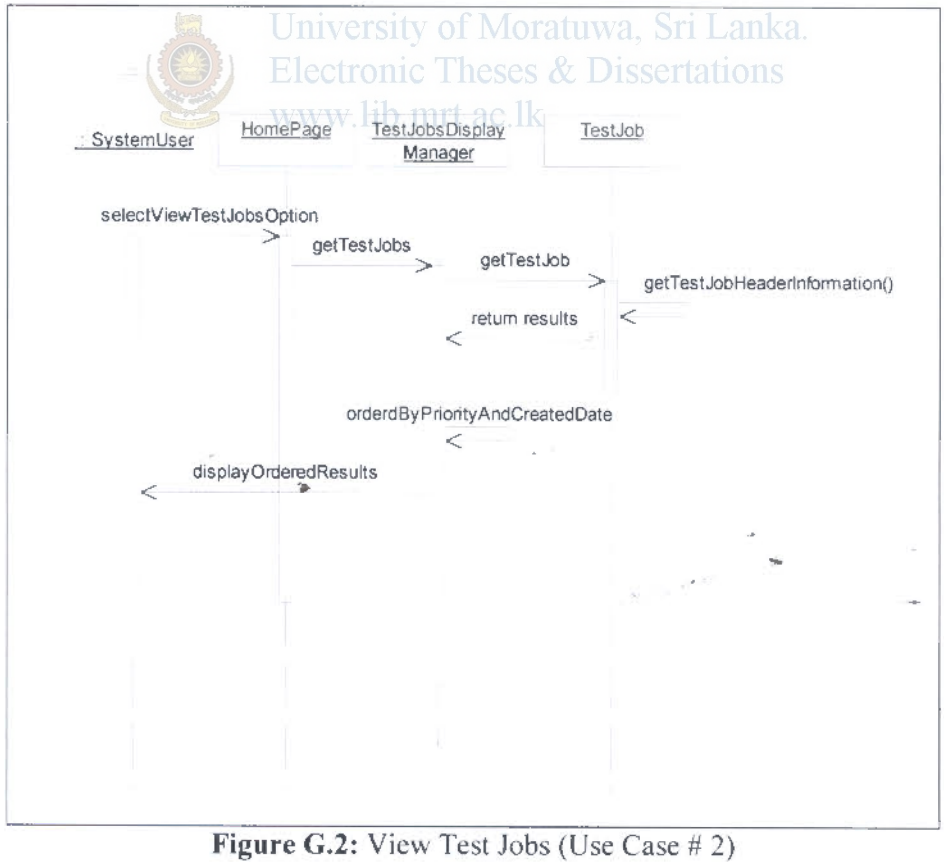

Figure G.2: View Test Jobs (Use Case # 2)

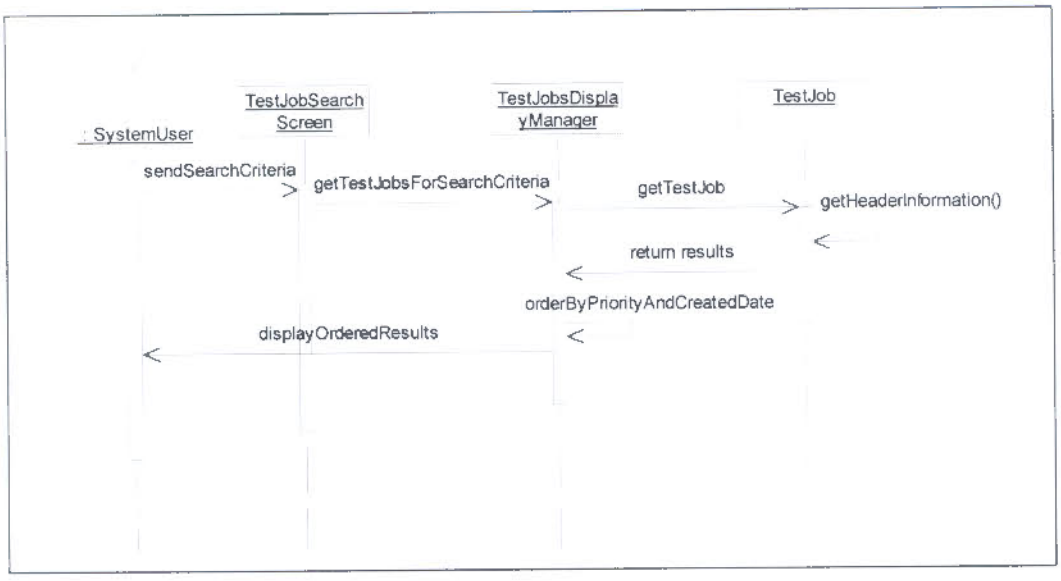

Figure G.3: Search Test Jobs (Use Case # 2.1)

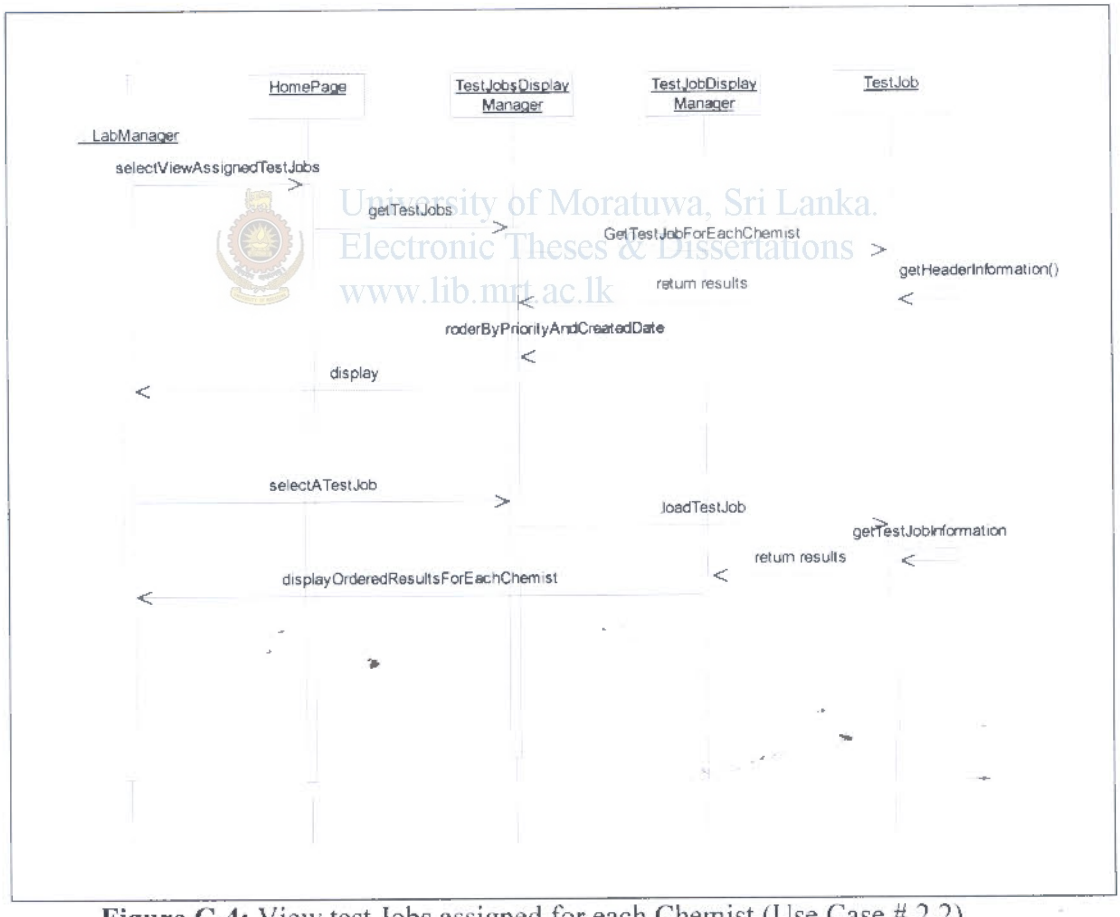

Figure G.4: View test Jobs assigned for each Chemist (Use Case # 2.2)

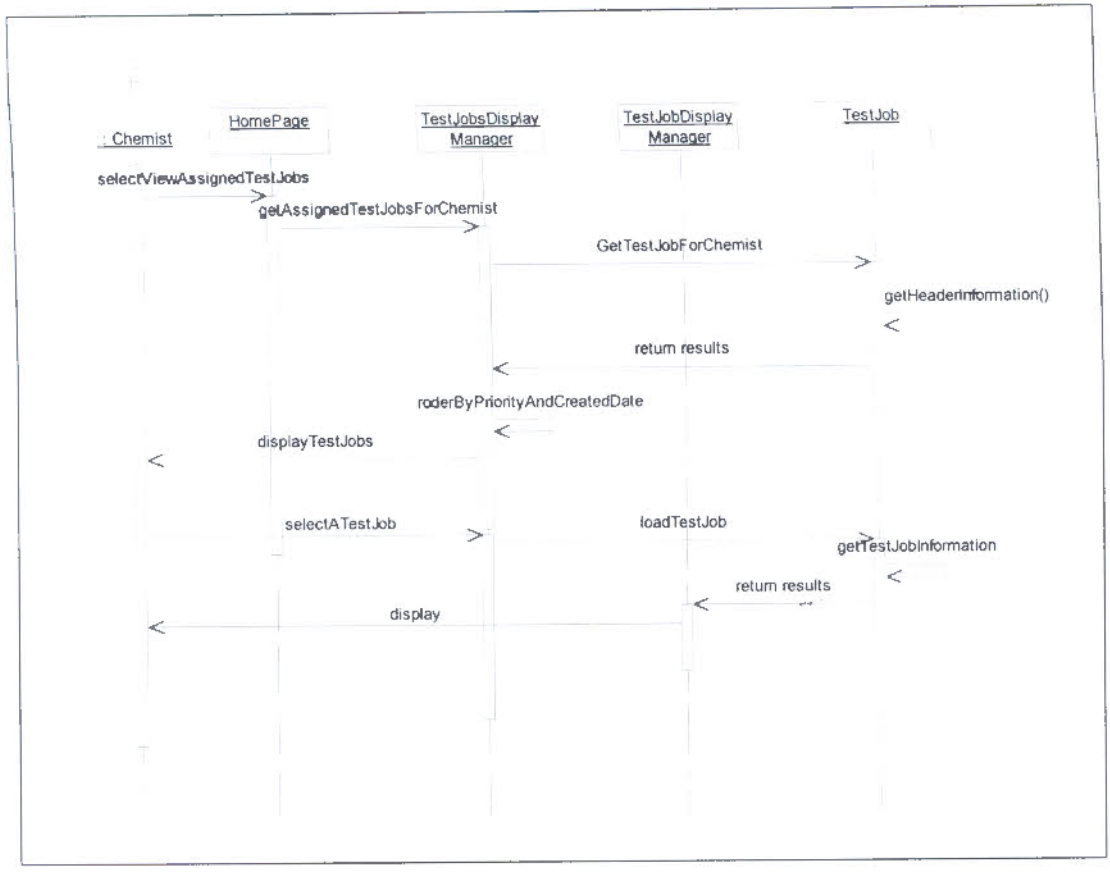

Figure G.5: View assigned Test Jobs (Use Case # 7)

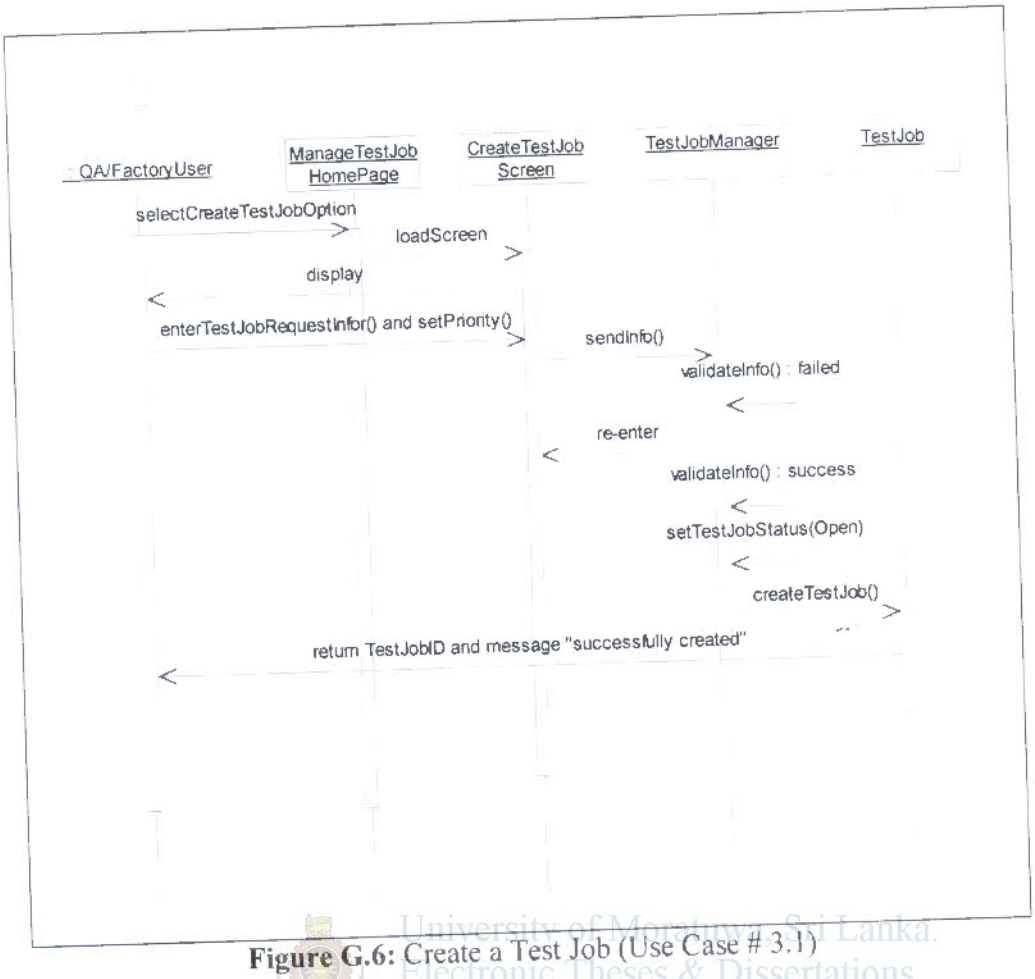

Figure G.6: Create a Test Job (Use Case # 3.1)

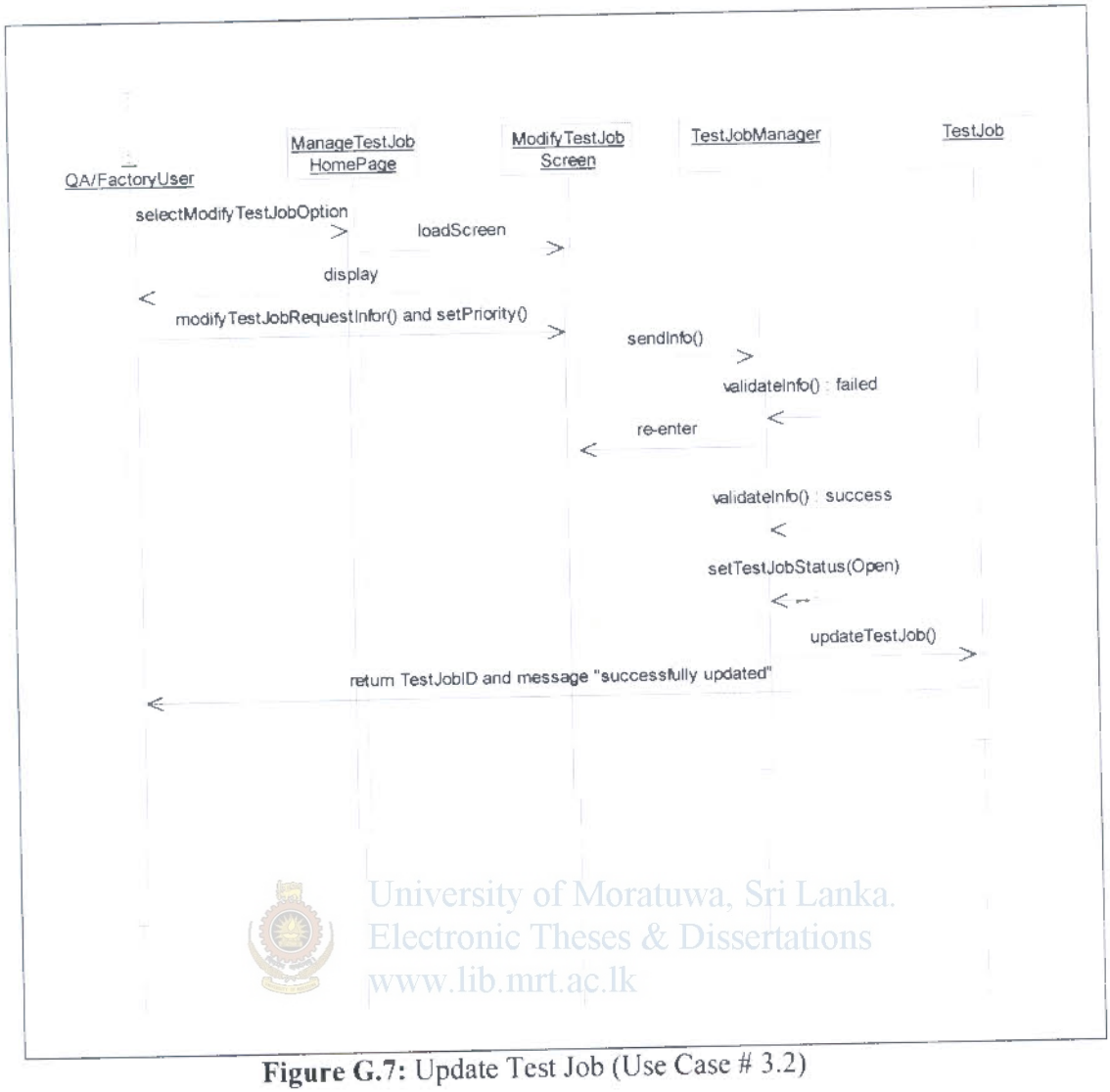

Figure G.7: Update Test Job (Use Case # 3.2)

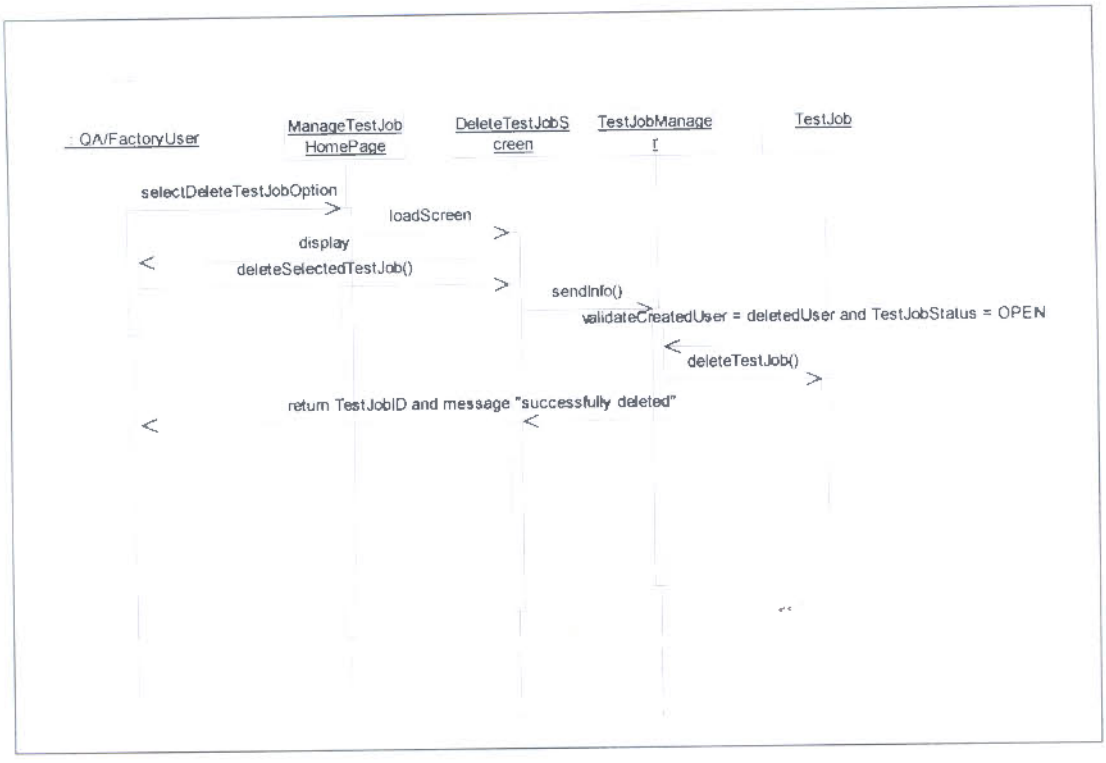

Figure G.8: Delete Test Job (Use Case # 3.3)

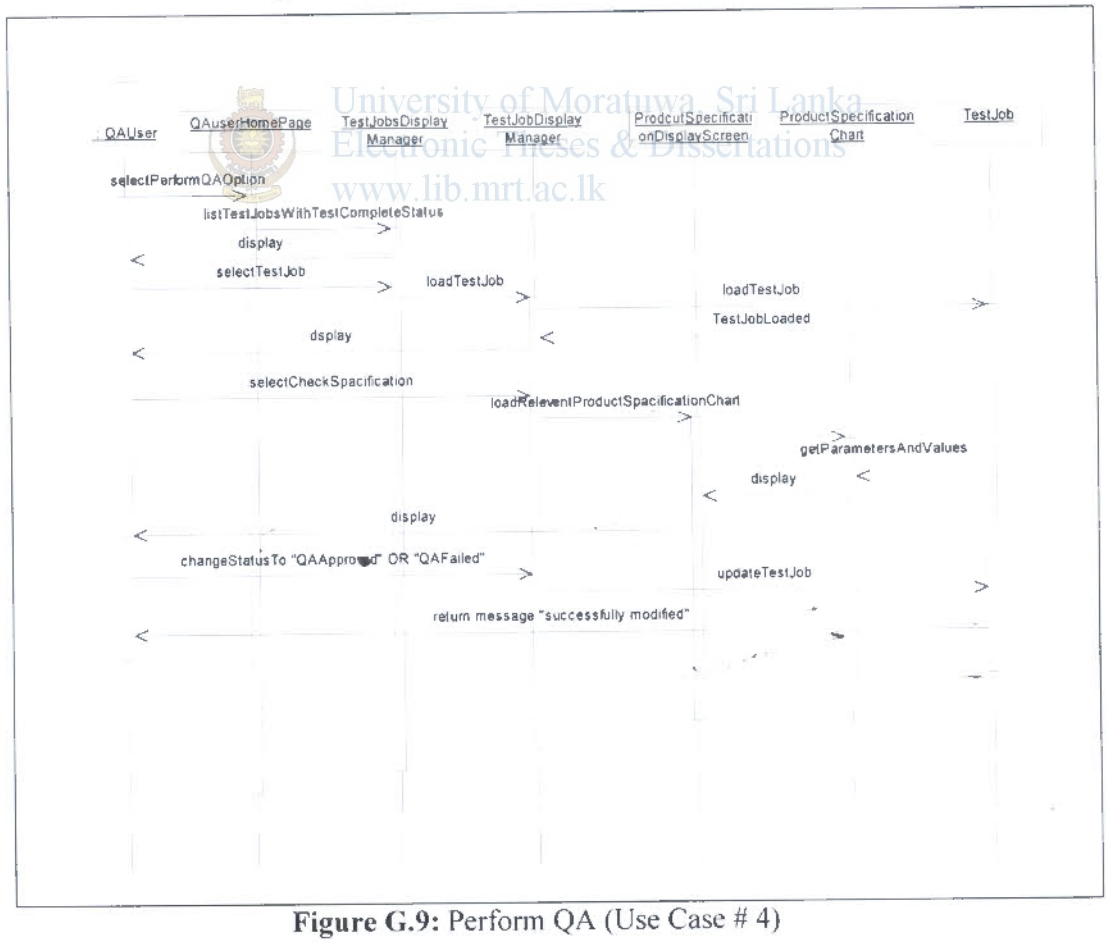

Figure G.9: Perform QA (Use Case # 4)

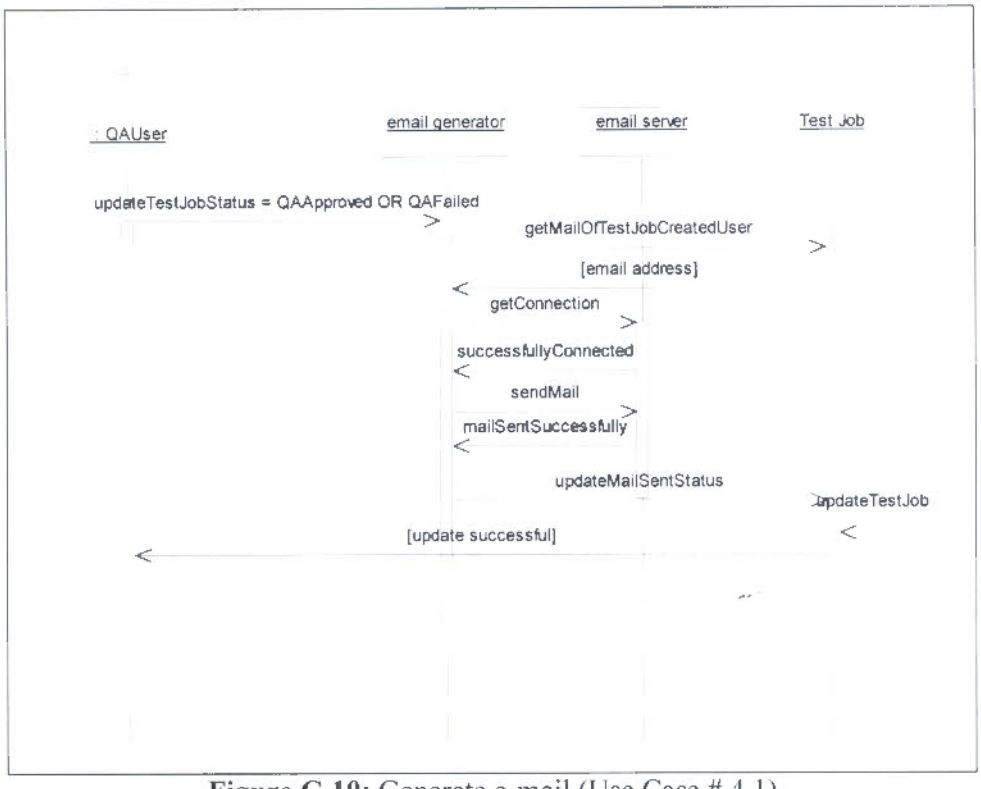

Figure G.10: Generate e-mail (Use Case # 4.1)

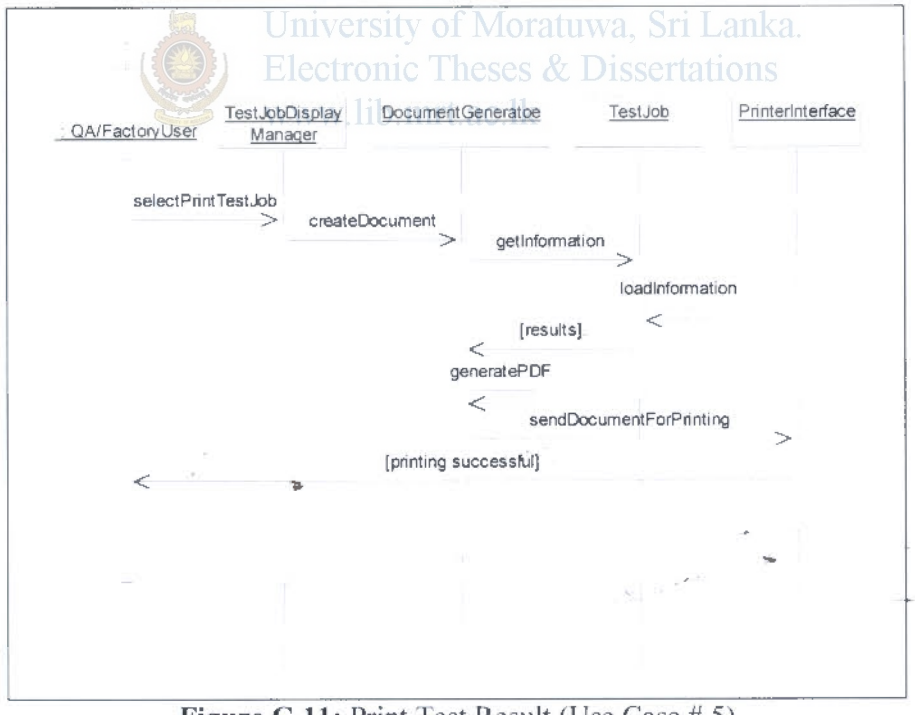

Figure G.11: Print Test Result (Use Case # 5)

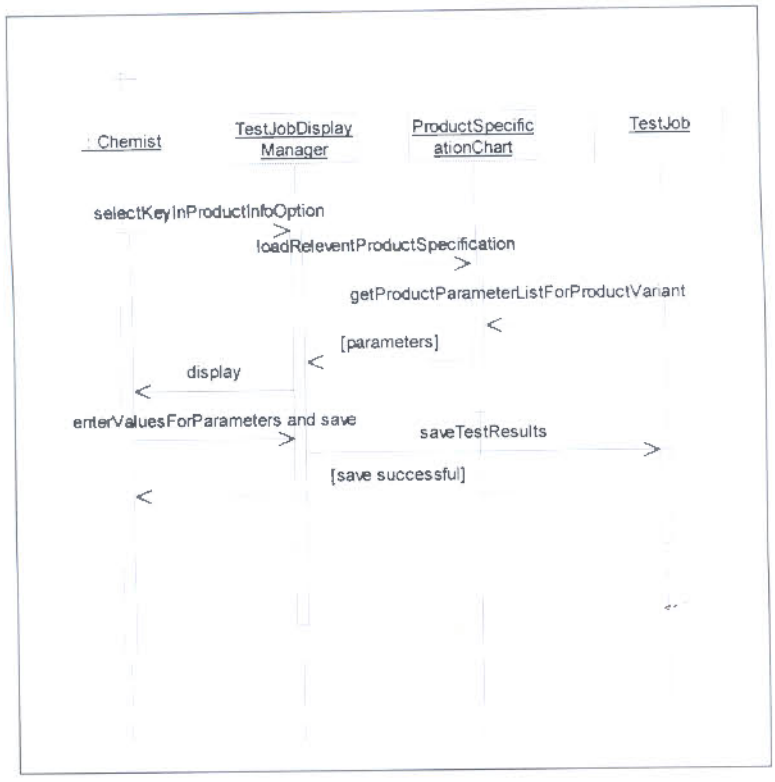

Figure G.12: Key-in Laboratory Test Results (Use Case # 6)

G.13 Manage System users (Use Case # 8, 8.1, 8.2, 8.3)

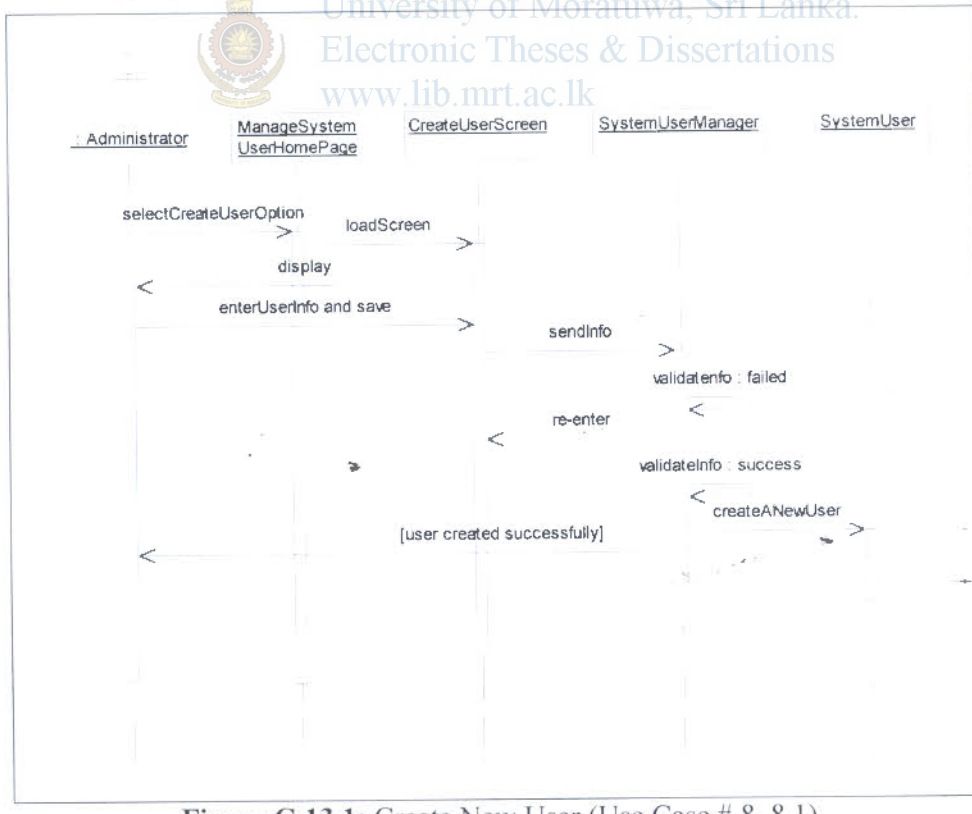

Figure G.13.1: Create New User (Use Case # 8, 8.1)

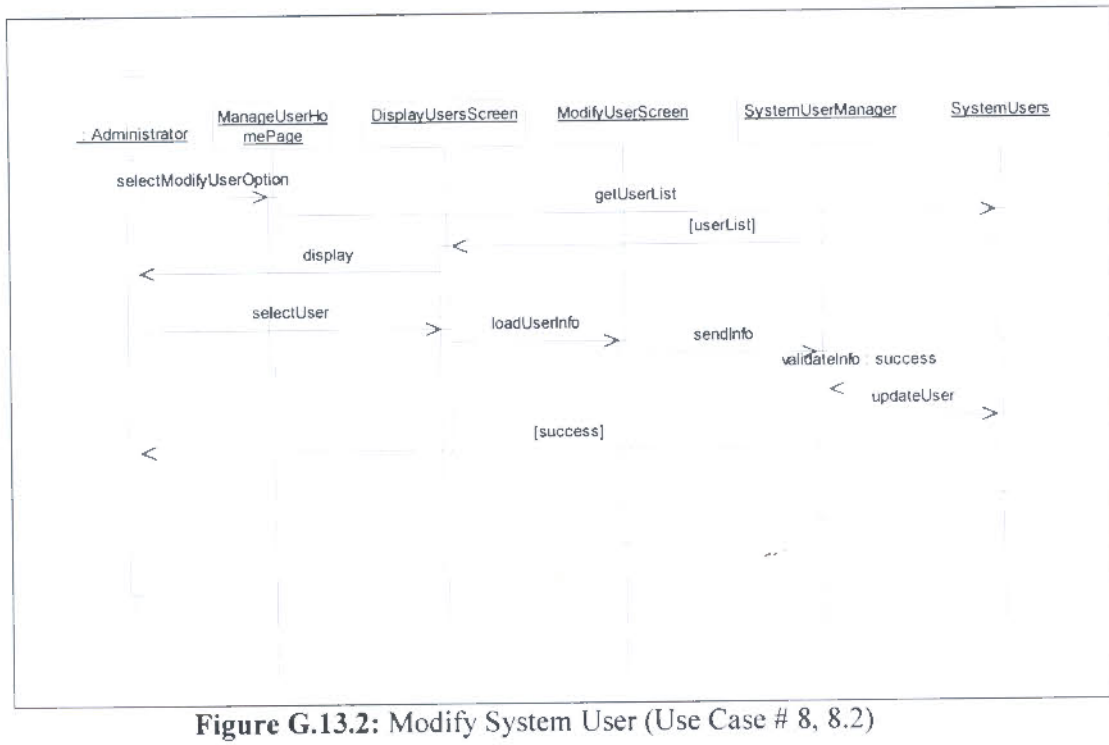

Figure G.13.2: Modify System User (Use Case # 8, 8.2)

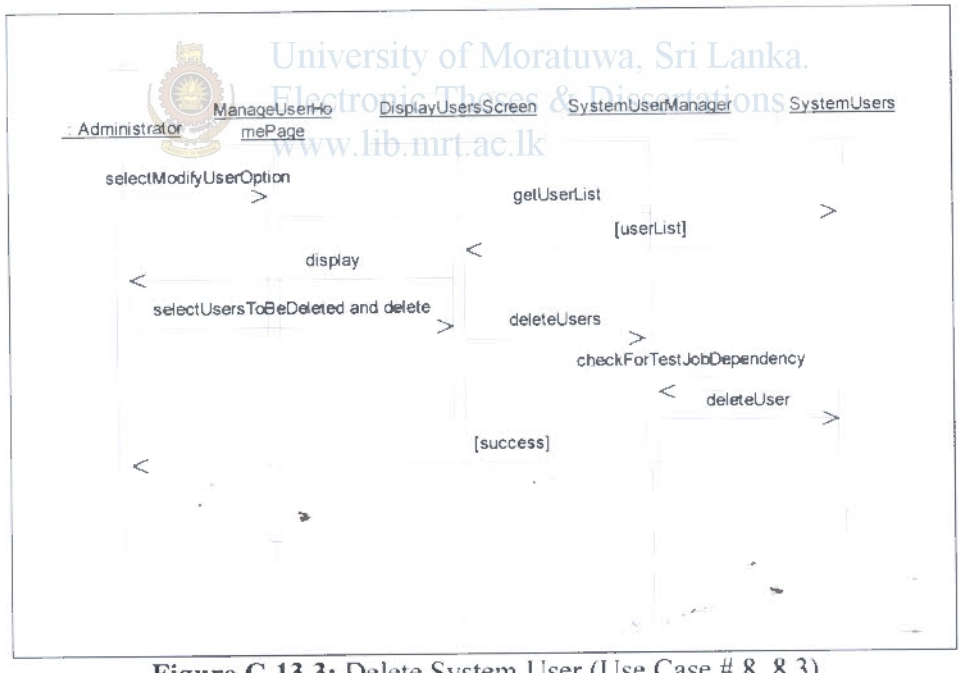

Figure G.13.3: Delete System User (Use Case # 8, 8.3)

G.14 Manage System User Roles (Use Case # 9, 9.1, 9.2, 9.3)

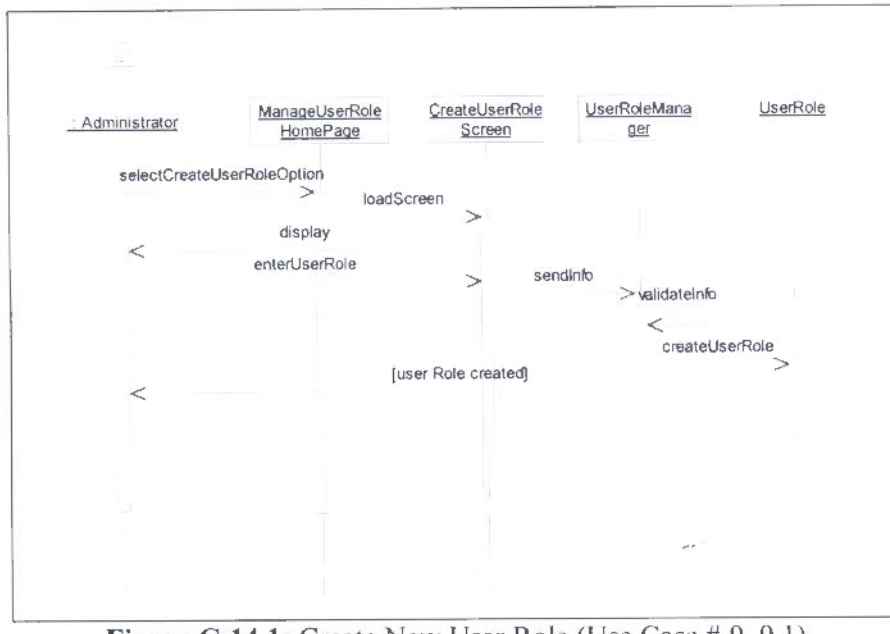

Figure G.14.1: Create New User Role (Use Case # 9, 9.1)

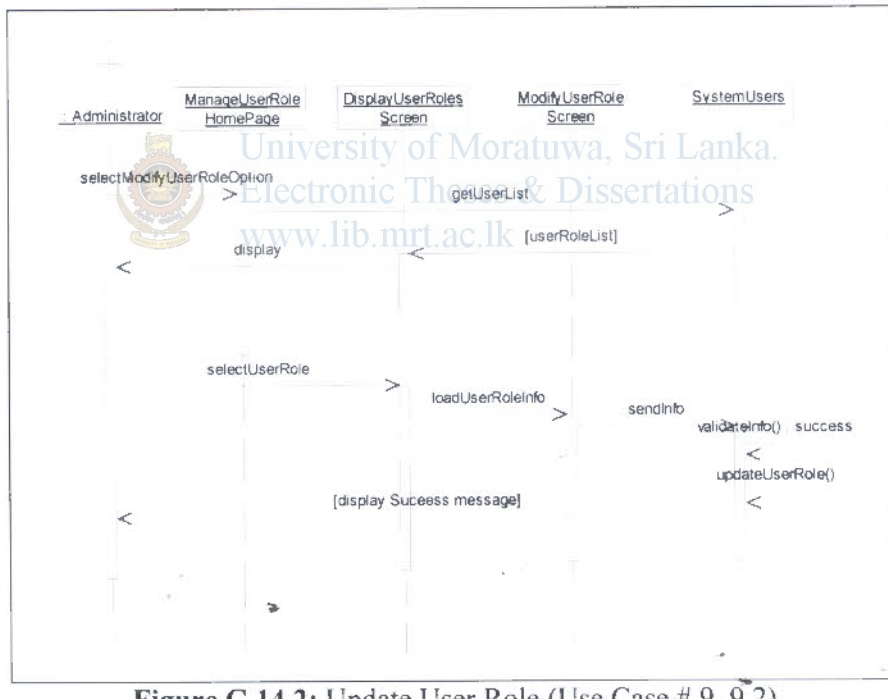

Figure G.14.2: Update User Role (Use Case # 9, 9.2)

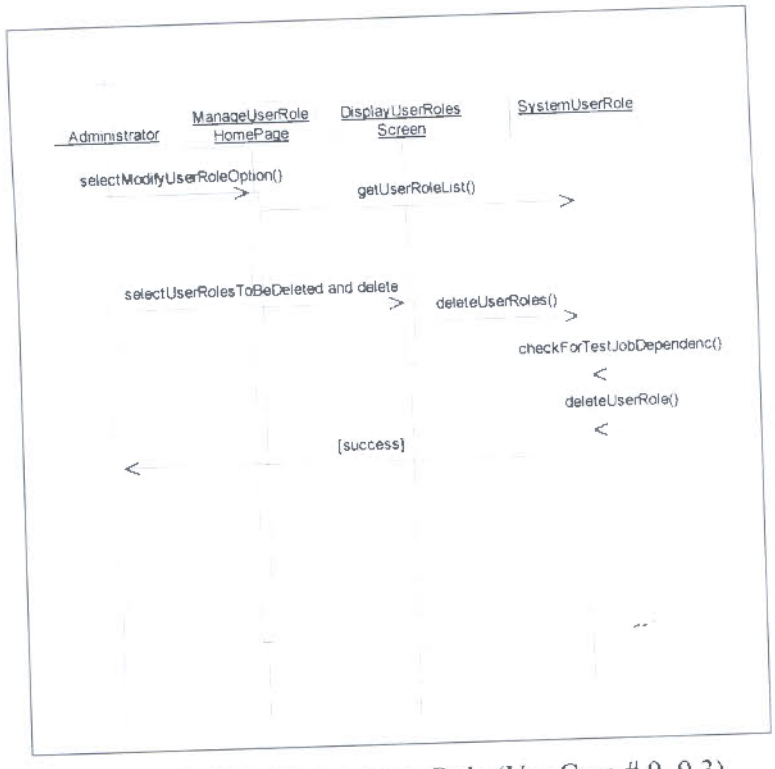

Figure G.14.3: Update User Role (Use Case # 9, 9.3)

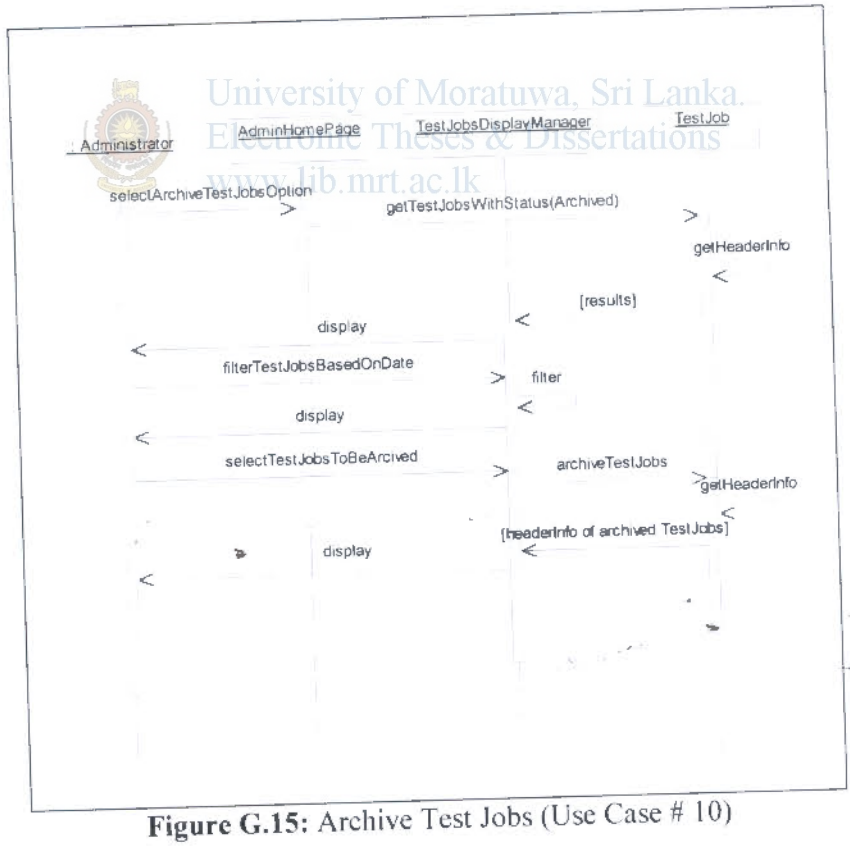

Figure G.15: Archive Test Jobs (Use Case # 10)

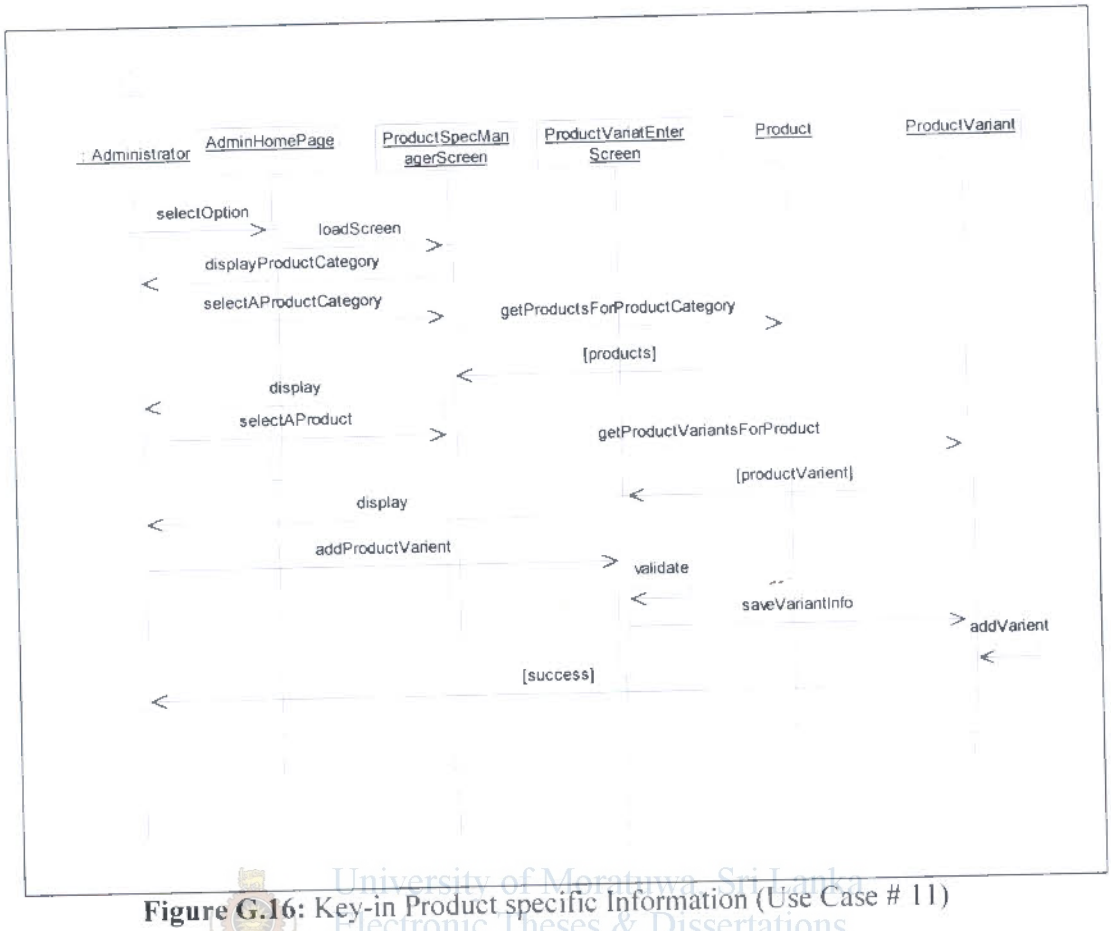

Figure G.16: Key-in Product specific Information (Use Case # 11)

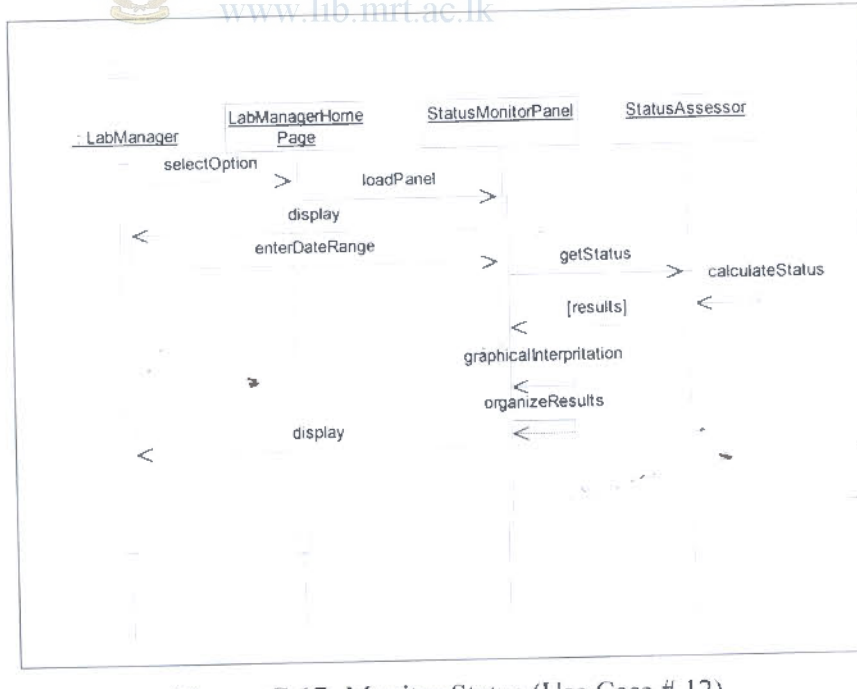

Figure G.17: Monitor Status (Use Case # 12)

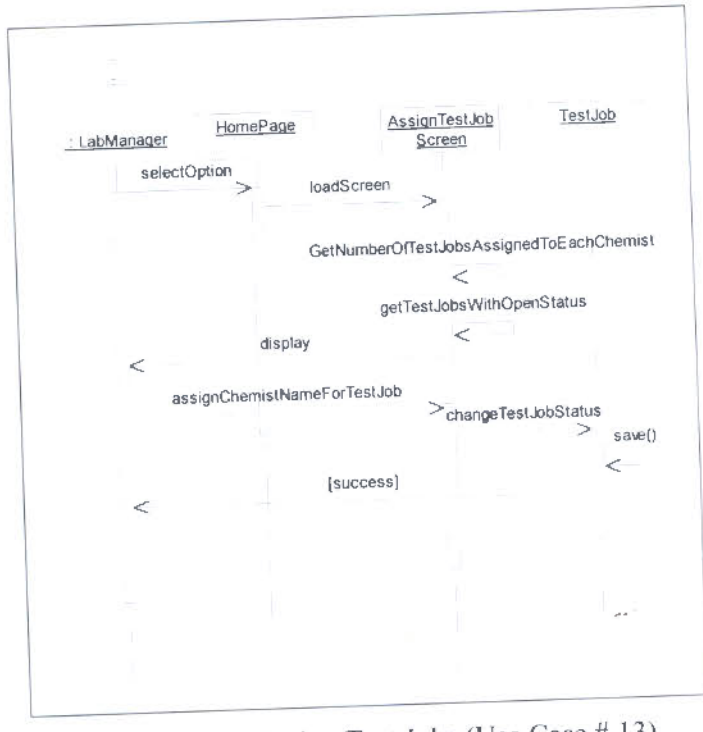

Figure G.18: Assign Test Jobs (Use Case # 13)