Chapter 4

Approach to the solution

4.1. Introduction

Proposed system comprise of 3 major areas of essential functionality in the domain interested.

- Microbiological laboratory related data entry
- Receipt and Lab sheet generation
- Report generation

Apart from these major functionalities, historical analysis of ABST patterns, secure login with user authentication and system administration facilities are another requirement to be addressed.

4.2 Major functionalities

4.2.1 User authentication and verification

System should have the capacity to facilitate secure login to the system. System administrator will enroll the users to the system and assign the roles to each user based on their expertise. Based on user roles, system users can perform different actions related to the ABST generation process.

Data entry operator: Feed the request form data to the system, print the receipt for each specimen accepted and finally print the ABST/Culture reports once it is approved by the consultant

Lab technician (MLT): Verify the data entered for each sample, generate a lab sheet according to the request form and updating lab sheet when the culture and ABST is completed

Microbiologist: Verify the accuracy of the culture and ABST report and authorization of each report for the printing

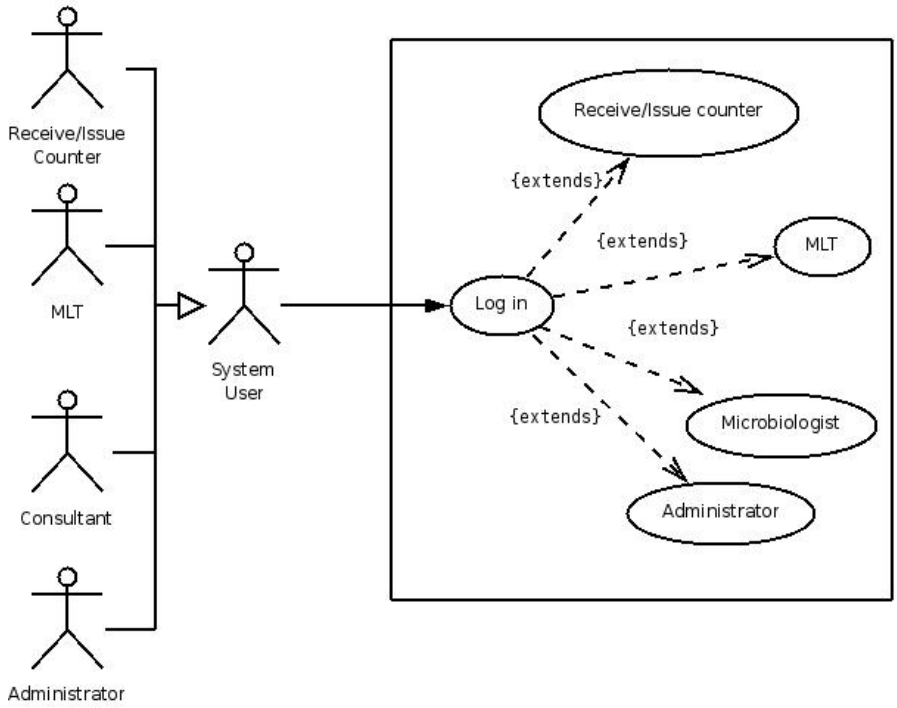

Figure 4: Use case diagram of the Login function

In the Login process, common system user will use the Log in function to gain access to each user roles. This will allow reusability of the log in function instead of having several users specific log in functions.

4.2.2 Receipt and Lab Sheet generation

Printable receipt will be generated for each specimen accepted by the laboratory. When the request form data is successfully fed to the system, system will automatically generate a receipt using request form's data.

Lab sheet will be generated by data provided in the request form and they will differ each other by the tentative diagnosis of the disease condition, organism suspected and type of antibiotics medical practitioner wants to be tested against.

When the culture and ABST is completed, MLT will feed the results of the test in to the lab

sheet. ABST and culture report will be generated based on this information entered in the lab sheet.

4.2.3 Report generation

System will generate ABST and culture reports based on the data provided by the MLT in the lab work sheets. These reports need to be verified by a consultant microbiologist before sending for the printing. Reports will be printed and handover to the clients by the report issuing counter staff.

4.2.4 Analysis of ABST patterns

Historical analysis of the ABST data is a suggested feature to be included in the proposed system. ABST should be analyzed based on the pathogen, antibiotics and resistant pattern.

4.2.5 Data visualization

Data visualization would assist in identification of patterns easily. PHP based chart will be used to aid data visualizations for pathogen and antibiotic resistant patterns [46].

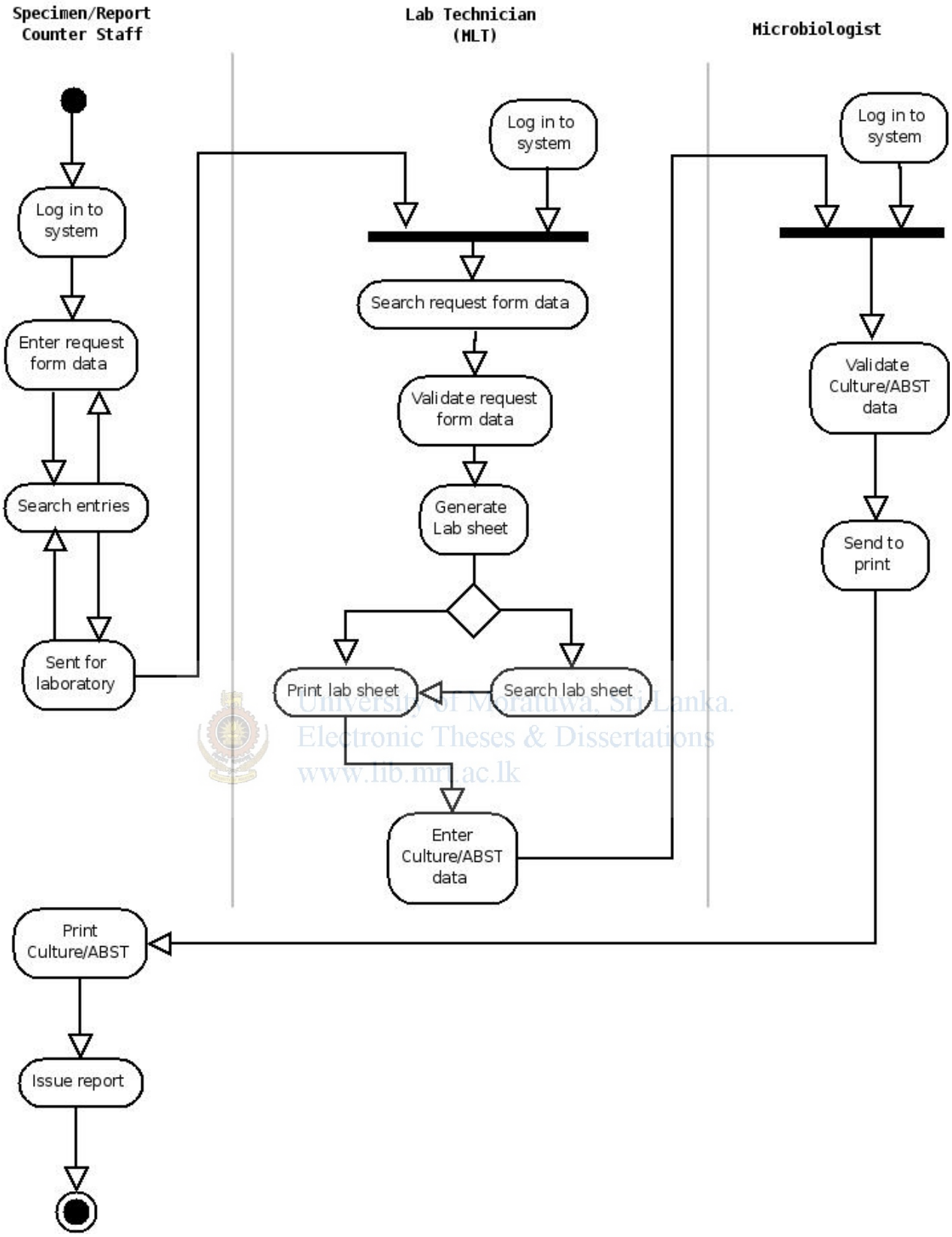

Figure 5 : Flow of documents in the proposed system

4.3 Scope of the project

- To develop a web based application for storage and manage antimicrobial drug, antibiotic sensitivity test data and therapeutically important microbiological information.
- User authentication based secure access and authorization of confidential health related information.
- Allowing microbiologists to access and analysis of database of antibiotic resistance to identify various trends and patterns of drug resistance.
- Allowing auditing the turn-around time of the investigation process

4.4. Limitation of the scope

- Being a web based system; it has to be set up by technically sound personnel, with the competence of installing and customization of web and database server.
- This system will address only the general requirements of the standard microbiological laboratory as identified by the College of Microbiologists of Sri Lanka.

4.5. Technology used

As discussed in the previous chapter, UML design methodologies will be used in the system analysis and designing process.

Spiral or Iterative Development Methodology would be the preferred development strategy over the other Software Life Cycle Management methods. The main reason for this is clients' request of a working prototype to understand the system. Since the antibiotic policies are in the process of development, clients felt that having a prototype would enhance their efficiency in making antibiotic and investigation guidelines. Once these guidelines are fixed and approved by the relevant professional and academic bodies, system can be fed with such decision making processes. This will reduce the human error as well as the manual data entry effort.

Since strict object orientation is not necessary, developer decided to use combination of object oriented and procedural coding, which will results less development time. PHP would

be the best solution as it will satisfy above requirements. Further to this PHP will have strong database connectivity as well.

Following are the summary of technologies which are being used in developing web based solution.

Table 4: Associated technical components for the web based system

Operating System	Linux, Windows XP
Web browser compatibility	Firefox, Internet Explorer, Opera
Programming Languages	PHP, AJAX, MySQL
HTTP server	Apache HTTP server
Database server	MySQL – Community server
IDE	Eclipse

4.6. Software licensing issues

The proposed system is planned to develop on PHP by using Eclipse integrated development environment. PHP and Eclipse are available under PHP license 3.0 and Eclipse public license 1.0 respectively. MySQL is used as database engine and which is also freely available under GPL license. System will be deployed using a Apache HTTP server. It is available under Apache license 2.0 for free use.

Since the system is developed using open source tools, client does not need to spend on purchasing license for software development tools, database management system or the web server [39].

The system was developed under GPL license as a Free and Open Source system. This renders any one to use the software and the source codes as they wish. At the same time, GPL license will prevent a proprietary system developer using the proposed system as a part of their software or as an add-on to the fore said proprietary system.

4.7. System architecture

The proposed system can function as a web technology enabled standalone system or a fully fledge web enabled distributed system.

When it deployed as a web based system it needs at least one server computer and three client computers to render intended functionalities to the client organization. Server and client computers can be interconnected through a local area network with a network switch. The client already possesses these requirements and hence there is no need to invest on purchasing computers and installing network systems.

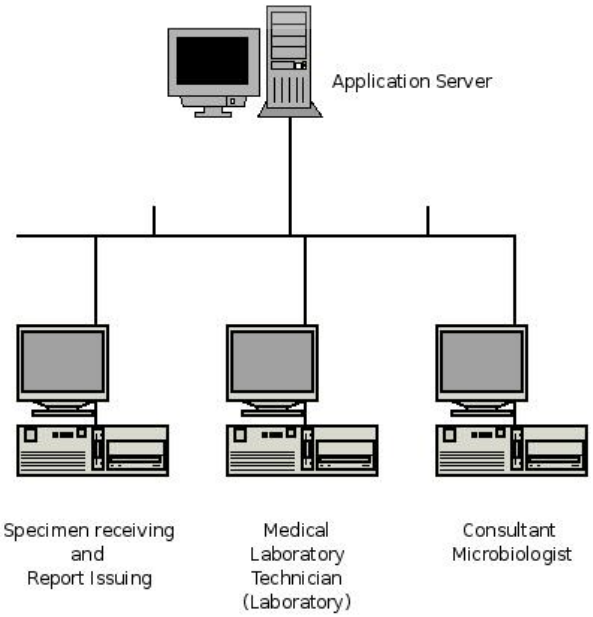

Figure 6 : Distributed system architecture of the system

4.8 Development Risk

Following risks were identified with the system development process.

4.8.1 Organizational Risk: Hospital or laboratory management may decide not to use the system even though the stakeholder organization (College of Microbiologists, Sri Lanka) recommended the proposed system for the routine use.

4.8.2 Product risk: Proposed system is based on generic requirements identified by the Sri Lankan College of Microbiologists. Specific hospital or microbiology laboratory may need additional features suits for their local laboratory routines, which is not available in the present system.

4.8.3 Project Risk: System development schedule and goals may not be achieved 100% due to technological and domain specific constrains.

4.9 Alternate Solutions

The proposed system has the capabilities of functioning as a standalone system using desktop personal computer or a laptop computer, which has no internet connection or network support. However it is scalable to a multi station environment using a local area network or a fully fledge three tire web application, which is accessible through the internet.

Feature	Deployment		
	Standalone system	LAN based	Internet based
Security	High	Medium	Low
Accessibility	Low	Medium	High
Response time	High	Medium	Low

Table 5: Deployment options for the proposed system

Considering all the above factors, developer recommend the LAN based system, which is relatively more secure and has wider access with good response time.

4.10 Tangible benefits of the proposed system

By introduction of the system, data entry process and report generation process will be quickened. This is measured by number of reports issued per day and which is directly proportional to the revenue generated.

When system introduced, issuing copies of reports can be done easily than manual system. This saves considerable time which is measured by man hours depending on the job title (MLT/Microbiologists).

4.11 Intangible Benefits of the proposed system

- Management and the staff will be able to retrieve process and analyze information within short time.
- Information stored in the system is password protected and confidential than paper based records.
- Allows higher degree of work specialization which in turn leads to more efficient working environment.
- Redundant work and documentation can be eliminated.
- Can be minimized heavy load of paper document flow.
- Information storage capacity can be minimized by minimizing paper based documents.
- Advanced data analysis features, which is otherwise difficult to perform manually [25].

Summary

This chapter covered the design issues and decisions taken in developing the proposed system.

PHP, and MySQL will be considered as main scripting languages with the mixture of object oriented and procedural coding styles. System will be implemented using Apache HTTP server with client side Java Scripts.

Next chapter will cover the analysis and designing of the system.