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Appendix A

Abbreviations

ABST	Antibiotic Sensitivity Test
BOE	Business-Oriented Software Engineering
BSO	Business System Option in SSADM
CM	Conceptual model in OPM
CMS	Content Management System
CRC	Class-Responsibilities-Collaborators
DFD	Data Flow Diagram in SSADM

ELH	Entity Life History in SSADM
EMR	Electronic Medical Record
ERD	Entity Relationship Diagram in SSADM
GNU	GNU is Not Unix
LAMP	Linux, Apache, MySQL and PHP
LIMS	Laboratory Information Management System
LSDM	SSADM CASE tool
MLT	Medical Laboratory Technician
OPM	Organizational Process Modeling
PHP	PHP Hypertext Preprocessor
RAD	Rapid Application Development
RUP	Rational Unified Process
SDLC	Software Development Life Cycle
SSADM	Structured Systems Analysis and Design Method
UML	Unified Modeling Language

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Appendix B

Documents used in a microbiology laboratory

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2. Request Form

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3. Worksheet for Processing Microbiological Specimens

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4. Microbiology Report

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5. Microbiology Report (Urine)

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6. Antibiotic Susceptibility Pattern

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7. Culture and Antibiotic Sensitivity Test Result Sheets

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Appendix C

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Appendix D

Usecase Diagrams and Usecase Descriptions

1. Existing System

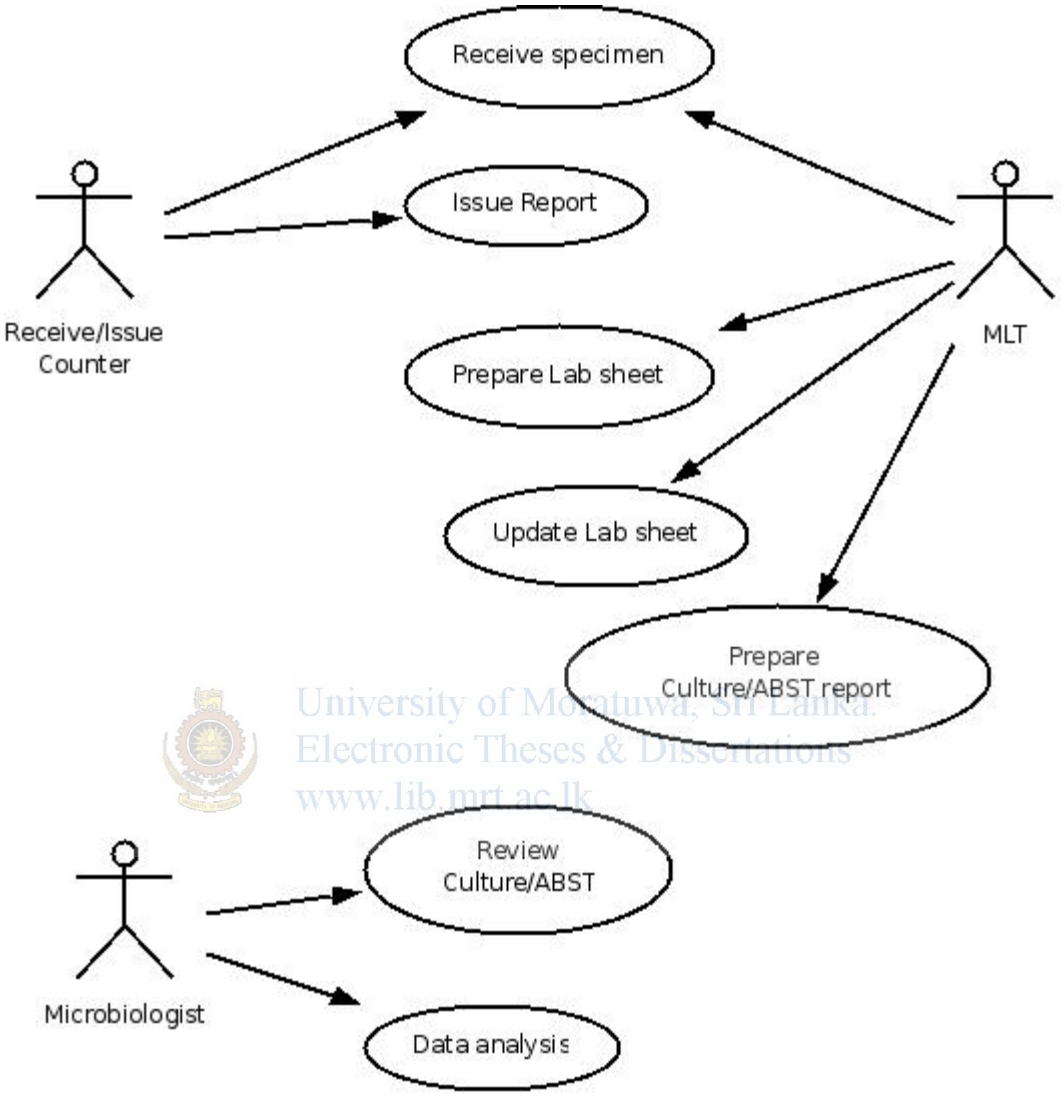

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Figure : Overview of the existing system

2. Proposed System

2.1 Proposed System - Overview

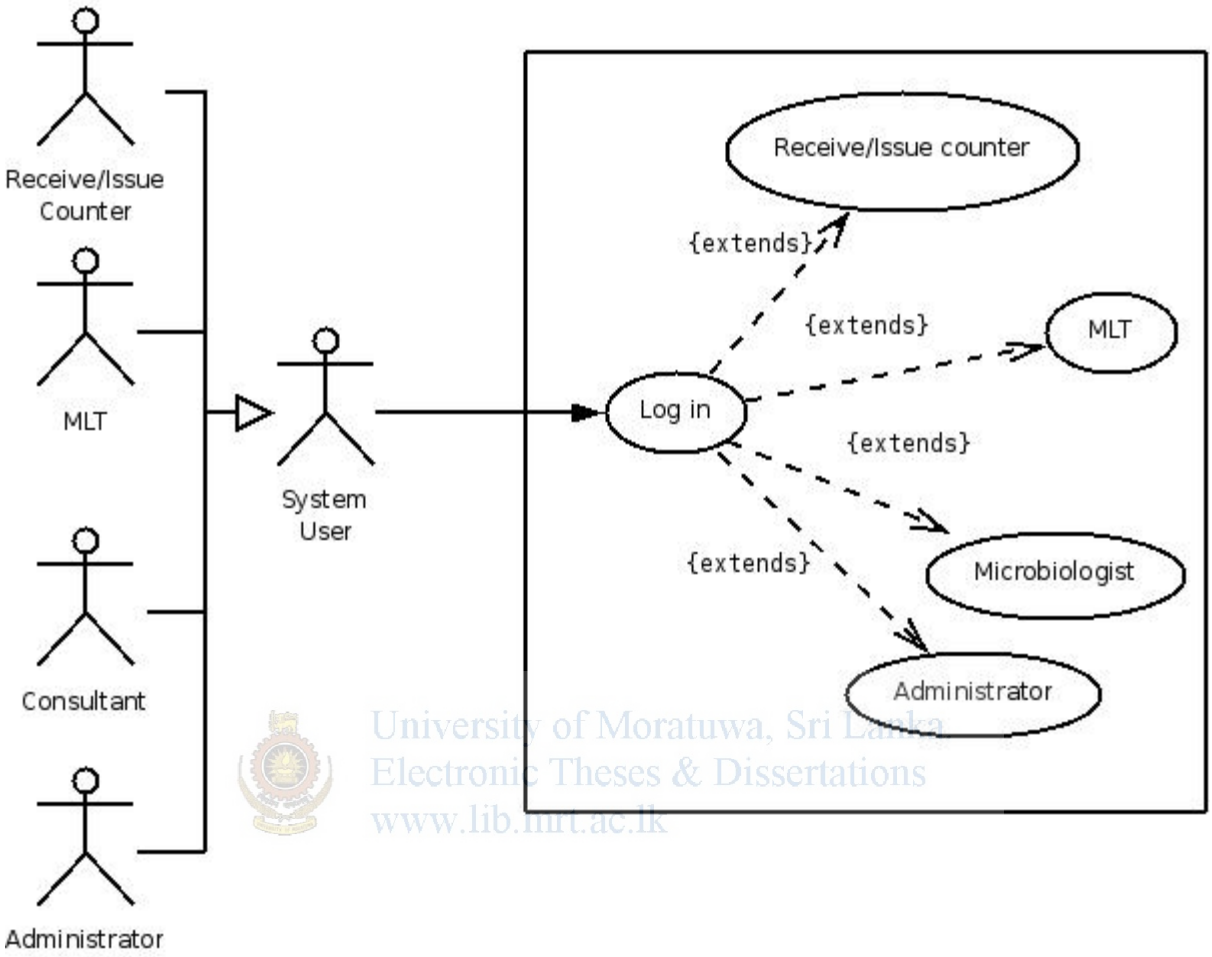

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Figure : Overview of the proposed system

2.2 Proposed System – Detailed View

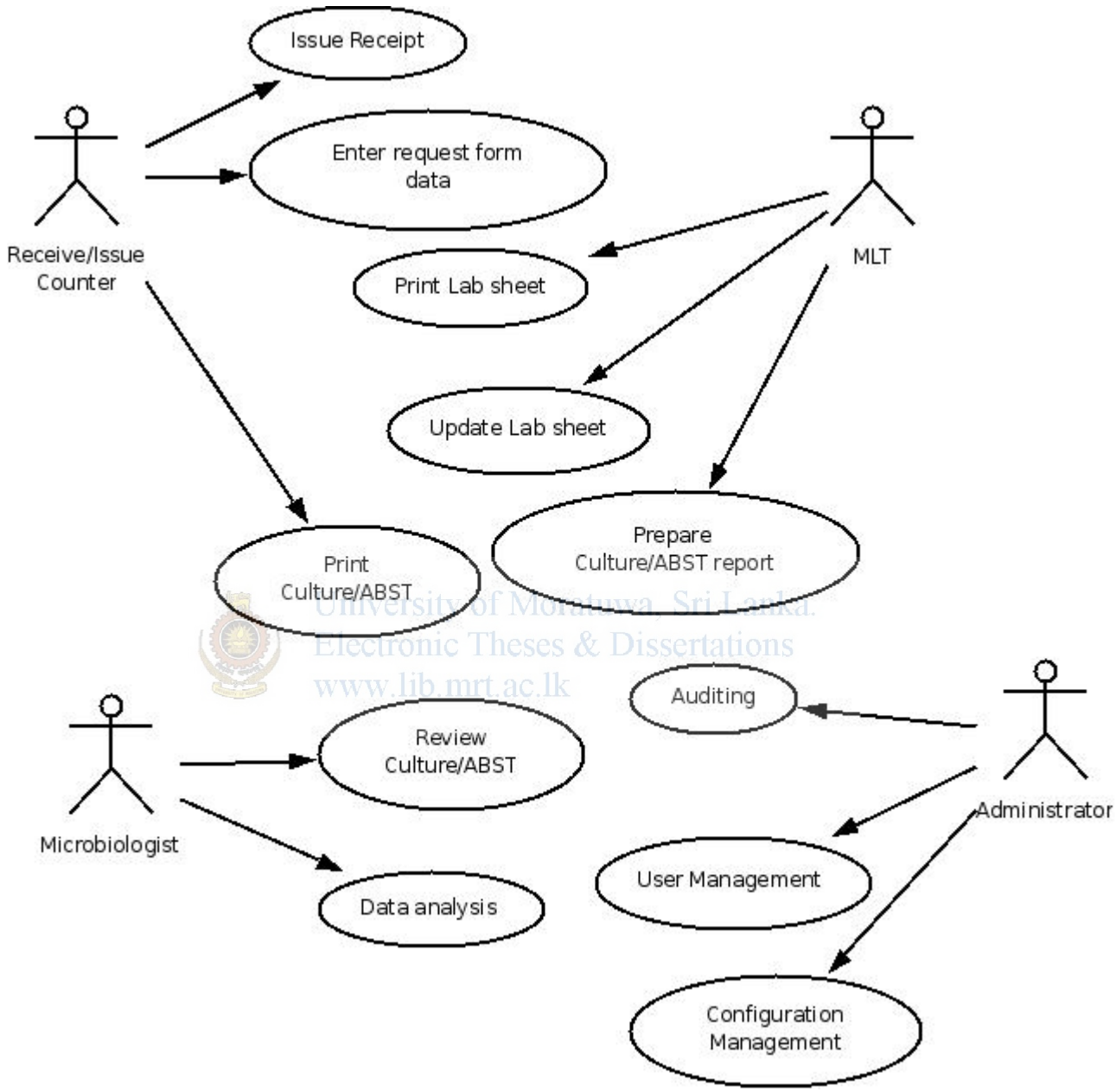

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Figure : Detailed view of the proposed system

2.2 Proposed System – Usecase Descriptions

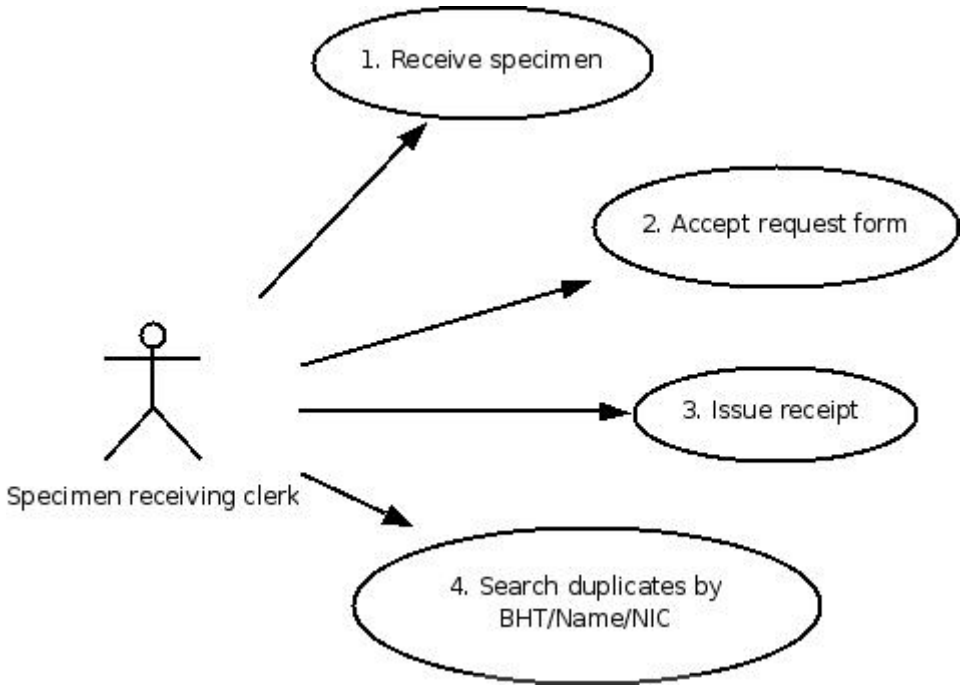

Figure : Use case – Specimen receiving clerk

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Name	1.0	Receive specimen
Actor	Specimen receiving clerk	
Pre conditions	Specimen has to be sent form the ward Specimen is accompanied by a valid request form	
Post conditions	Specimen is prepared to delivered to the laboratory	
Flow	• Specimen is sent from the ward with a request from • Specimen is received by the 'specimen reception counter' • Check for request form • Specimen is for Culture+/- ABST • Specimen details are entered in to the 'specimen received' book • Receipt will be issued for the specimen	
Exceptions	Specimen without a request form Staff is in a trade union action	

Name	2.0	Accept request form
Actor	Specimen receiving clerk	
Pre conditions	Request form accompanied with a specimen	
Post conditions	Request form information will be entered to the 'specimen received' book Specimen will be prepared to sent to the laboratory	
Flow	• Request form will be accepted by the specimen receiving clerk • Request form information are entered to the 'specimen received' book • Specimen is prepared to be delivered to the laboratory	
Exceptions	Specimen without a request form Specimen expires its 'due date' Staff in a trade union action	

Name	3.0	Issue receipt
Actor	Specimen receiving clerk	
Pre conditions	Specimen accompanied by a request form Specimen 'due date' not expired	
Post conditions	Specimen is transported to the laboratory Receipt and a number is issued to the client	
Flow	Specimen is accepted by the counter Receipt is issued to the client with a serial number	
Exceptions	Client rejects the laboratory	

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Name	4.0	Search duplicates by BHT/Name/NIC
Actor	Specimen receiving clerk	
Pre conditions	Specimens are already entered to the 'specimen received' book Client/ward request a details of a specimen, said to be delivered to the laboratory	
Post conditions	Specimen details are shown, if it is already accepted by the laboratory If there is >1 specimen for a single Name, BHT or NIC number, it is displayed	
Flow	• Ward/client is in search of specimen details, which is considered to be delivered to the laboratory • Authorized personnel search the entry in the 'specimen received' book • Specimen/s are searched by Name, BHT or the NIC • One or more specimens are listed under the selected search criteria	
Exceptions	Specimen is not found in the registration book Valid Name, BHT or NIC number is not provided Wrong Name, BHT or NIC is entered to the book Wrong specimen is sent to the laboratory	

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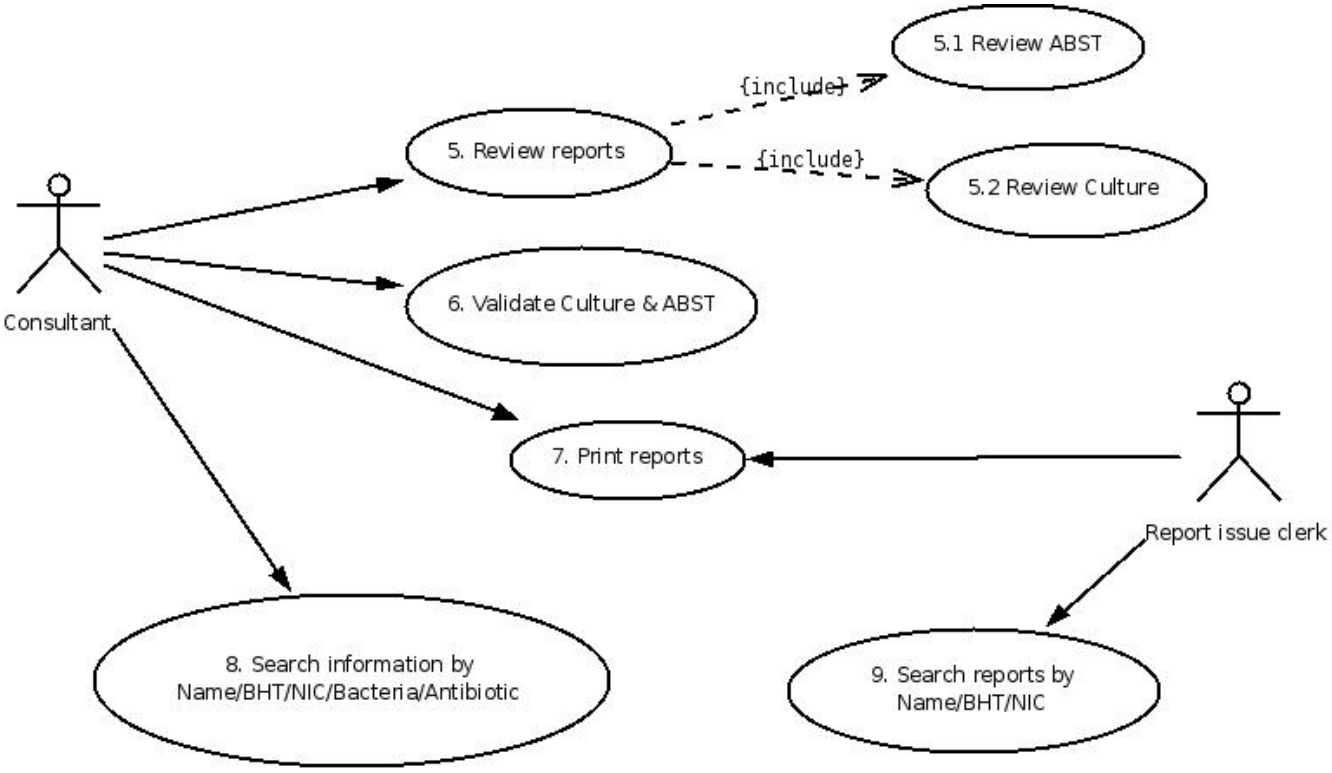

Figure : Use cases – Consultant and report issuing clerk

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Name	5.0	Review reports
Actor	Consultant (Microbiologist)	
Pre conditions	Culture/ABST has completed MLT has entered Culture/ABST results to the register Culture – No growth/Mixed growth or satisfactory growth ABST – sensitive/resistant or Intermediate	
Post conditions	Consultant can view the result of a Culture/ABST investigation Consultant can edit the report if necessary If satisfactory, consultant can approve the printing of the result	
Flow	4. MLT has completed the investigation and the result entered to the registry 5. Consultant can view the details of the investigation including sensitivity/resistant to the antibiotic 6. Consultant can edit the results of necessary 7. If satisfactory, he can approve the printing of the reports	
Exceptions	Culture/ABST not done Results are not entered to the registry	
Name	6.0	Validate Culture & ABST
Actor	Consultant (Microbiologist)	
Pre conditions	Culture/ABST is entered to the registry	

	Culture – No growth/Mixed growth or satisfactory growth ABST – sensitive/resistant or Intermediate
Post conditions	Report is sent to the print After printing, report is signed by the consultant
Flow	Result of the investigation is available in the registry Microbiologist review the report It has to be up to the satisfaction of the consultant Consultant approve the report Consultant sends the report to be printed
Exceptions	Incompatibility of ABST results with the organism isolated Consultant request for a repeat culture Consultant request for a different set of antibiotics to be tested Contaminated specimen Inappropriate specimen according to the tentative diagnosis Report is not up to the satisfaction of the microbiologist

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Name	7.0	Prints report
Actor	Consultant (Microbiologist), Report issuing clerk	
Pre conditions	Report is approved to be printed by the consultant Desktop printing facility	
Post conditions	Report is signed by the consultant	
Flow	Consultant approve the reports to be printed Report is printed Report is signed by the microbiologist	
Exceptions	No access to a printer Report is not approved by the consultant	

Name	8.0	Search information by Name/BHT/NIC/Bacteria/Antibody
Actor	Consultant (Microbiologist)	
Pre conditions	Reports are entered to the registry and approved by consultant Access to the registry	
Post conditions	Reports can be viewed and sorted by Name, age, BHT, NIC, bacteria	

	and antibiotics
Flow	• Reports are entered to the registry and approved by the consultant • Authorized person access the registry • Search the reports by Name, age, BHT, Turn-over time, NIC, ward, bacteria and antibiotics • Reports can be sorted by Name, age, turn-over time, ward and specimen type
Exceptions	No access to the specimen registry Information is not available in the registry Wrong search criteria

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Name	9.0	Search report by Name/BHT/NIC
Actor	Report issuing clerk	
Pre conditions	Reports are entered to the registry and approved by consultant Access to the registry	
Post conditions	Reports can be viewed and sorted by Name, BHT, NIC and ward	
Flow	• Reports are entered to the registry and approved by the consultant • Authorized person access the registry • Search the reports by Name, age, BHT, Turn-over time, NIC, ward, bacteria and antibiotics • Reports can be sorted by Name, age, turn-over time, ward and specimen type	
Exceptions	No access to the specimen registry Information is not available in the registry Wrong search criteria	

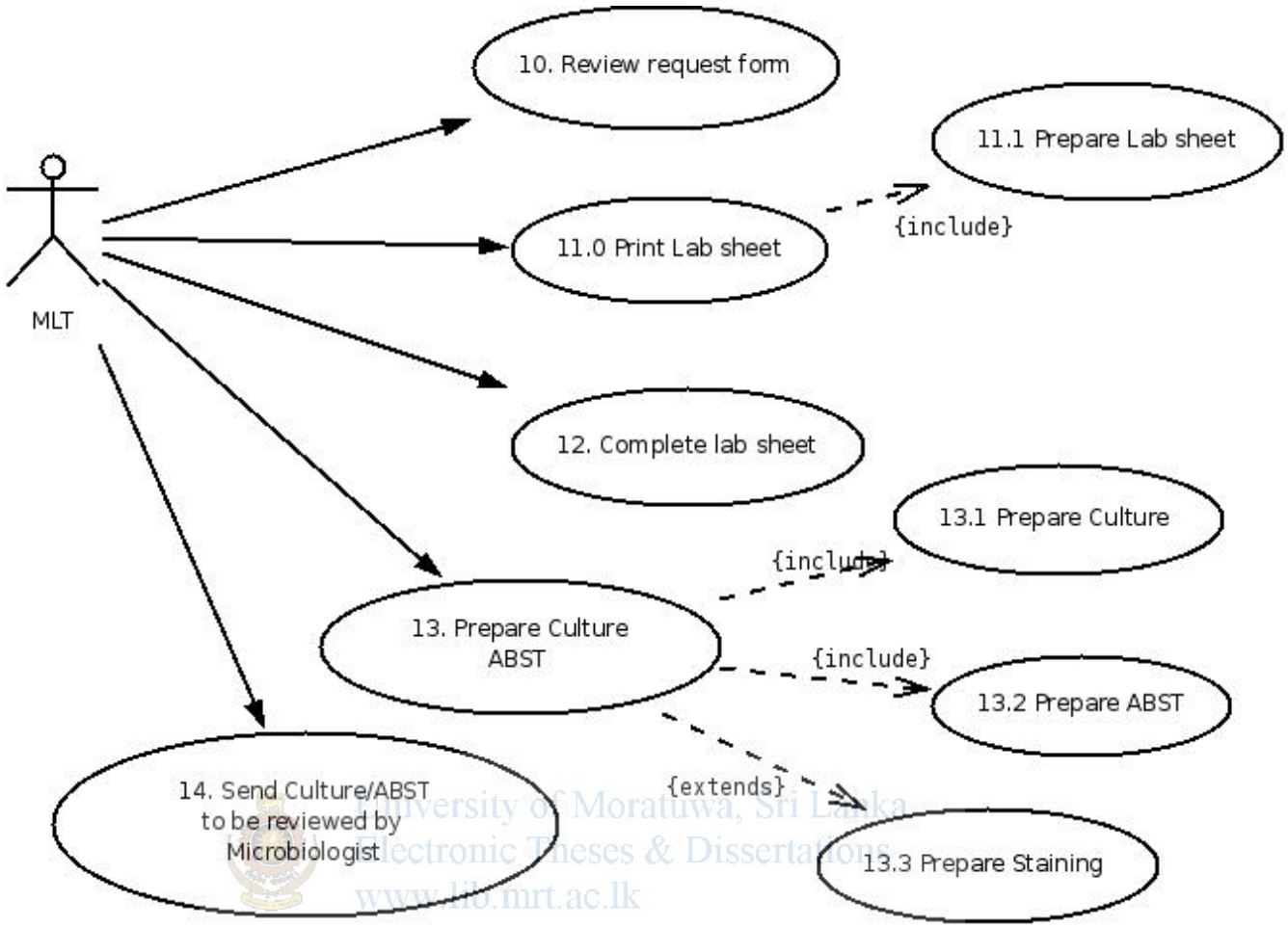

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Figure : Use case – MLT

Name	10.0	Accept request form
Actor	MLT	
Pre conditions	Request form and the specimen reach the laboratory Properly filled request form Viable specimen	
Post conditions	Lab sheet prepared by the information available in the request form	
Flow	6. Specimen and the request form reach the laboratory 7. MLT checks the viability of the specimen and the content of the request form 8. Prepare the lab sheet according to the requested investigation	
Exceptions	Incorrect information in the request form Specimen is not viable Reagents, necessary for the investigations are not available in the laboratory Necessary equipments are not available in the lab	

	MLTs are in work-to-rule or any other trade union action

Name	11.0	Print lab sheet
Actor	MLT	
Pre conditions	Lab sheet has to be prepared using the request form informations	
Post conditions	Lab sheet will be printed	
Flow	• Search the lab sheets already prepared • Select the lab sheet to be printed • Print a lab sheet with the data available in the request form	
Exceptions	Lab sheet is still not created using request form data Printer is not attached to the system	

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Name	11.1	Prepare lab sheet
Actor	MLT	
Pre conditions	Specimen and the request form reaches the laboratory	
Post conditions	Lab sheet is ready for printing or data entry	
Flow	• Necessary information regarding patient, organism and the tentative diagnosis are taken form the request form • Lab sheet is prepared for Culture/ABST results • Lab sheet allowed to be printed • Culture of the organism is carried out • Depending on the organism isolated, lab sheet updated • ABST is performed	
Exceptions	Necessary information is not available in the request form No ideal laboratory conditions or reagents are available for the investigation	

Name	12.0	Complete lab sheet
Actor	MLT	
Pre conditions	Culture is performed Lab sheet is prepared	
Post conditions	Lab sheet is completed and Culture and ABST data entered	
Flow	• Culture is performed • Search lab sheets created if necessary • Culture results will be entered to the lab sheet • ABST will be performed • ABST information will be entered to the lab sheet • Culture and ABST report is prepared	
Exceptions	Lab sheet not found Unsuccessful culture Unsuccessful ABST	

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Name	13.0	Prepare Culture/ABST
Actor	MLT	
Pre conditions	Proper lab sheet Successful Culture/ABST Correctly filled lab sheet	
Post conditions	Culture and ABST Delivery of reports to the consultant's approval	
Flow	• Culture and ABST completed successfully • Lab sheet is filled correctly • Using the information available in the lab sheet, Culture report and the ABST report will be prepared • Client information form the request form also used here	
Exceptions	No properly filled lab sheet	

	ABST/Culture not done properly

Name	14.0	Send culture/ABST to review
Actor	MLT	
Pre conditions	Culture and ABST available	
Post conditions	Culture and ABST will be reviewed by the consultant	
Flow	19. Culture and ABST report will be prepared by the MLT 20. Culture and ABST will be sent to consultant's comment 21. Consultant will check for the validity of the investigations, compatibility of the ABST results with the organism isolated 22. If consultant is satisfied about the report, it will be authorized for printing	
Exceptions	Culture and ABST is not prepared by the MLT or authorized party Incompatibility of ABST results with the organism isolated Consultant request for a repeat culture Consultant request for a different set of antibiotics to be tested	

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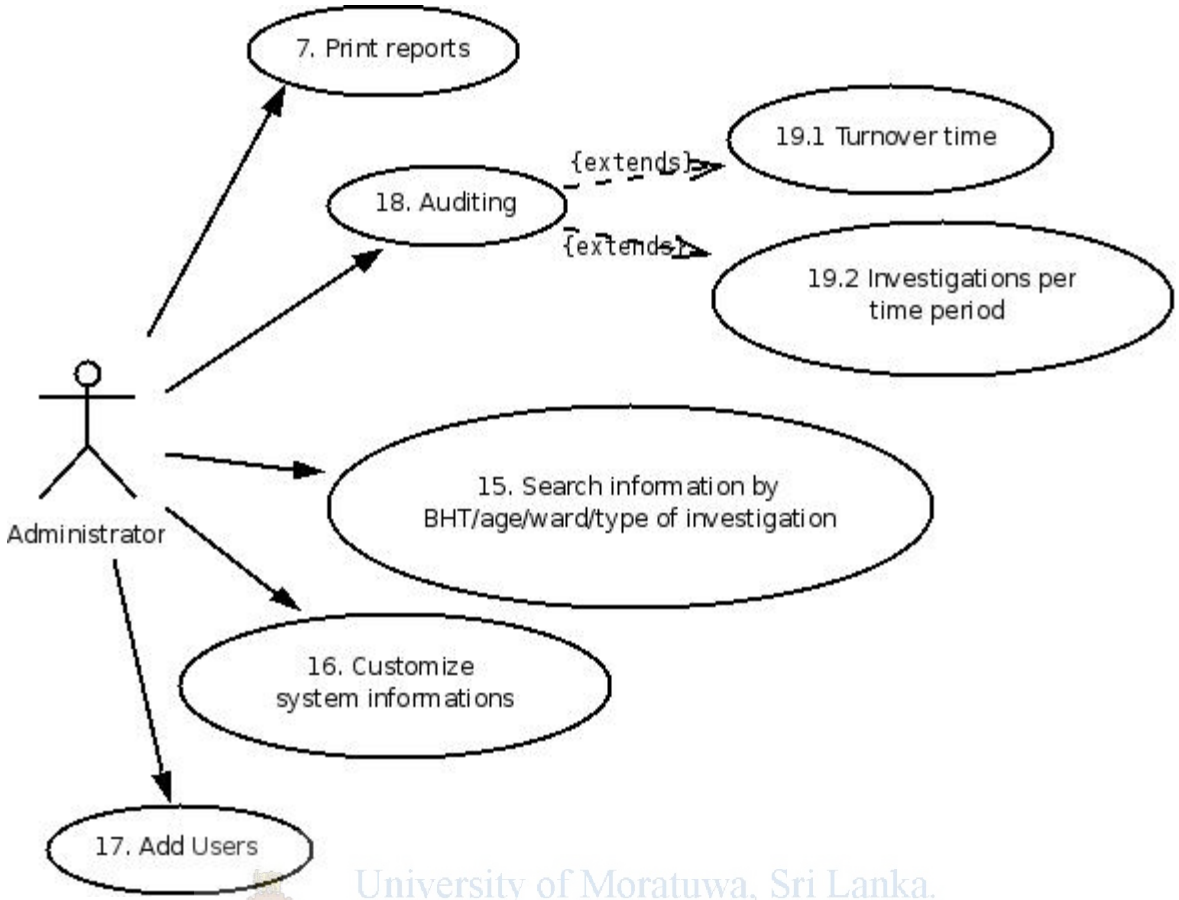

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Figure : Use case –Administrator

Name	15.0	Search information by BHT/age/ward/type of investigation
Actor	Administrator	
Pre conditions	Administrator privilege Records are available to the administrator	
Post conditions	Administrator can search the information of clients as well registered users of the system	
Flow	31. Log in as system administrator 32. Search for user informations, client/microorganism related or drug related 33. View search results	
Exceptions	No administrator privilege No records available	

Name	16.0	Customize system
Actor	Administrator	
Pre conditions	Administrator privilege System should have been deployed	
Post conditions	Organization/institution name and consultant name can be updated	
Flow	• System should have deployed • Administrator privilege should be obtained • Log in as administrator • Change of institution name, consultant's name etc are done • Log out as administrator	
Exceptions	No administrator privileges System is not up and running	

Name	17.0	Add user
Actor	Administrator	
Pre conditions	System should be accessible Administrator privilege	
Post conditions	New user added	
Flow	• If necessary, check for current user names • Log in as administrator • Add new user	
Exceptions	System is not up and running No administrator privilege	

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Name	18.0	Auditing
Actor	Administrator	
Pre conditions	System should be accessible Records must be stored in the database already	
Post conditions	Visualization of turn over time and number of investigations within a time period	
Flow	● Select audit type – turn over time/number of investigations ● if turn over time 1. select investigation ● if number of investigations ○ select start date ○ select end date ○ select investigation ● Execute the search	
Exceptions	System is not up and running Not logged in as Administrator No records in the database No start and end dates are given to search number of investigations within a time period	

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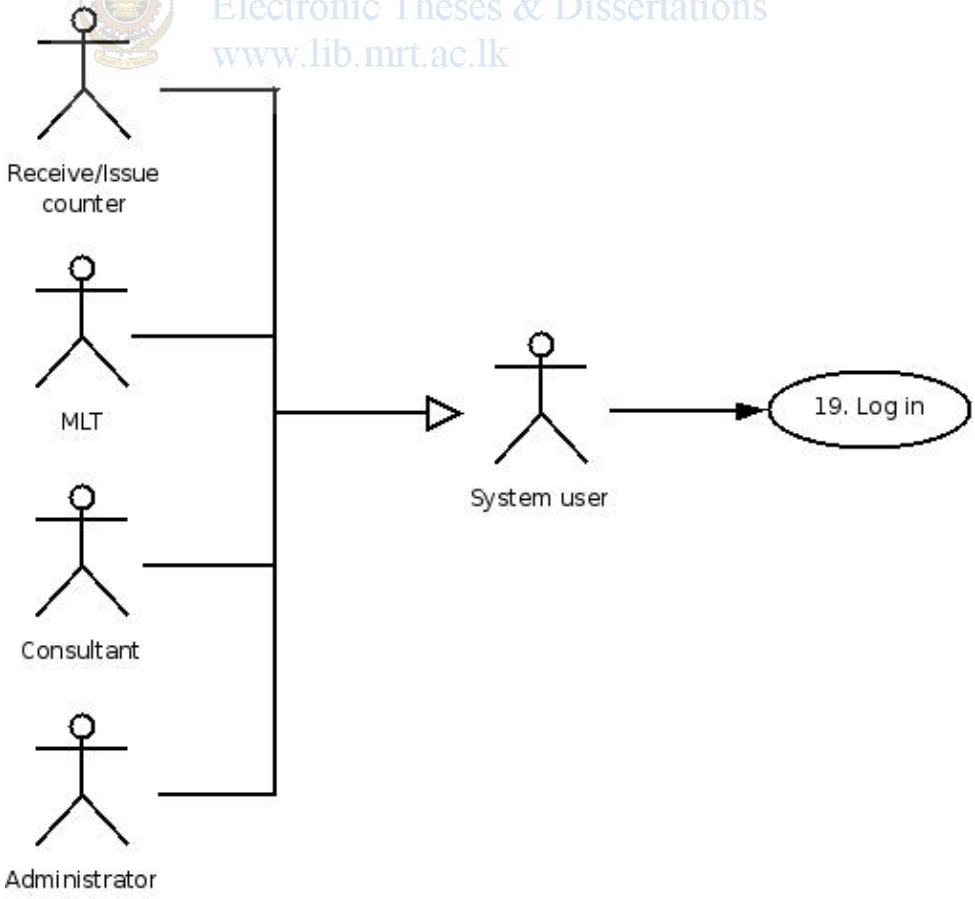

Figure : Use case – System user

Name	19.0	Log in
Actor	All users	
Pre conditions	System should be accessible User must be added to the system by Administrator	
Post conditions	Successful log in	
Flow	• Provide access level • Provide user name • Provide password	
Exceptions	System is not up and running Administrator has not register the particular user Wrong access level Wrong user name Wrong password	

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Appendix E

Activity Diagrams

1. Existing system

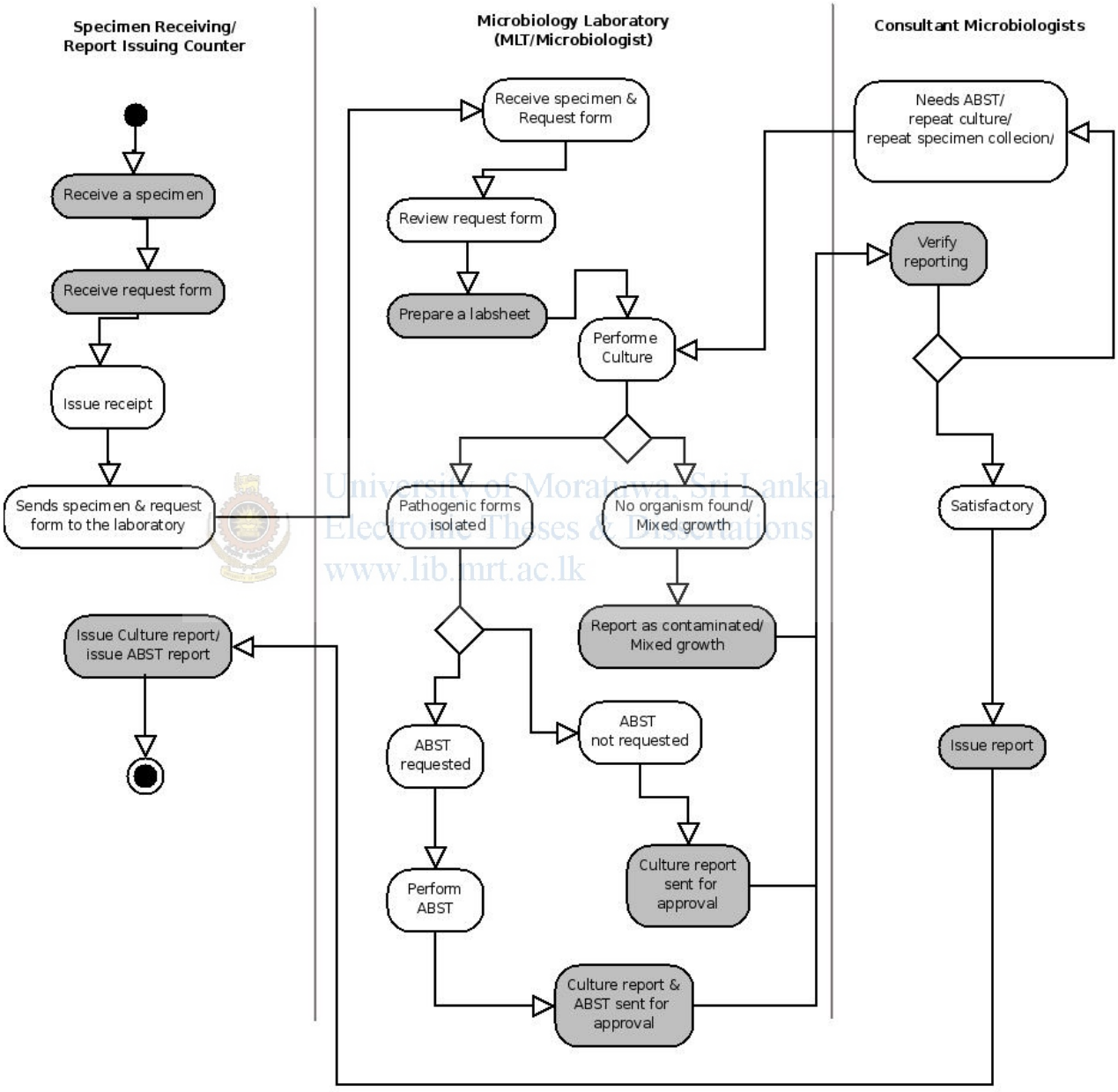

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Figure : Activity diagram of the existing system

2. Proposed System

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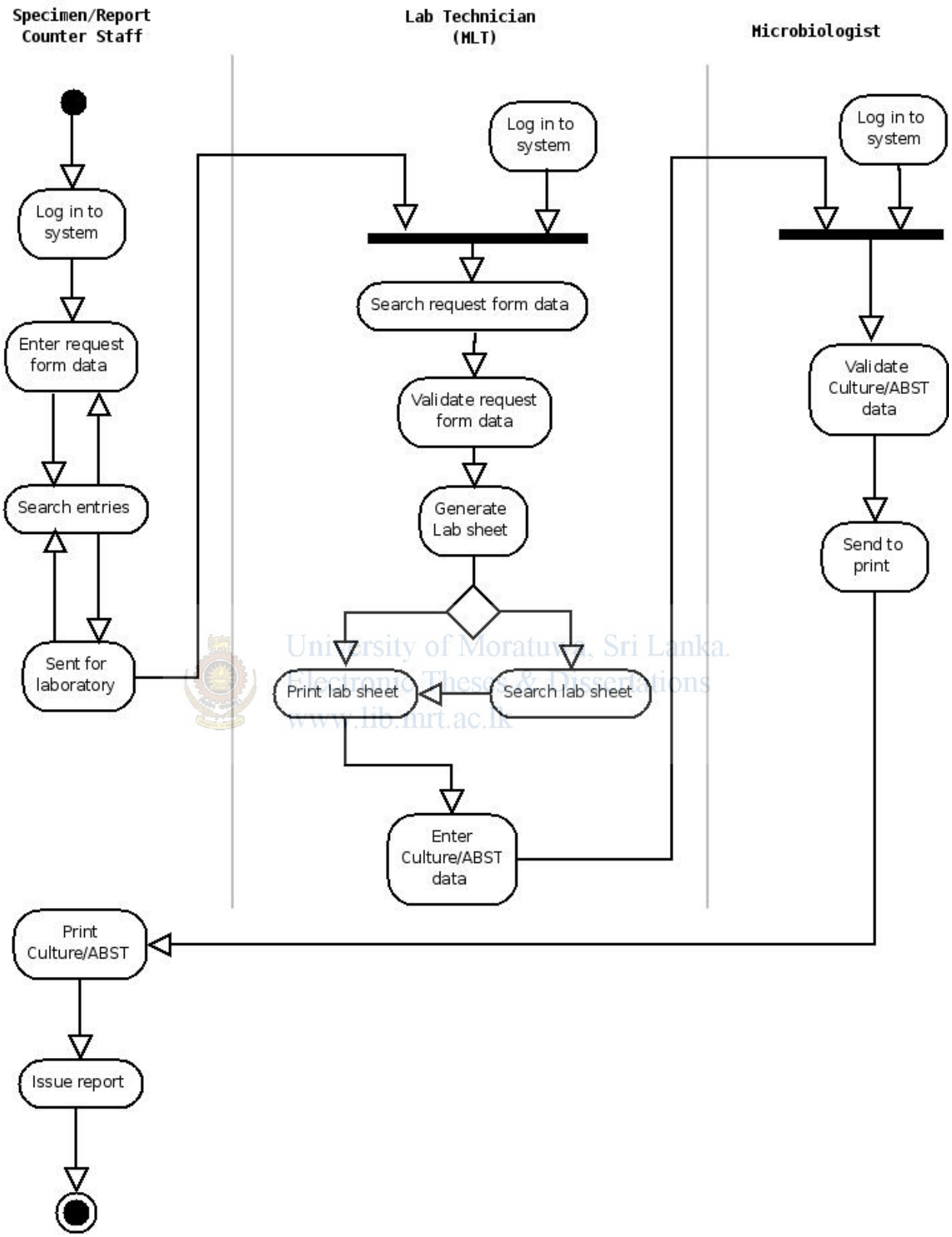

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Figure : Activity diagram of the overall information flow of the proposed system

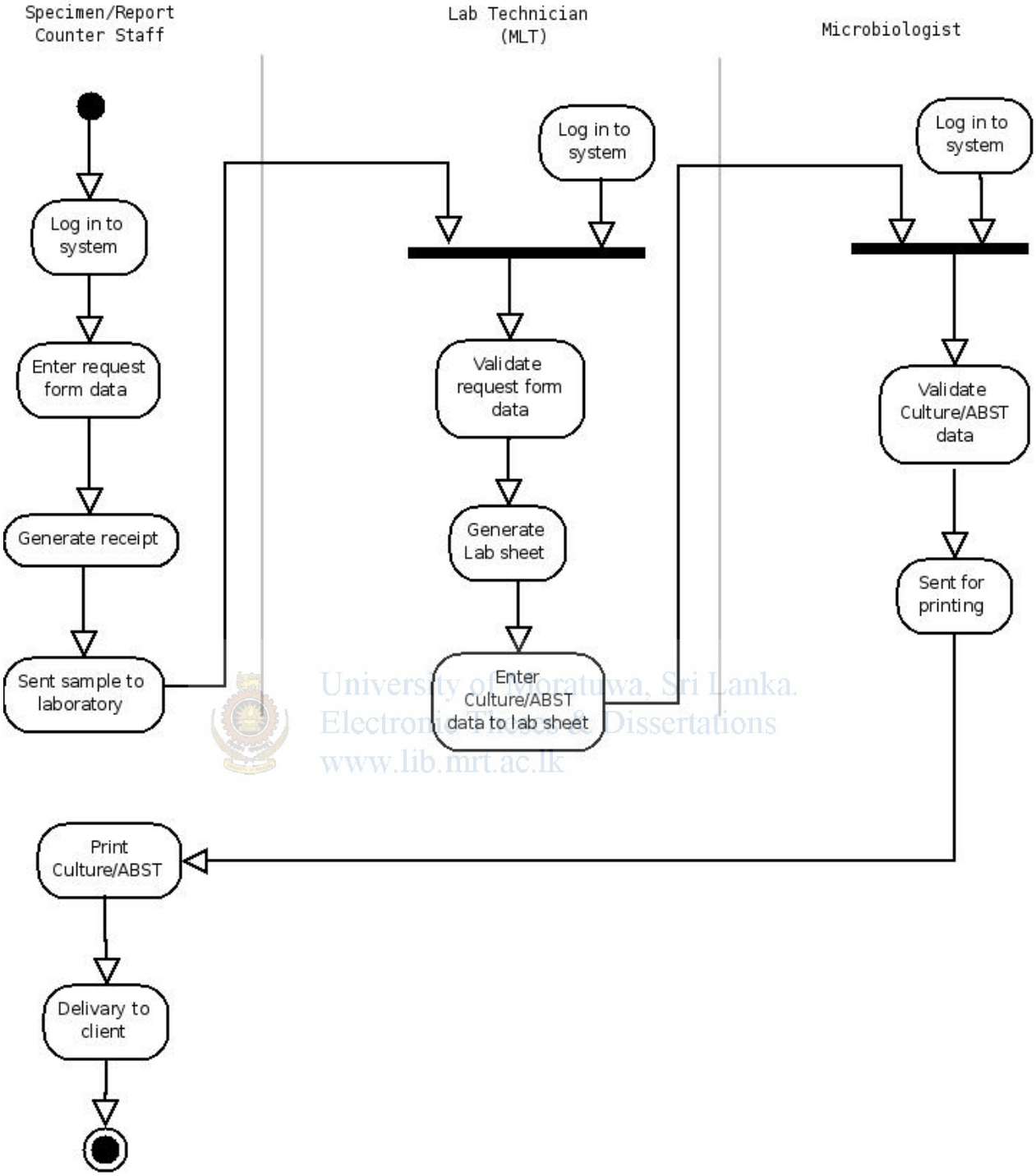

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Figure : Data feed in to the system and report generation process

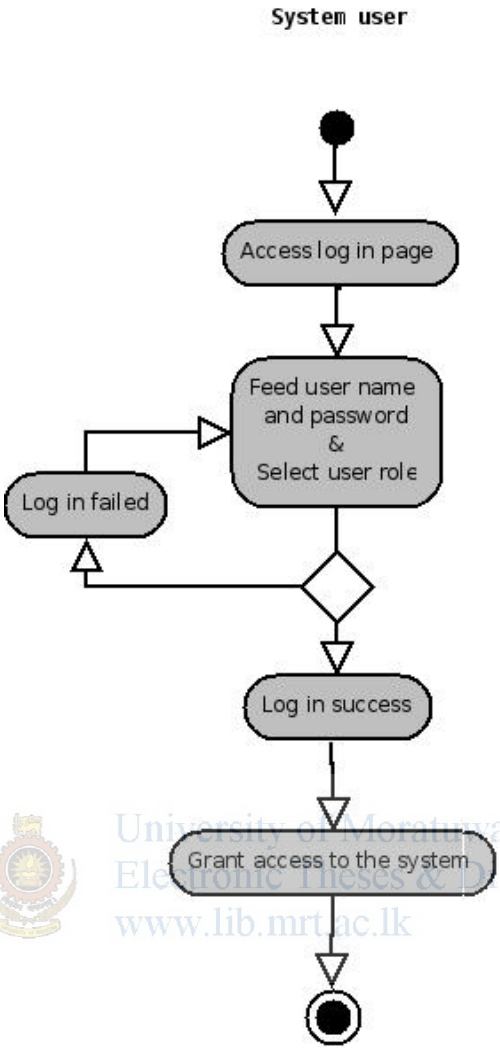

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Figure : Log in process

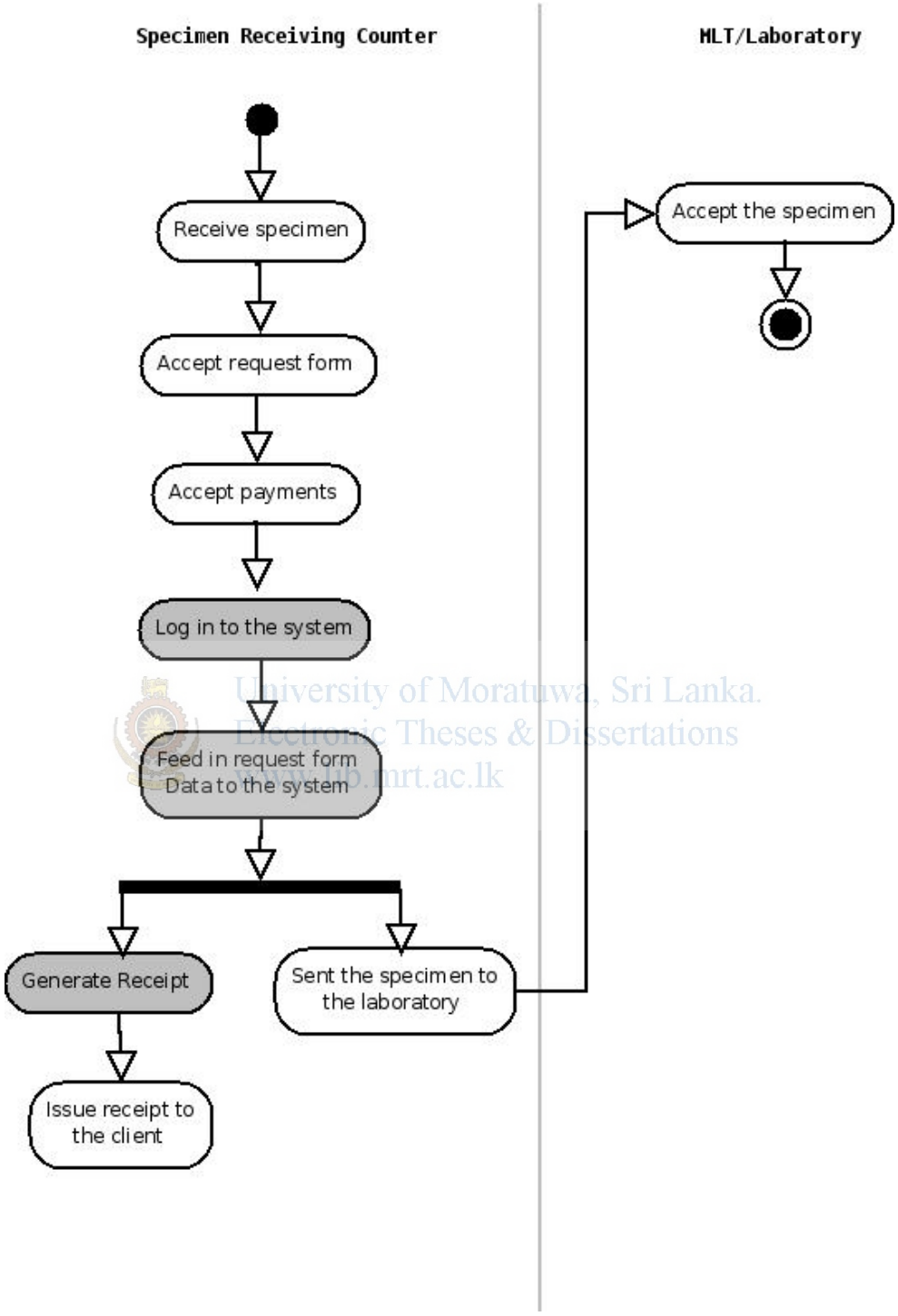

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Figure : Specimen receiving counter process

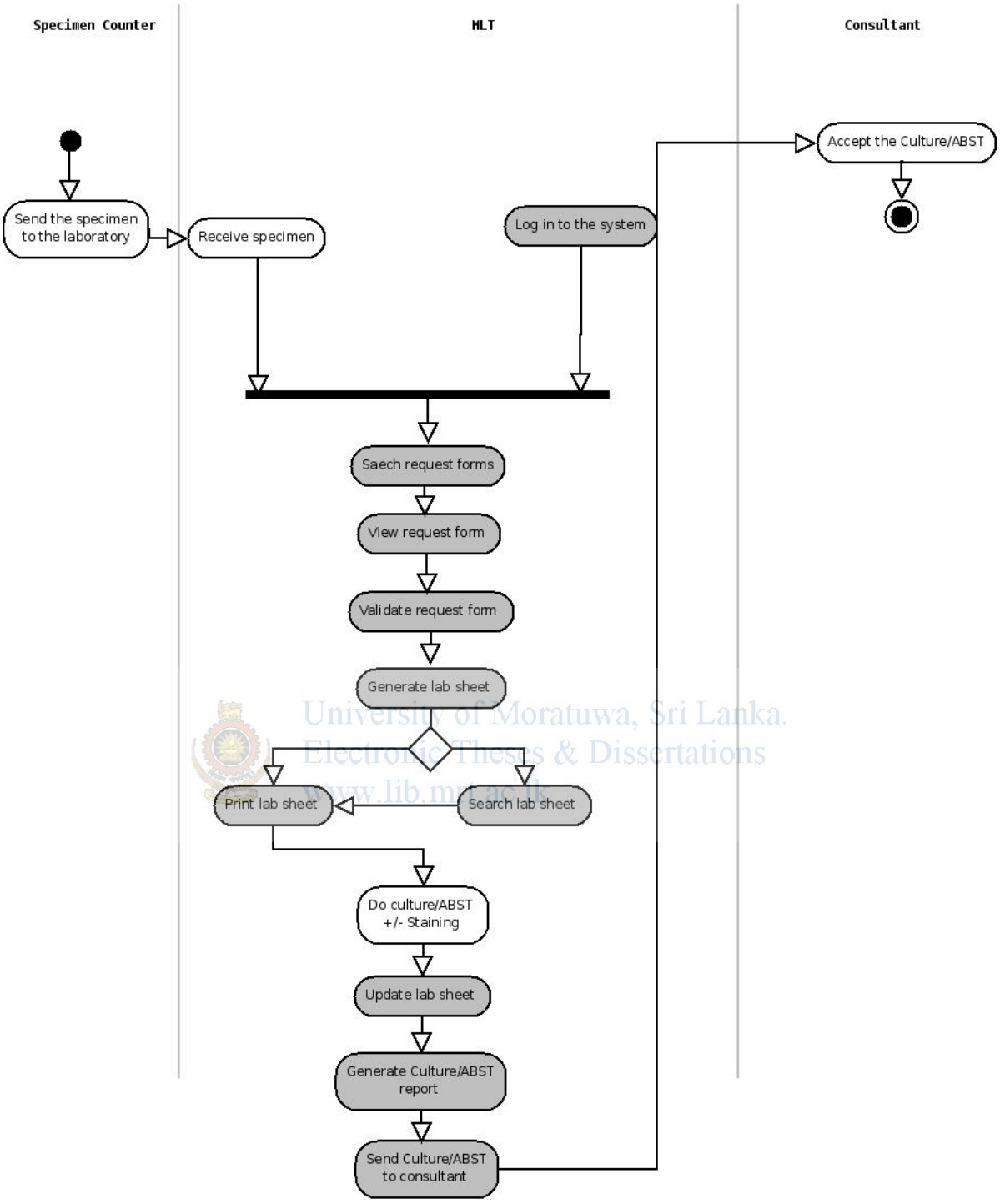

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Figure : MLT/Laboratory process

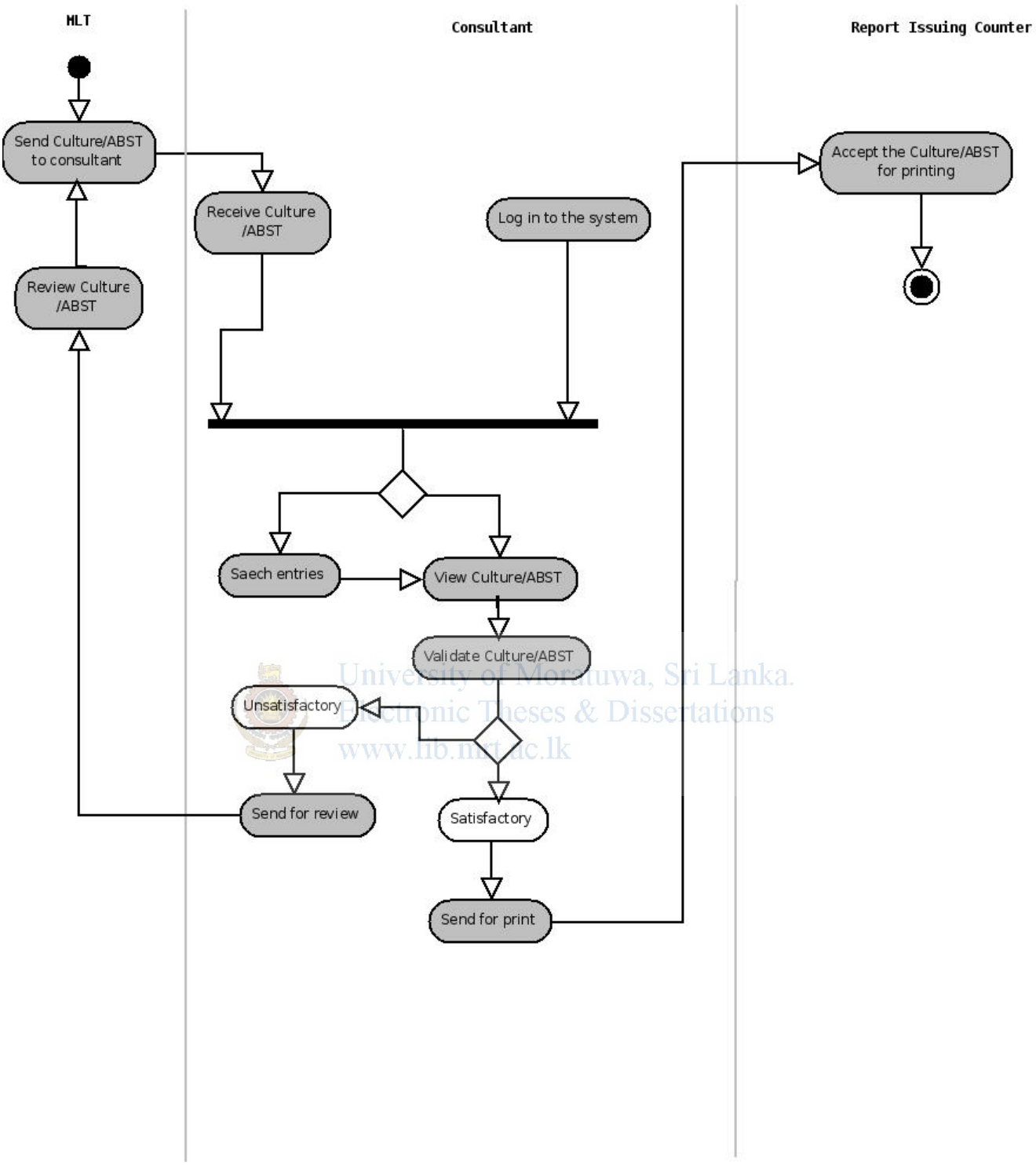

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Figure : Consultant Microbiologist/Consultation process

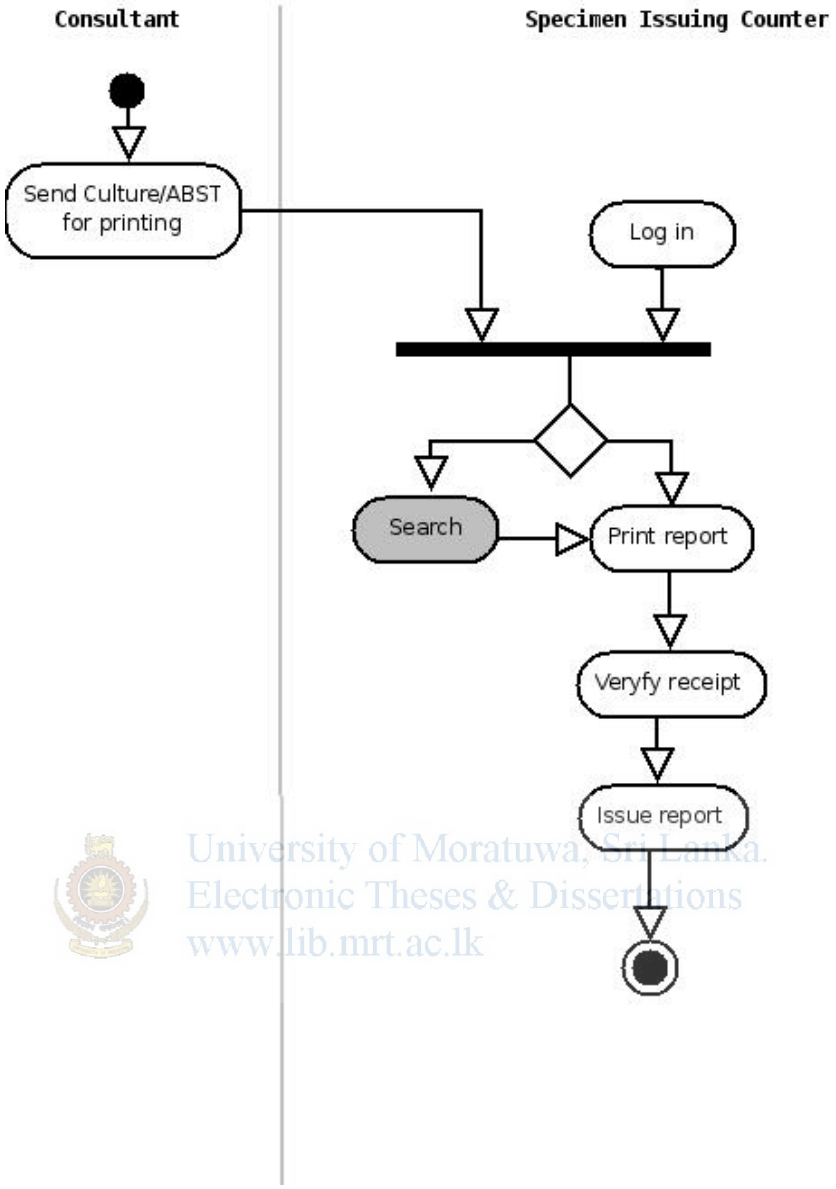

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Figure : Report issuing desk process

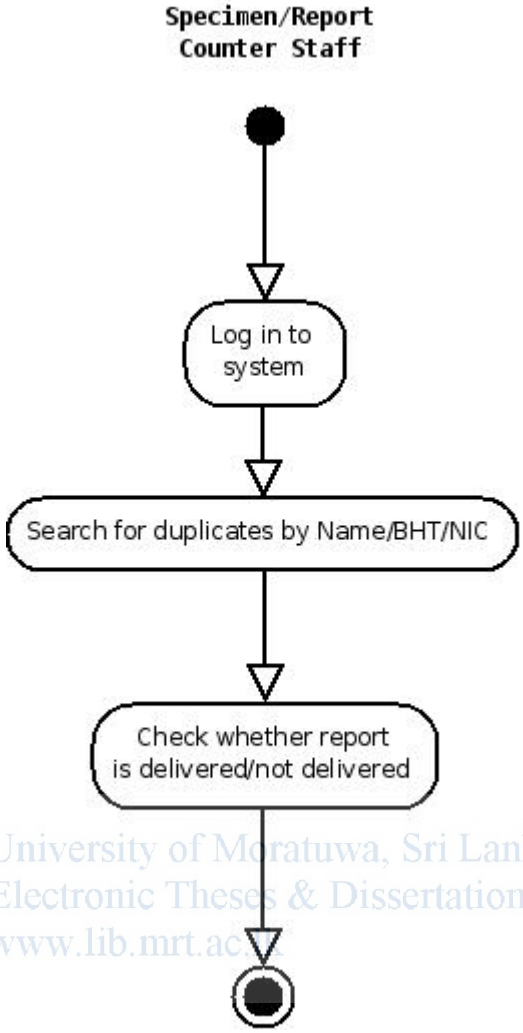

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Figure : Information search by specimen receive/issue counter

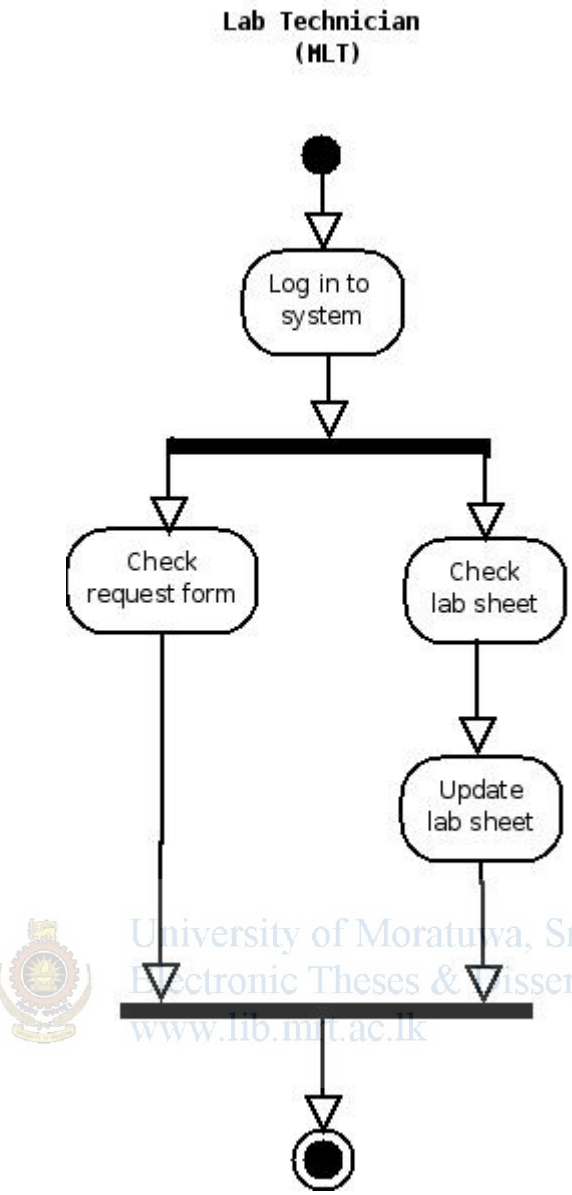

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Figure : Information search by MLT

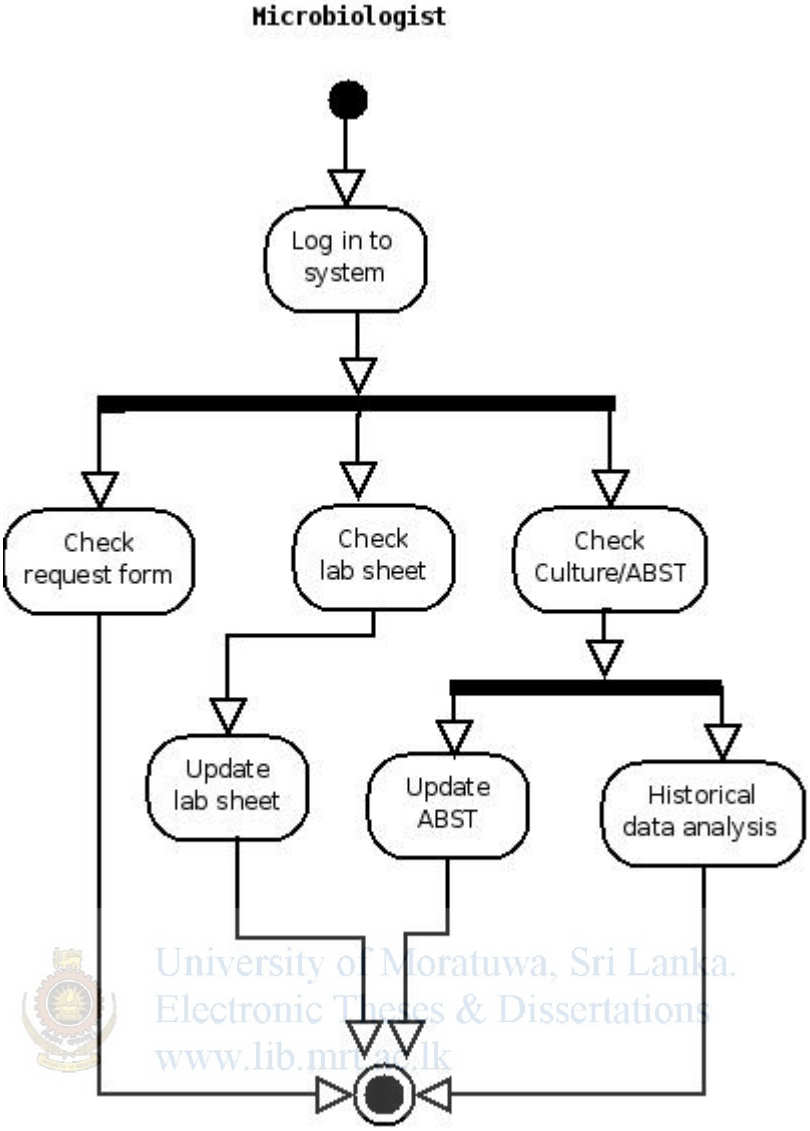

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Figure : Information search and historical data analysis process by microbiologist

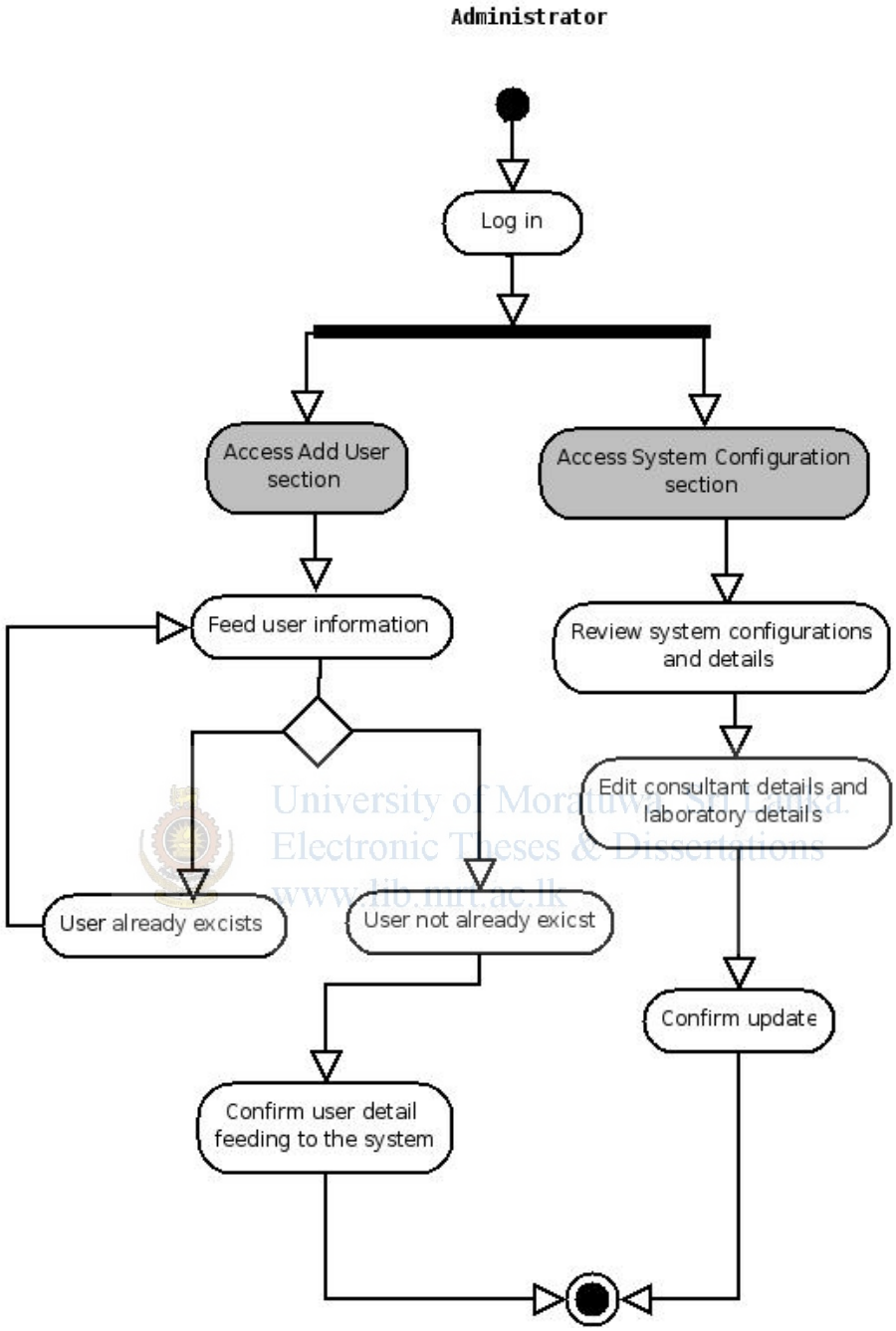

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Figure : User/System Configuration management process

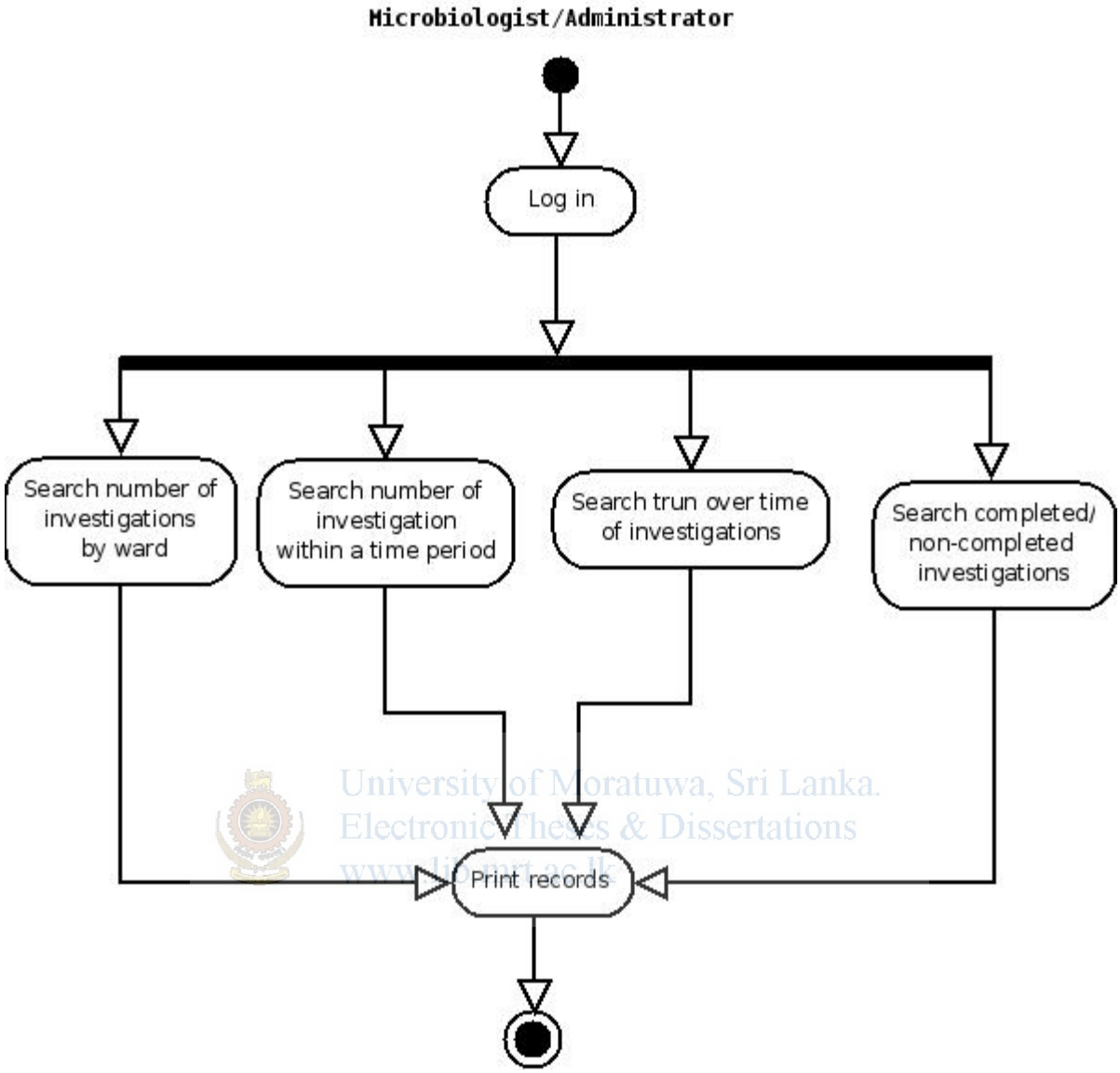

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Figure : Auditing Process

Appendix F

Sequence Diagrams

1. Login

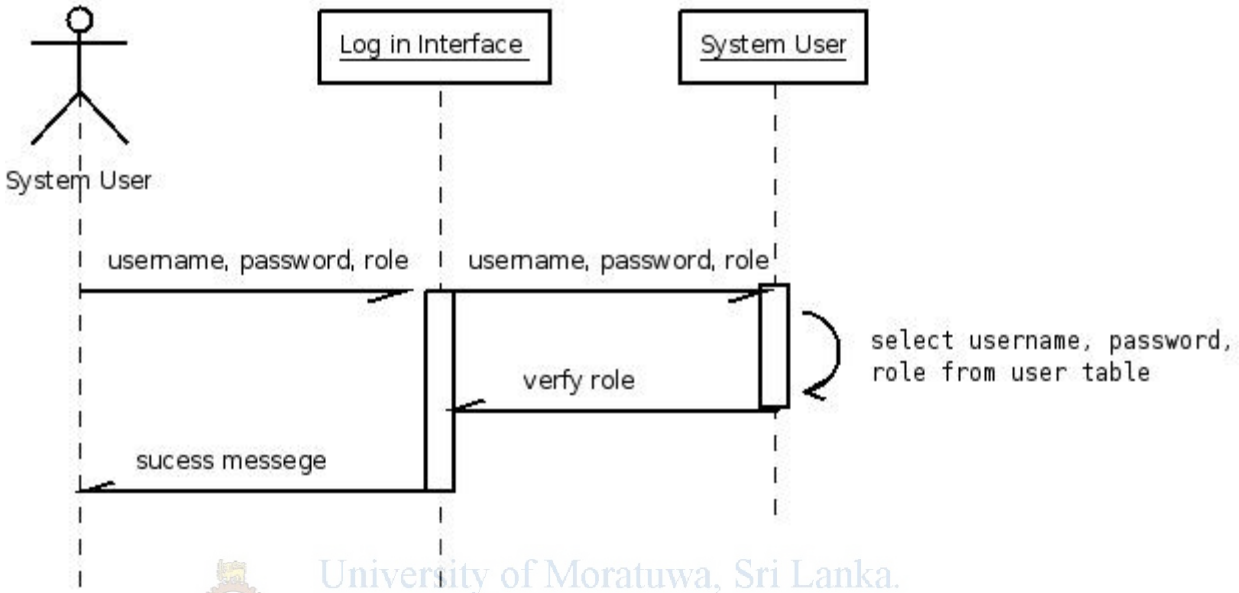

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Figure : Login function

2. Enter request form data

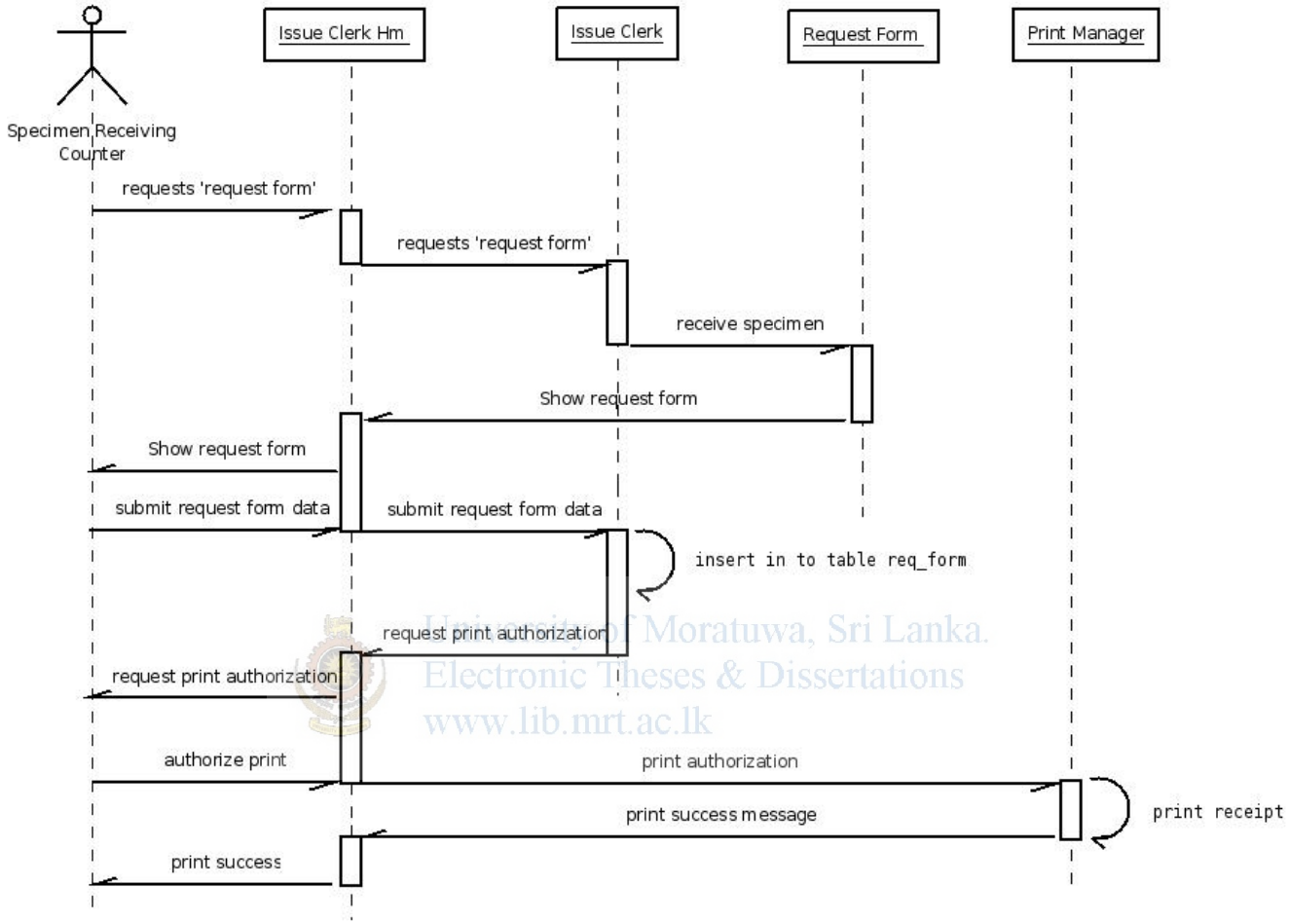

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Figure : Request form data entry

3. Search by Specimen Receiving Counter Clerk

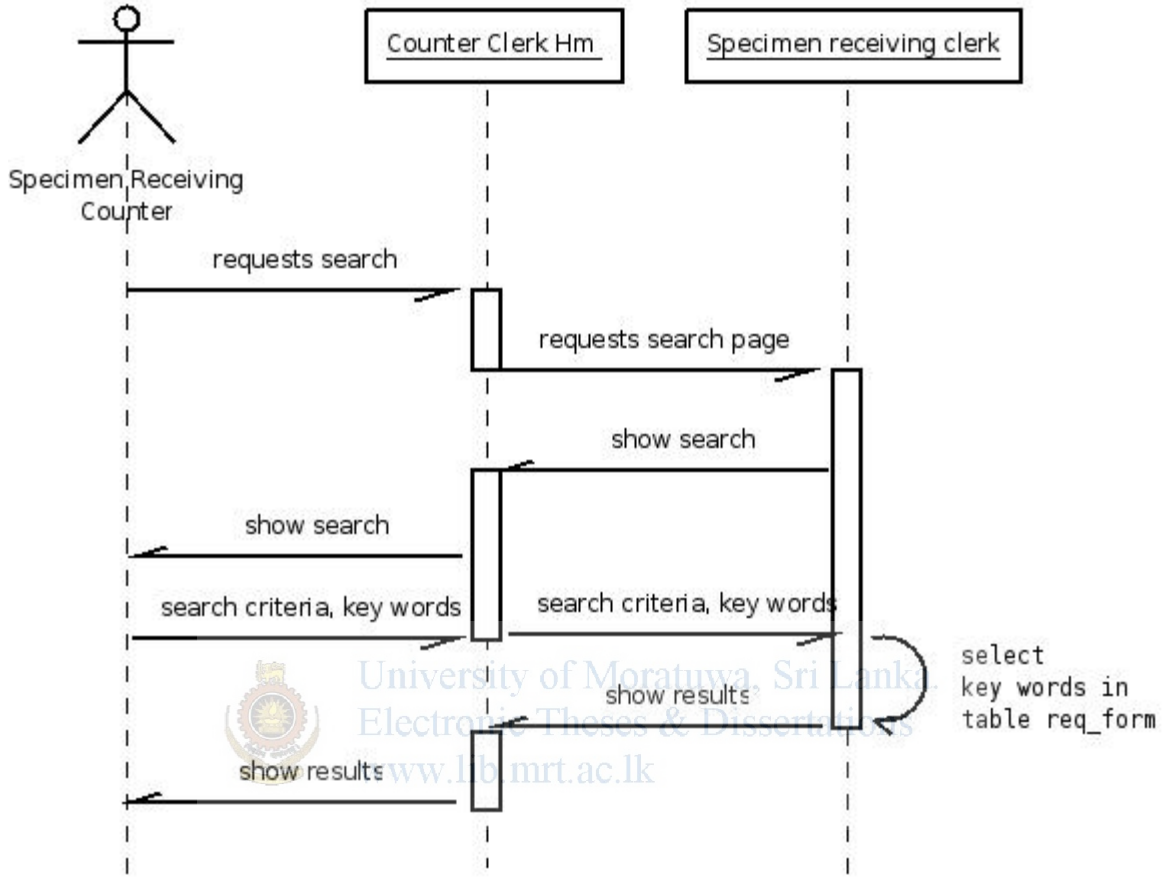

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Figure : Search by Specimen Receiving Counter Clerk

4. Generate laboratory worksheet

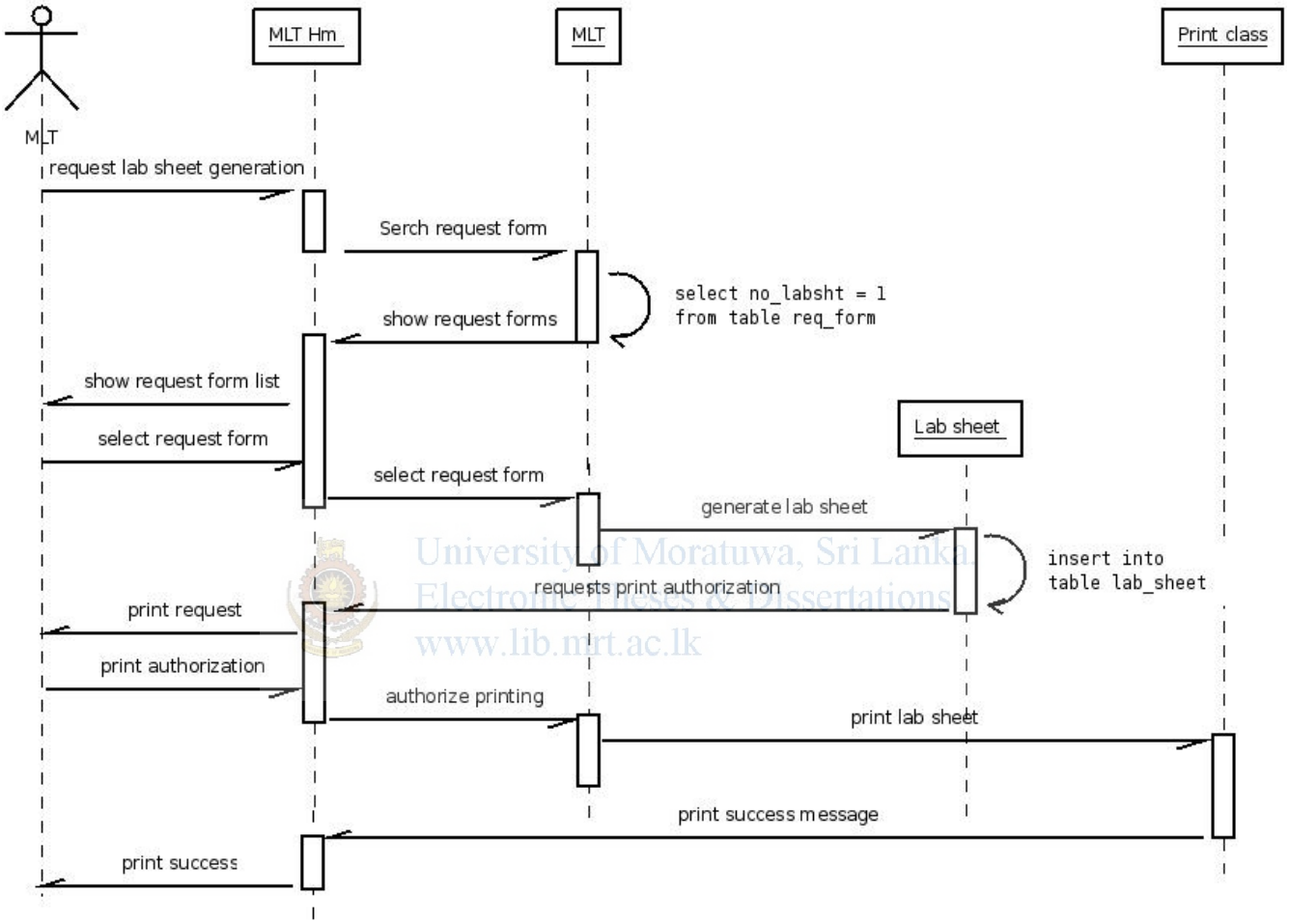

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Figure : Generate lab sheet

5. Search and print lab sheet

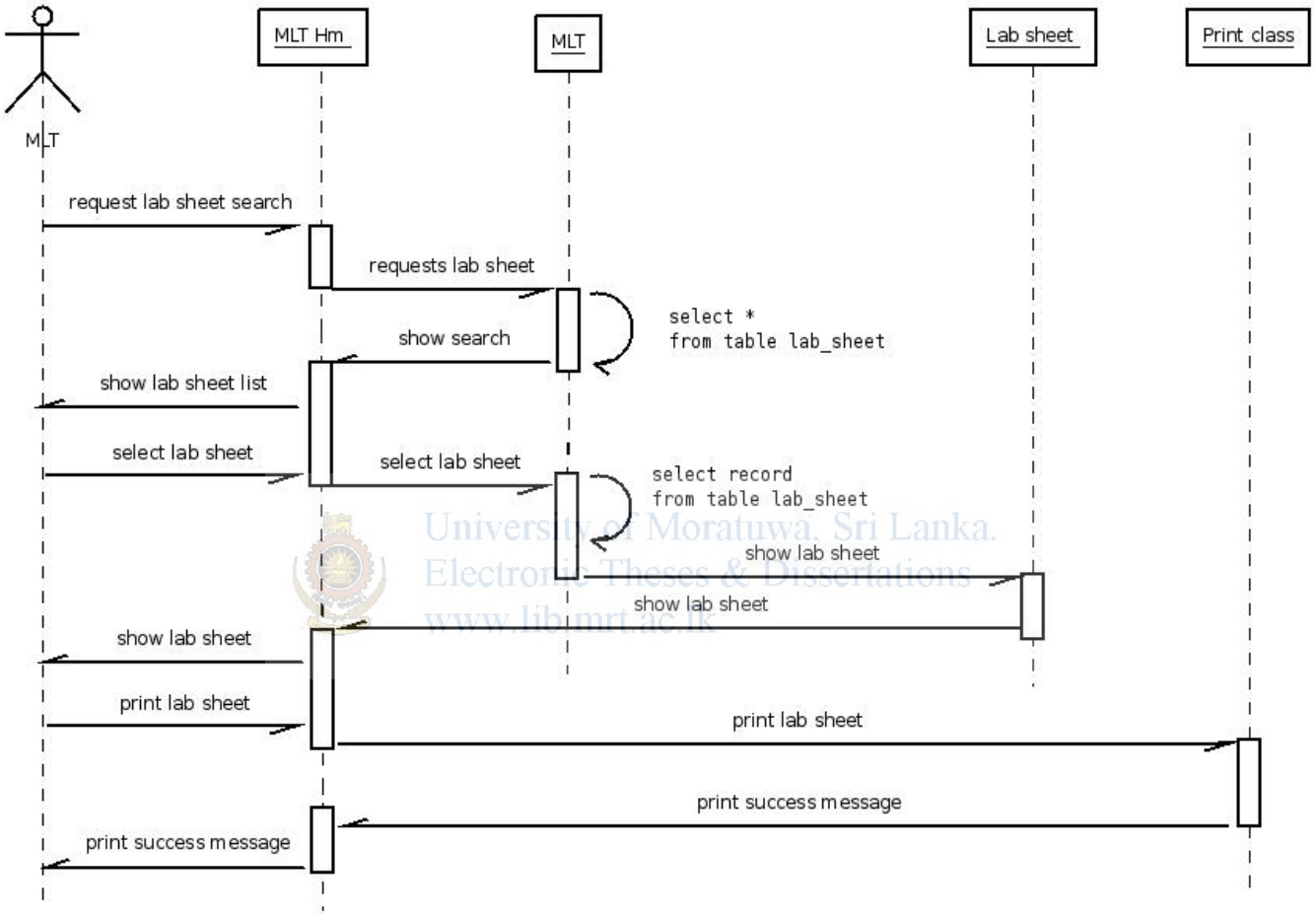

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Figure : Search and print lab sheet

6. Update lab sheet

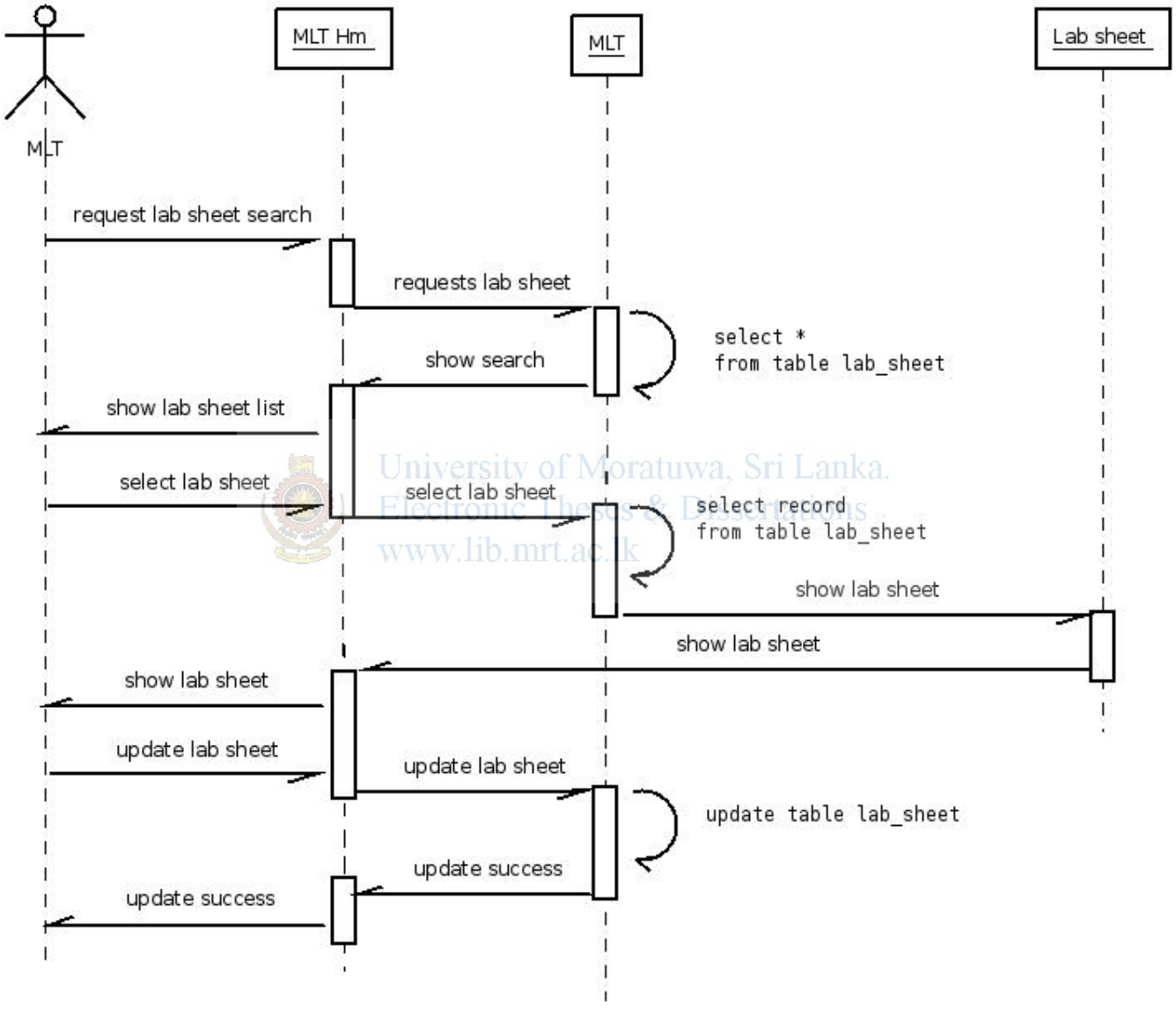

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Figure : Update laboratory work sheet

7. Generate Culture/ABST and submit for consultant approval

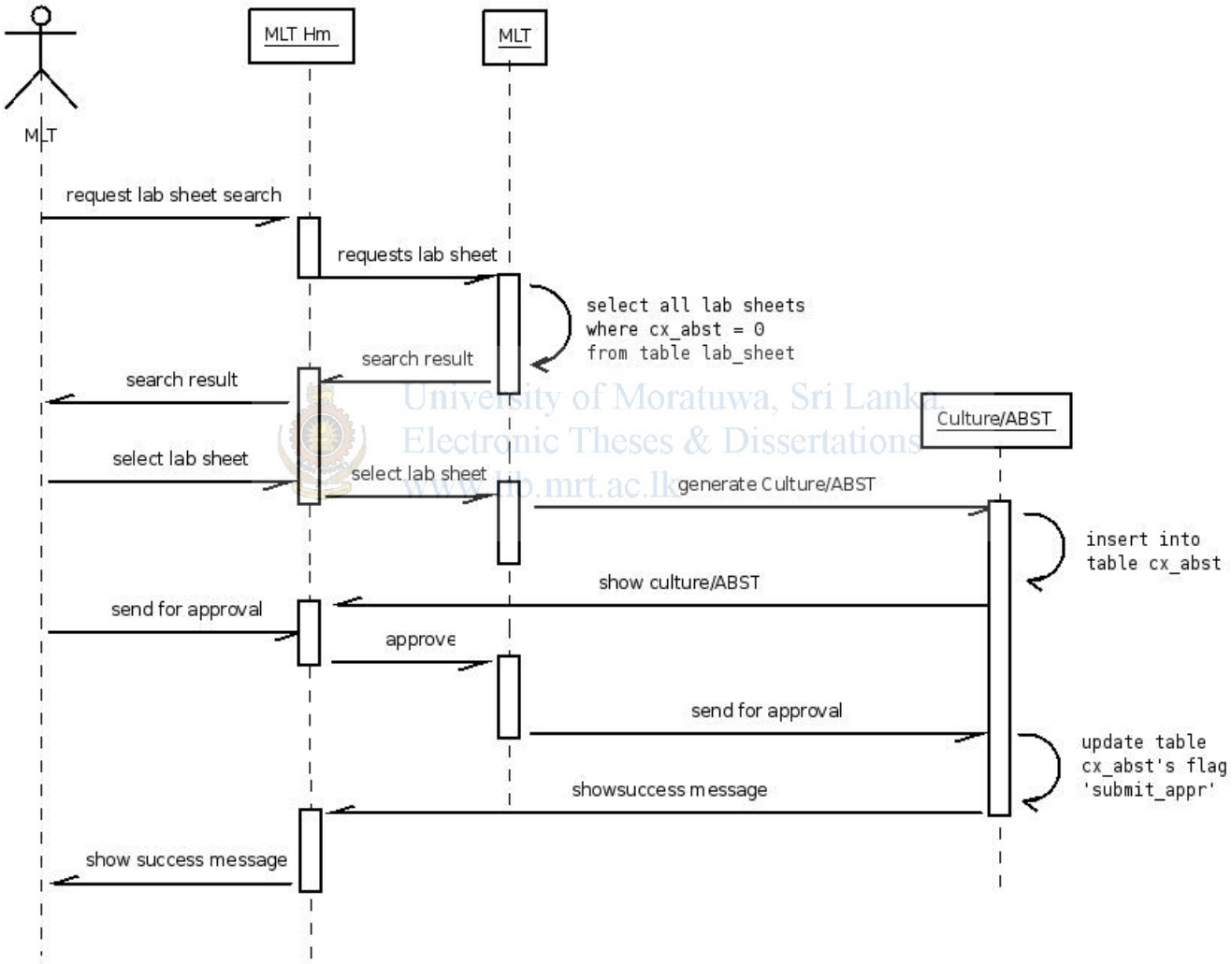

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Figure : Generate Culture / ABST and submission for validation by consultant microbiologist

8. Review Culture/ABST by consultant and approve for print

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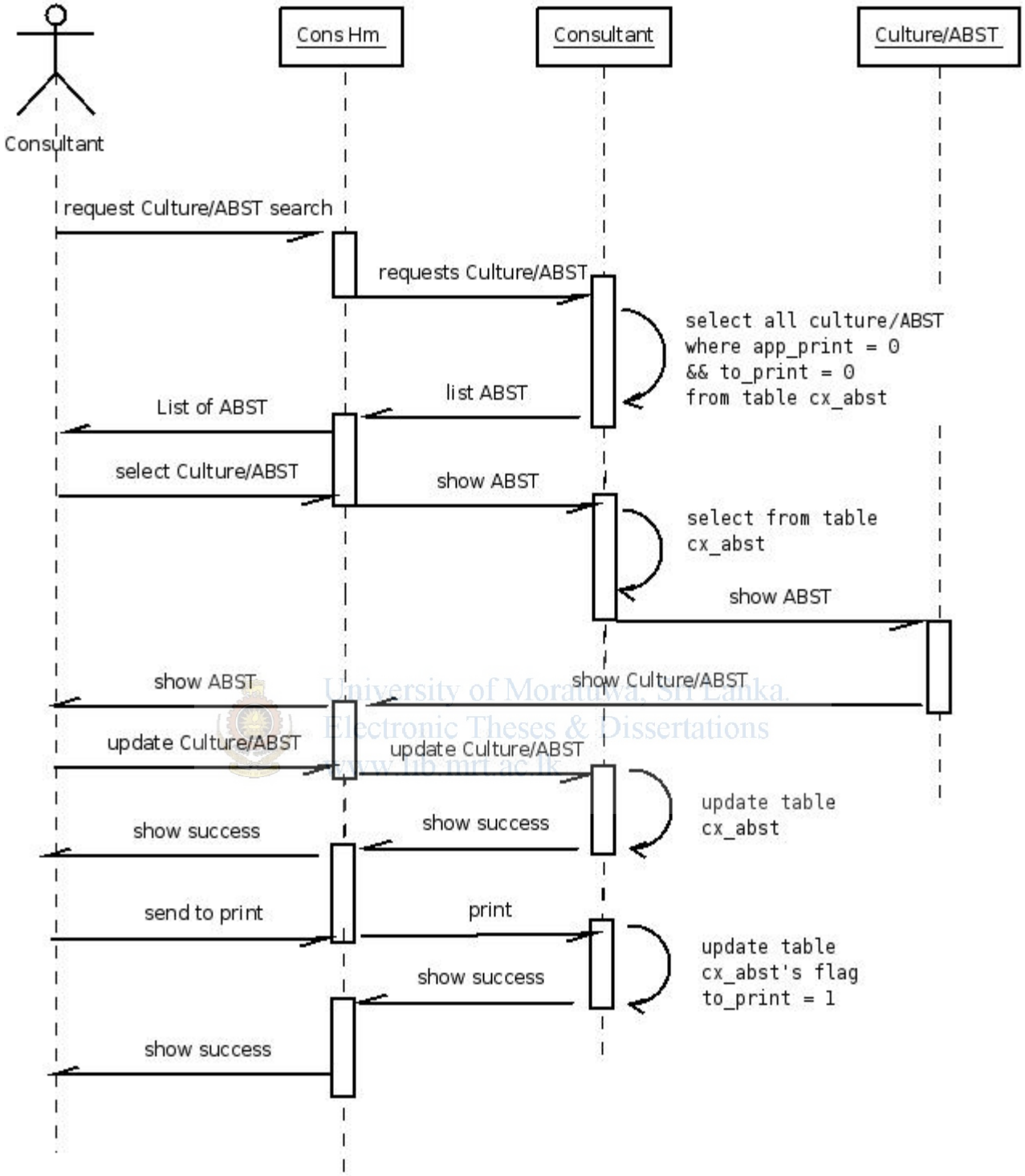

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Figure : Review Culture/ABST by consultant and approve for print

9. Print Culture/ABST

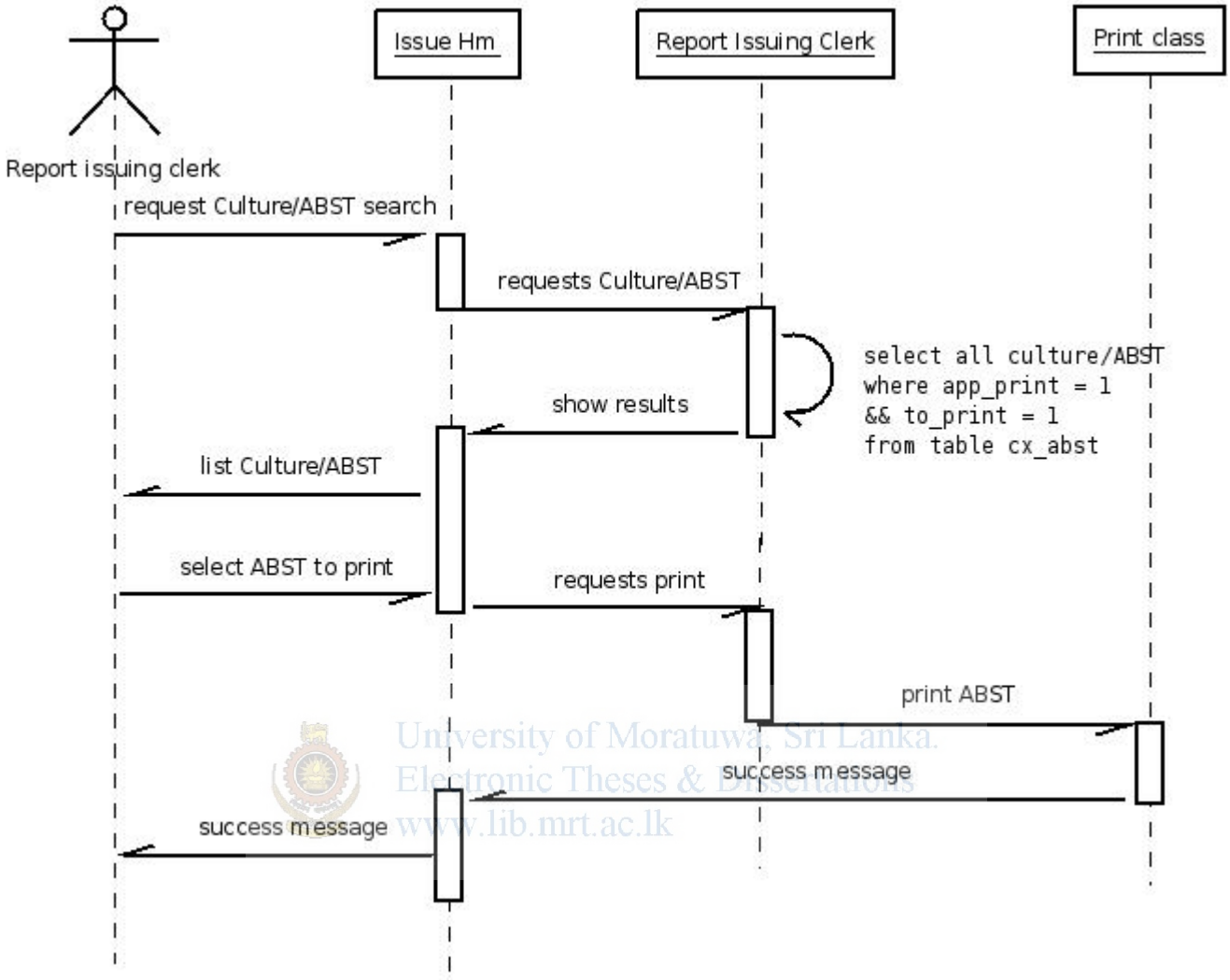

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Figure : Printing of Culture/ABST

Appendix G

User Manual

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Appendix H

Evaluation Form

Evaluator: Date: / /

Title: Dr/ Professor/ Mr / Ms

Platform: Windows XP / Windows Vista / Linux / Mac

Browser: Firefox/ Internet Explorer (version .....)/ Opera / .....

Job role: Consultant Microbiologist/Microbiologist/MLT/Clerical Staff

DOCUMENTATION & SUPPLEMENTARY MATERIALS:

1.5.1.	Necessary documentation is included	[ ]
1.5.2.	Steps for each procedure are clearly mentioned	[ ]
1.5.3.	Easy to learn design of graphical user interfaces	[ ]
1.5.4.	Materials for remedial activities are provided	[ ]

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PROGRAM CONTENT:

1.5.5.	Instruction matches stated objectives	[ ]
1.5.6.	Instruction addresses various learning styles and intelligences	[ ]
1.5.7.	Information is current and accurate	[ ]
1.5.8.	Level of language that the program offers clearly indicated	[ ]

PRESENTATION:

1.5.9.	There is appropriate variety in screen displays	[ ]
1.5.10.	Text is clear and suitable for target audience	[ ]
1.5.11.	Spelling, punctuation, and grammar are correct	[ ]
1.5.12.	Medical content are accurate	[ ]

EFFECTIVENESS:

1.5.13.	Users are able to recall and use information presented	[ ]
1.5.14.	Time to learn each activity is acceptable	[ ]
1.5.15.	Always clear to the user which point s/he has reached in the program	[ ]
1.5.16.	User offered useful feedback if s/he gets something wrong	[ ]

AUDIENCE APPEAL & SUITABILITY:

1.5.17.	Program matches interest level of indicated users	[ ]
1.5.18.	Expected input is appropriate for indicated audience	[ ]
1.5.19.	Attention is appropriate for indicated audience	[ ]
1.5.20.	Required time for each activity for each user category is sufficient	[ ]

1.5.21. Program relevant to your department/ institution [ ]

FEEDBACK:

1.5.22. Feedback is relevant to activity for each user level [ ]
1.5.23. Feedback is immediate [ ]
1.5.24. Feedback is appropriate [ ]
1.5.25. Feedback gives remediation [ ]
1.5.26. Reinforcement is positive and dignified [ ]
1.5.27. Collaborative learning experiences are provided for [ ]
1.5.28. Program branch to remedial routines [ ]

EASE OF USE:

1.5.29. Program is easy to start [ ]
1.5.30. User can navigate through program without difficulty [ ]

1.5.31. Icons that are used assist navigation [ ]
1.5.32. Screen directions are consistent and easy to follow [ ]
1.5.33. Help options are comprehensive and readily available [ ]
1.5.34. Program responds to input as indicated by directions [ ]
1.5.35. Title sequence is brief and can be bypassed [ ]
1.5.36. User can control pace and sequence [ ]
1.5.37. User can exit from any screen [ ]
1.5.38. User can easily quit something that is beyond his/her ability [ ]

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USER INTERFACE:

1.5.39. Interface provides user with an appropriate environment [ ]
1.5.40. User interface is easy to understand [ ]
1.5.41. Graphics and/or text enhance instruction [ ]
1.5.42. Graphics and text stimulate user interest [ ]
1.5.43. Graphics and/or text are of high quality [ ]

COMMENTS (if any):

Appendix I

Test Cases

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