St. MARY'S UNVERSITY

FACULTY OF INFORMATICS

DEPARTMENT OF COMPUTER SCIENCE

ELECTRONIC DOCUMENT MANAGEMENT SYSTEM

FOR

St. MARY'S UNIVERSITY

Project Work

By

Fasil Addis Gebremichael

Date: January 29, 2019

Addis Ababa, Ethiopia

St. Mary's University

Faculty of informatics

Department of Computer Science

M.Sc. in Computer Science

Electronic Document Management System for St. Mary's University

Signed by the Examining Committee:

Advisor :Getahun Semeon (PhD) Signature _____ Date _____

Examiner: Asrat Mulat (PhD) Signature _____ Date _____

Examiner : Michael Melese (Ato) Signature _____ Date _____

ABSTRACT

Electronic document management system is a software system developed to manage digital documents. Currently most organizations manage their documents manually. As a result, institutes face fundamental challenges like: difficulties in finding documents timely, important document can be loss during manual transaction, manual records takes much space and can be damaged by natural disaster, it is also time consuming to search, access and manage records. To overcome these manual document operation difficulties, designing of an electronic document management system is very essential. The purpose of this project is to design and develop an electronic document management system for St. Mary's University; in which the system will help users to fulfill their requirement and needs to manage documents in a secure and structured manner. For the development of the system, different procedures and techniques used. To capture the requirement different tools are used like semi-structured interview, observation and few relevant document review techniques. Analysis and design of the proposed system was performed by using analysis and design techniques and the detailed description is modeled using the Unified Modeling Language. To build the web application a laravel PHP framework is used. This framework uses the MVC design pattern and it is the combination of HTML, CSS, JavaScript and PHP. MySQL is also used as the database management. An electronic document management system enable users to create, index, manage, store, retrieve and access documents. This electronic way of managing documents enhances the productivity of users and reduce the time in searching documents. The system also can prevent loss of documents or damage from the effects of disasters; such as fire, flooding, animal like mouse or human errors.

Keywords: Document management, Document management framework.

Contents

ACKNOWLEDGMENTS

First, I would like to thank my Advisor Dr. Getahun Semeon, for his continuous comments and motivations to contribute or add unique features in my project work.

I would like to forward my deepest thanks to the employees of St. Mary's university who helped me to conduct this project work.

I am also grateful to my good friend Zeray Dagne for his encouragement on my project work.

Fasil Addis

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

Terms	Description
RFID	Radio Frequency Identification
SMU	St. Mary's University
EDMS	Electronic Document Management System
SDLC	System development life cycle
MYSQL	My Structured Query Language
PHP	Hypertext Preprocessor
HTML	Hypertext Markup Language
HRM	Human Resource Management
CSS	Cascading Style Sheet
JS	JavaScript
MS	Microsoft
JPEG	Joint Photographic Expert Group
OCR	Optical character recognition
XP	Extreme Programming
IDE	Integrated development environment
MVC	Model view controller
NFR	Non-functional requirements
UML	Unified Modeling Language
EDM	Enterprise Content Management
COSS	Commercial Open Source Software
SLA	Service Level Agreement
CMP	Content Management Platform
OSMM	Open Source Maturity Model
WCMS	Web content management systems

CHAPTER ONE

INTRODUCTION

1.1 Background

Electronic document management system is a step in the direction of realizing the concept of paperless office [1]. Electronic document management system is a software that facilitates the process of file management within an organization. This is done by converting documents and other papers into digital or electronic form. This Document management enables fast retrieval and makes file movement secure. It can also save time and money, creates more efficient processes. “The Document management system not only accelerates file processing but also ensures the effectiveness of capturing information and eliminating the need for manual document processing. Parallel to accelerating the process it securely searches and retrieve documents.

St. Mary’s University is one of the pioneer private higher learning institutions in Ethiopia. In the day to today activities, the university produces various kinds of records from its different offices. Currently, all of the records are handled manually. Documents as manual processing and storing can result in variety of problems and reduce performance. Hence, the need for a system that can store and manage such documents electronically is very essential. The proposed system will address these challenges and allows electronic documents stored in a central repository to be efficiently manage and easily located within St. Mary’s University. This document management system will be web based application system that generally manages digital documents; storage, retrieval and reduce huge amount of paper. The system users are also able to create, share, archive, and search files in an efficient way, thus allowing knowledge to be efficiently shared within the university.

1.2 Statement of the problem

According to Shurville, Browne and Whitakerd document management has become one of the most important challenges associated with educational services, due to the poor management of accurate, reliable and trustworthy records so, as to fulfill evidential requirements [2]. Currently, in St. Mary's university record creation, storing, retrieval, retention and disposal including protection of the document is done manually. Keeping and managing of all these records leads to a number of challenges. Some of the problem that are mentioned with regards to manual document processes are: difficulties in finding documents timely, time consuming to search, access and manage records, important documents loses due to manual routing of the document, Keeping all records takes much space inside the university; Inefficient use of manpower , documents can be damaged by natural disaster like flood, fire, and electrical contact or by animal like mouse, the look and feel of the manual records is not attractive and records are not secure: Unauthorized person can easily access to the place where manual records are kept. Hence, managing of these records in an electronic format helps for accurate and timely available of documents and it can reduce the above-mentioned problems. Therefore, this project presents to implement an electronic document management system for St. Mary's University using a larval framework. The advantage to use this framework and to develop the system from scratch is:

Laravel is a development framework as such; it can secure applications and allows to use everything in the application securely [3]. Developing a system from scratch is best suited for most institutes because it focus on specific problems. So that, it can adapt the business need easily and makes the intended system simple and easy to use. As well as, any additional features can be add according to the need of the customer.

.

1.3 Objective of the Project

1.3.1 General Objective

The general objective of this project is to develop an electronic document management system for St. Mary's University.

1.3.2 Specific Objectives

The specific objectives which address the above-mentioned general objectives are listed as follows:

- To understanding the existing or current manual system and identify gaps.
- Study and analyze the user functional and non-functional requirements.
- Propose a new automated Electronic document management System.
- Design a new Electronic document management System and identify possible design patterns.
- implement the proposed system
- Test and validate the new electronic document management System.

1.4 Scope of the Project

The scope of the project intends to focus on designing a document management system for St. Mary's University. The system provided a web based solution for document management. It can be used for Managing the document system of the university.

- The system supports electronic document management system including uploading, index, mange, store, retrieve and accessing of documents.
- The system allows any document to be forwarded between employees and for immediate review by anyone in the organization.
- Provide a single repository for documents which can be accessed by authorized users.
- Provide the ability to limit what users can see and do based on security level.
- Provide document security and maintain folder categories, location information and document information.

- Provide the ability to maintain the document classification scheme, office and department of the University.
- Provide the ability to handle document retention policy.
- The system provides the ability to easily backup up and store data in off-site.
- Supports or sends email notification for alerting purpose.

1.5 Significance of the Project

Electronic document management system helps organize documents in efficient manner and will assist the system users. So that the significance of the system is classified into two major groups according to the system beneficiary:

For the faculty /University:

- Minimize manual filing equipment costs like filing cabinets, box files, folders, clips, trays and so on.
- Improved the university service by prompt, relevant information retrieval.
- Develop communication: It can help to improve motivation among staff members of the university.
- Change the working environment of the University into simple and attractive.
- It Improves decision making while the new system provides faster access and retrieval of records.
- Minimize time consumption and avoids record lose.

For the employees of the University:

- Minimize time consumption
- Makes the workflow active for the staff members.
- Uses human resource effectively.
- Improve employee productivity by providing the relevant document to the specified individuals on time.

1.6. Organization of the Document

This project work is structured as follows: Chapter one is the introduction part and it covers the background, the statement of the problem, objectives, significance of the project, scope and limitation of the project. Chapter two deals with the literature review and related works. Chapter three deals with the methods and techniques used in the project. Chapter four and five sequentially presents the requirement specifications, system analysis, modeling, design and development of the intended project work. Finally, chapter six and seven presents testing, evaluation, conclusion and recommendation of future works.

CHAPTER TWO

LITERATURE REVIEWS

2.1 Overview

An effective literature review enables the researcher to understand the existing body of knowledge including where excess research exists, that is already know and where new research is needed [4]. Document management systems (DMS) refers to the system that is designed for document management activities. Documents here include electronic documents and manual. However, in most cases, many DMS refer to the management of electronic documents. Different kinds of Document Management system and related concepts are reviewed in this section. Each of the topics that are reviewed in this portion has got more useful elements to be considered as an input for the proposed system.

2.2 Document

Document is a textual record or capturing of some events or things so that the information will not be lost. Usually, a document is written, but document can also be made with pictures and sound. Ordinarily the word document denotes a textual record. Increasingly sophisticated attempts to provide access to the rapidly growing quantity of available documents raised questions about what should be considered a document. Document is a form of information and the scope may define with the need of specific information science [5]. Someone may wish to observe Events, processes, images and other objects as well as texts. The present interest in multimedia may have also different perception on it.

2.3 Document might be Paper or Electronic

2.3.1 Paper Document

Paper document is any source of information, in material form, capable of being used for reference or study or as an authority. Currently paper documents are still an essential part of most institutes and commercial office. That is why we found papers almost

everywhere in every institution. The main reason why most people still use paper is because of a life-long conditioning; paper has become an intimate part of how we generate, access and store information. “Achieving completely paperless office is not ensued yet, because some papers like deeds, notarized documents or receipts need to be saved for legal, financial or tax reason [6]”. The other point should be considered related to those documents is to put them in a group or in order. A way to group or order data is normally called classification schemes. Classification schemes have been used both to make things easier to find and add values to a group of objects. By adding value which means classification or describing a group may provide more information about the members of that group. “Most of the time Classification schemes are great for physical data, by most practicing records managers’ classification system (Taxonomy) is different in computerizing records. Using different techniques more appropriate to the computer like a way to index and then search for information makes it more preferable [7]”.

2.3.2 Electronic Document

“An Electronic document is an information container in electronic form, which gathers together information from a variety of sources, in a number of formats, around a specific topic to meet the needs of a particular individual [8]”. Electronic documents can be electronic web sites, mail or hypertext or any information recorded like text, graphics, or spreadsheets that need a computer or other electronic devices to display, interpret and process it. The electronic Documents should be stored on different kinds of storage medias, this makes the electronic file to be easily managed and effectively use documents.

2.4 Electronic Document Management System

Document management is the process of handling documents, with or without documentation management, in such a way that information can be created, shared, organized and stored efficiently and appropriately [9]. Electronic document management system is computer based programs which benefits many organizations by facilitating document storage and retrieval process. It mainly stores, manage, retrieve and track documents and reduce paper use which can lead to result in paperless

office. “An Electronic document management system is a collection of technologies that can have list of features.

2.4.1 Document Scanning

Scanning documents creates an image of the document in a format that convert papers to electronic formats. Scanning document will gives a best advantage to put paper documents in computer and allow easy process of it. Scanning documents can be performed using different formats like PDF, TIF (Tagged image format) which can be used for document capturing solution.

Every capturing solution format has its own benefits. For example:

- TIF format: most documents that are scanned are turned into TIF format, which compresses documents so that they do not take up a lot of storage and at the same time enables them to be indexed on a page level. So if you had a 100-page contract to scan in, then TIF would be a better format than PDF as it would be better indexed.
- PDF format: if the contract was created in MS-Word, and you created the PDF directly out of Word, then the PDF document would be smaller than a scanned TIF file. Further, a PDF created from a Word document would probably be a better quality image than a scanned document. As with all things, there are pluses and minuses to every choice.

While we discussed scanning paper documents, we should keep in mind that all documents are not black and white. You might have scanned a picture. Think of a contract for a piece of property. It might have pictures of the property as exhibits. Pictures might be scanned with different formats. Each of the formats type have different benefits [10].

2.4.2 Document Converting

Conversion is the act of converting one document format to another, which allows the document to be read in many more applications. Documents can be converted into other source document formats, consumer formats and structured data. The conversion of the document is usually done by the EDMS when the document is ready to be stored in the

repository. The task of converting scanned paper documents to useful electronic formats is one of the most important applications for document conversion. Documents, scanned to image formats have lots of limitations such as large file size, impossibility of context search and content reuse. So they should be converting to more useful formats such as read-only PDF or TXT, DOC, RTF, XLS, PPT if it should be editable [11].

2.4.3 Document Storing

Document storage is the process of storing documents as electronic files. There are number of advantages in storing documents as an electronic format, it has the influence to create organized document filing system and makes the retrieval simple and efficient when compared to physical storage of paper documents [9].

2.4.4 Document Archiving

Archiving is the process by which inactive documents, in any format, is securely stored for long periods. Archival documents are important pieces of company information and should be stored in a safe, secure, and organized manner. Such documents may or may not be used again in the future. Which means documents that are not needed for current use might be need in the future. Therefore, it should be stored until the end of its retention schedule. “Document retention times are one of the most important parts of records retention plan. Understanding how long need to hold documents and critical records can save any litigation headaches. However, all records among the different types have their own specific retention times [12] .” for example, any documents that have not been used or referred to in 2 years or more might be part of your archiving project as they have become inactive and can take up valuable space. When files become inactive it does not mean that they are no longer important. Their might come up the need to be able to access those files again so it is important to keep all those inactive documents. The other point is keeping all inactive documents would quickly run out of the storage space. Therefore, it is important to consider offsite storage to keep all inactive documents.

2.4.5 Document Indexing

Document indexing plays vital role to increase process efficiency and it is the process of associating or tagging documents with different "search" terms [13]. Indexing makes the document searchable and indexing is the key component for Document management system. Indexing is a sequence of arrangement of materials specially in Alphabetic or alphanumeric, to make the item easily retrieve or search. Documents can be searched by using different search mechanisms. For example, an employee in a certain institute can be searched using employee ID or Employee name or using any key words. However, every organization is different so that they can use different type of indexing mechanism; "Three primary indexing ways in document management systems are indexing by associated document groups (folder/file structure), Metadata indexing, and full-text indexing. Full-text indexing allows users to search any word or phrase that appears in any document indexed [9]".

2.4.5.1 File naming - Folder Structure

This indexing method is recommended for simple or small projects to organize documents. If this indexing method is chosen, it is important to have a stable and understandable agreement to prevent confusion down the line. This is the reason why it is not recommended for complex tasks. "Some applications have automatic naming conventions that can be applied, such as adding the current date to the file name, or appending specified prefixes to number sequences to produce something like A-0001.pdf, A-0002.pdf, A-0003 etc.

2.4.5.2 Searchable Text-OCR

"Optical character recognition (OCR) is that the mechanical or electronic conversion of pictures or written or written text into machine-encoded text which are editable and searchable. This allows any electronic document format to be quickly indexed and conveniently searched [14]". The imaged documents are processed further using Optical Character Recognition (OCR) programs that convert the image into machine-readable text. The accuracy of the OCR programs will then determine the quality of the index.

2.4.5.3 Full-text indexing

Documents might be indexed by their full-text content, which means they go through all the words in each document and index the document against all these words. hence they can be retrieved by any word in the content [9].

2.4.5.4 Metadata

Metadata is one of the indexing method. Additional information is attached to the document such as a unique identifier, date of creation, or the main topic of the document. Metadata is the extra information about document. So that it can be used to identify something or to make documents easily searchable [9].

2.4.6 Retrieving

"Document retrieval is finding documents of unstructured nature text that satisfies an information need from within large collections usually stored on computer and it enables user to find relevant document from collection of countless resource [15]. When documents are stored in a central document management system, depending upon how the system is organized and how users are allowed to access the information, documents are available for retrieval from the centralized system. "Indexing is one of the important tasks of Information Retrieval that can be applied to any form of data, generated from the web, databases, etc. Document retrieval is the science of searching for information in a document, searching for documents themselves, and Searches can be based on full-text, metadata or other content-based indexing [16]". This implies that when considering retrieval methods, it is important to check different indexing techniques.

2.4.7 Version Control

This is the ability to track and manage multiple versions of the same information. This is quite an important aspect of an EDMS. In order to correctly manage the ongoing development of digital data it is necessary to create and correctly store multiple versions of data as it progresses through the system. An EDMS can manage version control in two ways. The EDMS can lock the document for other users, when in use, to ensure that only one user can access a document at any one time. Or in cases where it is necessary for several users to collaborate simultaneously on the same document, An

EDMS could enable concurrent use This is where a version control system is essential. A version control system allows concurrent access by storing a master copy of the document. In this way the users can make changes only to the most recent version. Multiple users can then submit their changes to the most recent version. This process is also known as checking in. The master copy remains unchanged during the whole process. Multiple users are expected to regularly use the update command of the software, which will refresh their copy of the document to incorporate the most recent changes. Versioning is useful for documents that change over time and require updating, but it may be necessary to go back to or reference a previous copy [11]. Without a feature like version control, it becomes difficult for the administrator to track which changes have been made by whom and when. So Version Control is one of the most important features. Using the version control feature the administrator can track the changes of the different versions of a document.

2.4.8 Workflow

As the name implies, a document management workflow is a system used to produce, track, edit, store and mange documents associated with a business process. “In practice it means management of different stages of a document. It is presumed that all stages are done in the system and there is information in the system about every step. Example of different stages is commenting document, publishing document, distributing document and so on. As there is document management in use for these stages, users’ e-mails are not loaded as much in handling and moving all the documents. As the document under work is stored whole time in the document management system and all the versions, changes and so on can be seen from there also [9]”. paperwork document process moves documents from one desk to another desk in traditional way and it has got its own drawbacks, like getting lost of documents during the process, the process may take much longer than it should and so on. Document management software creates workflows that help modernize this paperwork process. Documents become digital and can be processed more efficiently.

2.4.9 Security

Paper documents may be secured by locking them in a file cabinet, after they are converted to digital format it needs different techniques to secure and protect

documents from unauthorized access. “Who has access to which documents? In any enterprise it is vital that the security of electronic documents is appropriately managed. An EDMS ensures that access to the system is restricted only to those with the correct access permissions, both to ensure the integrity of data and to reduce the number of documents presented to the user only to those documents that are relevant to his or her role [11]”. There are basically two categories of rights called access right and feature right. Document access right is one feature of every document management system. Document should be created to be accessible or available by authorized users. To access the document knowing the location or having a system that can facilitate the accesses system is very essential. It basically determines who can log on the system. Feature right determines a range of actions, including adding pages, annotating, copying, or deleting records.

2.4.10 Distribution

Distribution is a feature for exporting documents from the system. “A published document for distribution has to be in a format that cannot be altered. Once a document is distributed it becomes available to the users that have access to it [11]”.

2.5 Other Related Technologies

Document management system is the use of a computer system and software to store, manage and track electronic documents and electronic images of paper based information captured through the use of a document scanner [9]. There is also a common component found on similar technologies like Document Information Systems, Enterprise Content Management, web Content Management and Paperless office. Collaboration and information-sharing are enhanced with all the above listed similar technologies, such as centralized storage, easily retrieval information and controlling security features etc.

2.5.1 Paperless office

A paperless office is a work environment in which the use of paper is eliminated [6]. However, has paper has been eliminated? “Not actually. In spite of many technological advances such as internet, e-books and digital cameras, paper is still there. The importance and usage of paper in different functions is obvious to everyone. Paper is an extraordinary medium. Lightweight and flexible, it is high-resolution, supports thousands of typefaces, can present both black-and-white and color illustrations, and its high contrast makes it very easy to read. Users of paper documents get a great deal of paralinguistic information from them at first glance [17]” this implies that fully achieving a paperless office is not reliable yet. Paperless office concept has got similar process steps like Document management has, in order to eliminate papers, it should be converted into digitalized form. Going paperless can save money, help the environment, save space, increase productivity, makes document sharing easier. This concept and procedures are also applied on Document Management system.

2.5.2 Document Information Systems

Document information system can be defined as a combination of components that work together to achieve a common goal. If we can observe, there are systems around us that work together to achieve a common objective. For instance, computer system can be best example, because it is a group of different components that work together to meet a specific purpose. Information system, capture and store data, process data to produce meaningful and relevant reports, and support operations by enforcing defined processes [18]. Document information system is also involving how a certain organization stores and track its essential electronic records.

2.5.3 Enterprise Content Management System

“Enterprise Content Management is a generic industry term for software products that manage unstructured data such as documents, image, files and web content [19]”. Enterprise Content Management is the systematic collection and organization of information that is used by a designed audience business executive, customers, etc. Neither a single technology nor a methodology nor a process, it is a dynamic combination of strategies, methods, and tools used to capture, manage, store, preserve, and deliver information supporting key organizational processes through its entire

lifecycle. Content management is the set of process and technologies that support the collection, managing, and publishing of information in any format or medium. Content may take the form of text (such as documents), multimedia files (such as audio or video files) or any other file type that follows a content lifecycle requiring management [20]. An electronic content management system follows some sort of process, such as digitalizing documents, organizing files into an easily searchable filing system etc., but ECM consists of several management tools and it is more advanced one when it compares to DMS.

2.5.4 Web Content Management System

The Web Content Management System is an application that used to manage web content. It is a web application that facilitates a group of collaborative users, usually from different units across different sectors, to maintain and organize web content in an effective and manageable way [21]. the main advantage of a web Content Management Systems is its collaborative nature. Multiple users can log on and contribute, schedule or edit content to be published. Because the interface is usually browser-based, a Content Management System can be accessed from anywhere by any number of users. This makes it easier to collaboratively update a website. The basic components of a web content management system Includes manages multiple types of content, externally oriented, supports content delivery for customer facing engagement, includes multiple content delivery capabilities and adjusts into digital experience management.

2.6 Related Works

Different kinds of File tracking system or related concepts are reviewed in this section. Each of the topics that are reviewed in this portion has got more useful elements to be considered as an input for the proposed system.

2.6.1 File Tracking system

File Tracking system was implemented by Haris Krasniqi and submitted to the Faculty of Architecture and Engineering, Epoka University. The purposes of this web application was to serve offices that has more related work with papers, especially in Universities. The goal of this web application is to improve file management, increase staff efficiency, save staff energy and time, reduce cost and improve the work efficiency. The specific function of the system is to manage all the file movement and helps them in managing the flow of files effectively and efficiently. All the files such as: reports, decisions, requests, reminders, and others can be processed and tracked by the system at any time. The application has four modules namely Supper-Administrator, Administrator, Department's and Secretaries with their own different privileges. The Administrator has privileges like assigning users, ability to manage all users, managing files, modifying users, sending messages, blocking all incomings, backup the database, etc. The difference of the Administrator module and the super-administrator module is that the supper administrator module has all and extra privileges. For example, if the files are deleted from the archive, only the supper administrator has privilege to restore. Departments and Secretaries modules has less privileges for instance, the Secretaries module cannot create file; instead can send a message in a form of request to the administrator for creating a specific file and forward it.

To develop this system, it was used web technologies like PHP for programing languages that will be used to program the web application and (MYSQL) relational data base system based on SQL for the purpose of a web database. The other thing is HTML and CSS was used to design the structure of the web application, and JavaScript and JQuery helped to make influential animated function [22].

2.6.2 Document management System

This project with the titled Document management system was implemented in Cochin University of science and technology by Mr. Sathesh Menon, and it is a web application. The objective of the project was to provide an efficient and time saving document management system. This web based Document management system project mainly contains five modules Administrator, version control, registration, user and search. Administrator is the main module of this system project, it provided function of maintaining the category of different files and has full authority on the system. The second module is visual source control, all the information about the files is stored in this module with it is basic features like check in and check out, view version, latest version download and update. On the next registration module all the users are registered and created a folder to download the file and store it in their directories. Another important module is users. A special feature is only users can download or upload files. For this purpose, it provides a user authentication mechanism. Users are allowed to create folders in their login. Users can implement various security measures on the files they upload. The last one is search module, searching for file is possible using two possible ways the first one is using a filename and the other is using a metadata search. The web application was developed using a windows platform in ASP.NET [23].

2.6.3 Electronic Document Tracking System

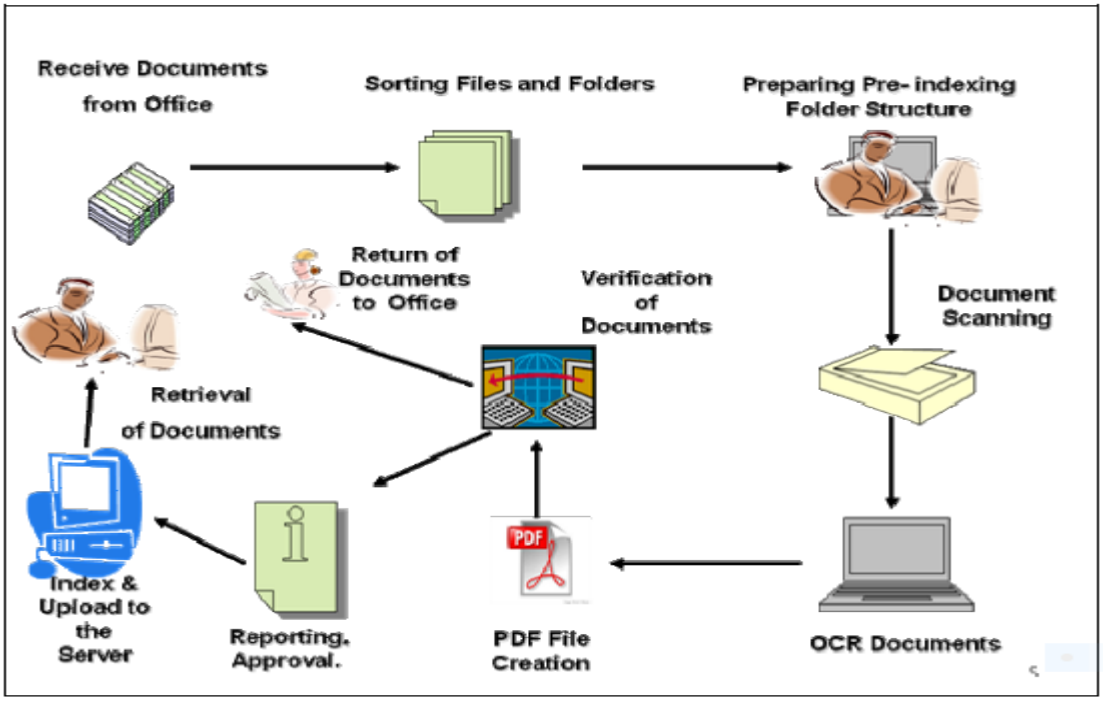
This EDTS has been developed as a solution to improve the efficiency of retrieving the document online at any time and tracking the movement of documents in and out of the faculty of office Management and Technology (FOMT) in University Technology MARA, Malaysia. With the support of the internet the system handles the management and tracking of documents, Major components of the system include create and store records, workflow processing, text retrieval, maintain the context and tracing the record. Storage component function will allow users to store documents within the electronic document management storage system. All documents are scanned and converted to soft copy; after that additional information is assigned or indexed (metadata) attributes for fast, easy storage and retrieval purpose. Text retrieval function also, allows users to search every word in an entire document. Metadata document indexing is used to tag or associate it with document searching. The other component

is Workflow; the system support workflow needs and enable the users to pass documents form one unit to another. All the components of the system have got their own contribution to support the system users; as well it gives many benefits and helps to the top level management to retrieve the document easily at anytime and anywhere. This web based application system was developed within windows environment using open source tools such as PHP and MySQL. The application relies on TCP/IP and internet to support server and client communications. Object Modeling technique was also used to develop this web-based application [24].

2.6.4 Document Management System: A Notion Towards Paperless Office

This paper is conducted by three authors Ugale, patil and musand; in Aurangabad by department of computer science engineering. It describes DMS with five major components including an architecture of EDMS. The first component is scanner: Scanners can be used to convert records to digital format that can be used by the computer. Which can help to put documents into personal computer easily. The second component is called storage which can provide a capacity to store records. The third one is document indexing; this is the process of associating or tagging documents with different searching terms. do so will make future searching or retrieval more effective. The retrieval is the other component which can make documents viewable to only authenticated electronic document system users. The last one document retention. This permits the document to associate it with a retention schedule that came to end of their maintenance calendar to distinguished and destroying it. The architecture below describes different steps for processing different documents using scanning, tagging, and indexing for effective data retrieval with OCR and Indexing techniques.

Figure 1: Architecture of document management system



After over viewing different OCR and indexing software, this paper proposes an effective information retrieval indexing method using the evaluation copy of Adobe Reader. Subsequently, indexing the documents, retrieval is much faster than simple tagged documents. Once documents are built and analyzed, next step is to index them so that the document can be retrieved based on certain keys instead of whole contents of the document. Though PDF documents tagged with identifying keywords to enhance searchabilty, indexing gives a better solution to retrieve information efficiently. It reduces a time for information retrieval. Thus indexing needs to be carried out after tagging of documents to increase retrieval accuracy [25].

2.6.5 Document Management for small business

This thesis work studies document management system in small and medium size enterprises (SME). Most of the time Document management is considered unimportant thing especially in small companies. If document management system properly handled even in small businesses it may cause confusion and duplication of the same work. This thesis work selected a company called AgentIT Finland OY. AgentIT is a company which is categorized in small and medium size enterprise and document management is not in disorder but the employees have problem in finding documents and also have

difficulties to know whether it is the correct version or not. The other difficulties are documents stored in multiple places and edited by several employees. Regards to document management staff survey was done and reviewed at AgentIT. After the document was reviewed it was used for requirement analysis of the development process. The survey was used to discover what employees expect form document management system and to identify the existed document management system of the company. The objective of this thesis work was to find out the most important thing about document management which are needed for selecting a proper document management system for a small company. To achieve this the thesis explored a lot of document management systems that focused on the basic features and its architecture. The development part of the thesis takes a look into creating process, requirement analysis and for closer analysis the following four document management systems were selected: OpenDocMan, SeedDMS, LogicalDOC and M-Files and comparison was made. Based on the mapping and comparison, the company received clearly defined processes for basic document management operations. The result of the development project was to find the most suitable system for the client and to define document management processes for the company [9].

2.7 Different Document Management system solutions

Developing and owning an Electronic document management system, enables organizations to spend less time and to have an efficient working environment. When it comes to developing Electronic document management system there are usually two options system developers can take to achieve the intended result, the open source software or Proprietary software.

2.7.1 Proprietary

Proprietary software is primarily commercial software that can be bought, leased or licensed from its vendor or developer. In general, proprietary software doesn't provide end users or subscribers with access to its source code. It can be purchased or licensed for a fee, but relicensing, distribution or copying is prohibited. Most software is proprietary software and is produced by an independent software vendor. The restrictions or conditions imposed by the vendor or developer on proprietary software is elaborated within the software's end-user license agreement, terms of service

agreement or other related use agreements. The user or organization must accept the agreement prior to installing or using the software. The software developer or vendor can take legal action against the end-user or organization for violating the end-user license agreement or terms of service agreement [26]. The term proprietary is derived from Latin word proprietas it is to mean property. Most of the time its source code is kept secret. Source code is the important section of a computer program that is originally created by a programmer. It can be read and easily understood by software programmers, and it is necessary to have the source code in order to be able to modify or improve a program.

2.7.2 Open Source

The term "Open source software" is software with source code that anyone can inspect, modify, enhance and share since it designed in publicly accessible way. Open source software (OSS) has been gaining large attention lately. In fact, several studies have shown that the collaboration is a remarkably major factor influencing the OSS quality and has some limitations [27]. "There are two types of open software: The first one is Project/Community open source which is developed and managed by a distributed community of developers who cooperatively improve and support the source code without remuneration. These projects may be copyrighted by the contributors directly but larger projects are typically run by non-profit foundations. Well-known examples of community open source projects are Linux and Apache Web Server. The other type of open source software is Commercial Open Source Software, or COSS, is distinguished by open source software of which the full copyright, patents and trademarks are controlled by a single entity. The owner only accepts code contributions if the contributor transfers copyright of the code to this entity. They may distribute their software for free or a fee. Their business model typically includes revenue from providing technical support and consulting services.

2.7.3 Open Source Document Management Solution

There are several list of famous open source document management solutions that are proposed by different organizations. This topic references well known and most popular open source document management system that are used to organize and manage the document.

2.7.3.1 Alfresco

Alfresco is an English editor, founded in 2005 by the former directors of Documentum and Business Object. The company is today present in England, France and the United States. Alfresco is available in two versions: A free “Community” version and an “Enterprise” version, which requires annual subscription and offers access to editor guarantees, together with intermediate updates. The cost of this subscription depends on different factors: The Service Level Agreement (SLA), the modules implemented, and number of processers used. Alfresco is one of the most popular open source content management systems available in the market, today. Some of the usual features of the system are metadata, document types, document and advanced workflows, category management, collaboration tools, search, management of several independent databases, Web content management [28].

2.7.3.2 Nuxeo

A comprehensive open source content management platform, Nuxeo provides several solutions to a business or an individual such as case management, document management and digital asset management-all in a single, integrated package. Known for its modular design and flexibility, Nuxeo offers a slew of features that cater to almost every content management need that a company may have. Nuxeo offers CMP (Content Management Platform) that allows organizations to focus on developing content-oriented applications, instead of weaving the data around the code. This allows for a modularized approach that could turn out quite handy for the business in several scenarios. The open document management system that comes with Nuxeo contains a whole set of features, such as support for multi-formatted content, meta-data standardization, easy navigation within the structure, and secure workflow to ensure that no data is compromised upon [29].

2.7.3.3 Feng Office

Formerly known as Open Goo, Feng Office is not your typical open source office suite in that it is Web-based, like many of today's Software as a service, offerings. Feng Office is an open source collaboration platform developed and supported by Feng office and the OpenGoo community. It allows users to upload and share any type of document and certain files can be edited online as well. A spreadsheet component is under development. In addition to document management, Feng Office has applications for notes, e-mail, contact management, calendaring, task management and time keeping. A commercially supported version is available which can be hosted on-site or provided as Software as a service [30].

2.7.3.4 Knowledge tree

Knowledge Tree is an enterprise level document management system solution, developed by the South African company Jam Warehouse. Knowledge Tree has a full range of functions and several modules which allow good integration into the office environment. The Open Source version of Knowledge Tree integrates most of the package, but several modules, notably those which concern integration to the work station (hot folder, navigation, Microsoft Office integration, scanner management application), are only available under commercial license. The application is well designed overall, providing a simple and efficient EDM. The application is well designed overall, providing a simple and efficient EDM with features like advanced search functionality that will meet the most demanding needs for complex searches, immediately operational standard interface, the admin functions, the default virtual navigation modes and the ergonomics of the module when integrated with MS Office [31].

2.7.3.5 LogicalDOC

LogicalDOC is a document management tool, edited by the Italian company Logical Objects together with some independent developers. Two versions of the solution are available, the Open Source edition, and the Commercial edition which has extra functions and includes support. Some of the functions proposed include: version management, document dispatch by mail or generated link, webmail integration, document language management, discussions. LogicalDoc offers the functions that are essential to any EDM tool, together with some interesting features such as graphic

rights management, the appearance of the main console is simple and clean, also the interface appears to be essential in the contents, this fosters the user as it is not distracted by an excess of icons or visual gadgets [30].

2.7.4 Challenges to Use open source Software

2.7.4.1 Total Cost of Ownership

Compared to closed source software it may seem that the open source software has more benefits because it is normally cheaper or it might be free. However, it is important to consider the metrics of total cost of ownership. “Total cost of ownership reflects not just the balance of the direct qualities of competing software products (price, functionality, reliability etc.) but also the relationship of the software to the organization’s broader set of technology platforms, installed systems, culture and skills base, and strategic goals, as well as the ability to access market and community based services and support [32]”. Overall, total cost of ownership for free commercial open source data integration software can be significantly higher than the upfront cost of proprietary software licenses for several reasons. Commercial open source solutions require high levels of software development expertise and significant learning curves, and are often restricted in their ability to scale or adapt to enterprise-grade demands. Moreover, many commercial open source free alternatives are basic packages that require manual configuration, lack necessary features, or otherwise fail to meet key requirements for a truly purpose-built data integration architecture. Finally, you must consider the business risk if the commercial open source project fails. “open source licenses are free and anyone can alter and improve the code to fit their needs. But, there can be risks and unpredictable outcomes when open source software is not factored into the overall business strategy [33]”.

2.7.4.2 Quality control and too many choices

Quality control is a procedure or set of procedures intended to ensure that a product or performed service adheres to a defined set of quality criteria or meets the requirements of the client or customer. Unavailability of a dedicated quality assurance team leads to compromise on quality of the software [34]. Various studies reported that identifying quality products among the many available Open source software products is difficult due to an uncertainty about the quality. The quality is typically referred to in terms of

quality attributes such as usability, reliability and performance. Source forge, the largest repository for Open source software product projects, alone hosts more than 230,000 projects. This challenge has long been recognized, and has resulted in a variety of Open source software evaluation methods and frameworks, such as Capgemini's Open Source Maturity Model (OSMM) [35].

2.7.4.3 Documentation

Documentation is a set of documents provided on paper, or online, or on digital analog media. A lack of good quality documentation remains to be a challenge that is difficult to overcome. Well-documented software is easier to understand by others, which makes it easier to modify the software. However, Open Source Software contributors are typically more interested in coding, and some consider adding comments in the source code is sufficient. Researchers have proposed various architecture recovery methods to overcome the lack of design and architecture documentation. The availability of different descriptions of the same components is problematic as well. Open Source Software products may have documentation, but due to the active evolution of many Open Source Software products, this documentation may quickly go out of date [34].

2.7.4.4 Technical Support

A wide variety of challenges have been reported with respect to the interaction with the community. This interaction can be related to future support for the product as well as contributions to the project. Maintenance can be done by both the Open source software product's community as well as through contributions from the product's users. In fact, the boundary between "community members" and "users" may not be that clear according to the onion model [34], which states that the social structure of an Open source software community is layered, and users are just another layer. since OSS are open source tools, for every problem, users are usually asking the community. Open-source software still provides some support, but it usually comes in the form of documentation and experiences from other users.

2.7.4.5 Uncertainty about product future

While open-source software continues to be developed, it doesn't usually keep up with the times as well as its closed-source competitors. For example, eFileCabinet has continued to upgrade its interface as well as its ability to integrate with other programs

to improve the customer experience [36]. A realistic concern that organizations may have is the future, or longevity of the OSS product. Obviously, if a certain OSS product is adopted, an adopter does not like to be in a situation where the community supporting that product disappears. If that happens, it means no support or updates for that particular product. In such a case, an organization may choose to take over the maintenance of the project. However, this would result in additional maintenance efforts, and may distract the organization from its core business [34].

2.7.4.6 Security

When it comes to security, open source software is more vulnerable to hacking. The appeal of open-source software is the fact that anyone can modify the code. And because the software is meant to be played with at its core [37]. Many Web applications, such as those for e-commerce or collaboration, use out of the box Web content management systems. WCMSs let users who don't have in-depth development knowledge easily build a customized Web site with broad functionality. For small- and medium-sized enterprises, open source WCMSs offer an easy to use, low-cost alternative to commercial software. However, these systems raise significant security issues. Security is critical to any Internet-connected information system; vulnerabilities can create serious consequences for system users and operators. Because of their wide usage, open source WCMSs are a desirable target for attackers. Once malicious users discover a vulnerability in a particular WCMS, they can carry out attacks on many if not all of the applications built with it. Open source WCMS developers are aware of this and have established security teams, Internet forums, and security tips for users. Still, the security of such systems remains unclear [38].

2.8 Gap Analysis (Challenges and Opportunity)

Even if there are free open source document management system, this project focuses on developing new document management system from scratch that fits the existing document creation, organizing, storing, retrieving system at St. Mary's University. Doing so have plenty of advantages over the already existing free open source document management system.

First, it avoids additional learning curve and administration difficulties that is being required by free open source Document Management System. This means that the newly developed system is designed to fit SMU user requirements. This makes the system cost effective in the long run plus it will save time and effort to train the system user. Any software program irregularly goes wrong. When such a thing happens with open source software, it requires time and knowledge for debugging the problem and customizing can get tricky. Secondly, the System Users will get continuous support and can easily understand the system, while in the case of free open source document management system; more features are included inside the system. The more features a system contains the more complex it will be. The fact is that EDMS on free market have general solution they are not optimized to solve specific problems. As a result, system users cannot easily understand it. As well as it can create a barrier to usage. Thirdly, it can avoid system update payments. With most open source document management system software's, there's always a way to get something fixed, patched, improved, enhanced, refactored, upgraded and the upgrades most likely require payment. Finally, institution gains quite some independency when it starts relaying on its own software. In the case of OSS anyone has an access to modify the code so that it can be vulnerable to malicious users. While this system is intended to develop a system from scratch using the Laravel framework. This framework made to strengthen the security of the application. So that the system will be secure. Additionally, some feature can be added to the system according to the request or the need of the user.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

To develop the proposed Electronic Document Management System, it is essential to use a set of methods and techniques. This section describes the methods and techniques chosen to achieve the objectives of the proposed system. For data collection and requirement, gathering mainly semi-structured interviewing and observation is chosen. To develop web applications laravel were selected. Laravel is a powerful MVC PHP framework, and it normally contains HTML, CSS, Javascript and bootstarp on its framework.

3.2 Development Methodology

There are different methodologies that visualize how the software development projects can be executed. These are waterfall model, spiral model, agile methods, incremental development and so on. All these process models visualize the steps that are usually taken in software projects.

3.2.1 Agile

In Agile methodology overhead of traditional software development processes and documentation is tried to keep reduced. Regardless of what Agile method have been chosen key idea is to run fast incremental and iterative development where fast paced releases are reviewed with customer [36]. The reason why agile methodology is not chosen for this project is: agile method is mainly focus on the final deliverable of a project work. Which means it avoids much of the documentation part. Rather it requires multiple deliveries and demonstrations to the end user of this system.

3.2.2 Waterfall

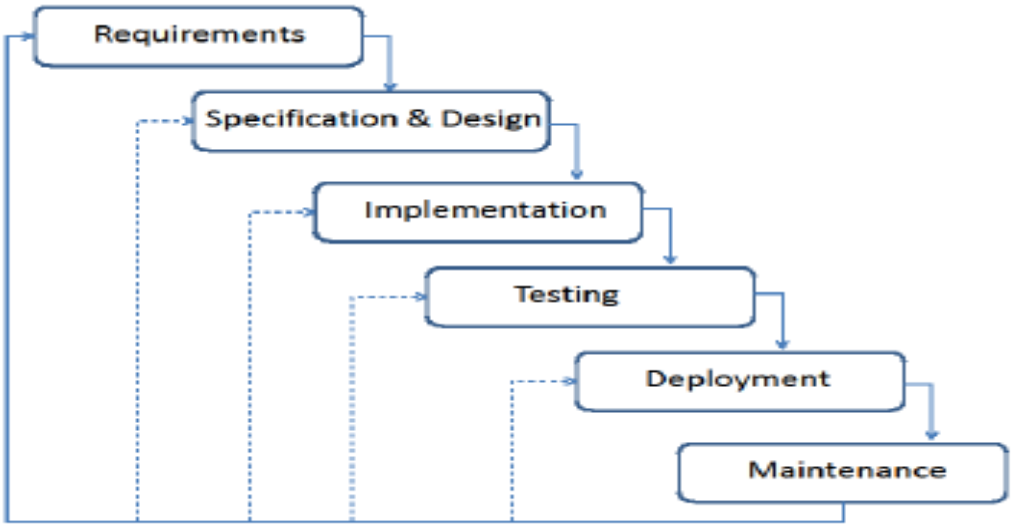
The waterfall process model is usually referred as the oldest and most well-known process model [36].Considered the traditional software development method, the waterfall method is a rigid linear model. In this model there are different sequential

phases (Requirements, Design, Implementation, Verification, Maintenance). Each separate phases gets feedback from the previous one and each phase therefore must be fully complete before moving onto the next phase, and traditionally there is no process for going back to modify it.

3.2.3 Modified Waterfall

The modified waterfall model is closely based on the waterfall model [11]. The reason for its existence is to minimize or erase the defects or disadvantages of the traditional waterfall model. The main change of this model, compared to the waterfall model, is that the phases in the modified waterfall model life cycle are permitted to overlap.

Figure 2: Modified Waterfall life cycle model for SMU EDMS



In order to develop the proposed system modified Waterfall model is chosen; Duo to the advantages listed below.

- In the modified waterfall model life cycle are permitted to overlap.
- It is more flexible when its compared to waterfall model.
- It is also possible for a number of tasks to function concurrently.
- In this model it takes a less formal approach to procedures, documents and reviews. Because of this, it reduces the huge bundle of documents. Due to this the development team has more time to devote to work on the code and does not have to bother about the procedures. This in turn helps to finish the product faster.

- It ensures that the defects in the software are removed in the development stage itself and the added costs of making changes to the software before implementation is saved. Because there can be a number of phases active at one point of time, making changes to the design and rectifying errors introduced can be easily dealt with [11].

3.4 Data Collection Method

Different data collection methods were used to gather user requirements for building electronic document management system. It is believed that Qualitative research is more suited to the information systems field, due to the relation with understanding human behavior from the informant's perspective. In this project work qualitative method of data collection was chosen to explore the topic in more detail. "Qualitative methods are used in information science and records management and information system practices and contribute constrictive aids to the information profession. This contribution is attributed to a number of aspects like:

- the complexity in an information environment requires a flexible understanding of complex evolving social constructs and variability in data analysis.
- qualitative research helps facilitate the use of triangulation to enrich research findings
- it is suited to the non-qualitative background of many information professional" [39].

3.4.1 Interview

Interviewing is a primary way of collecting data in qualitative research in this way, three types of interviews can be used: Structured, Semi-structured and unstructured. Structured interviews questions are asked in a set of standardized order; this means new questions cannot be asked during the interview so that it is not flexible. While Unstructured Interview is sometimes referred to as discovery interviews. They will contain open ended questions that can be asked in any order [40]. Semi-structured interviews are conducted with a fairly open framework which allows focused, conversational, two-way communication. The interviewer follows a guideline but is able to follow topical trajectories in the conversation that may stray from the guide when it seems appropriate. Not all questions are designed and phrased ahead of time.

The majority of the questions are created during the interview, allowing both the interviewer and the person being interviewed the flexibility to go into details when needed [41]". In this project work semi-structured interview was selected. The reason for selecting this interview is that; semi-structured interviews have a focus, but are flexible based upon the direction of the participant's responses. The interview protocol was developed for different offices of the university.

3.4.2 Document Review

Different record types from St. Mary's University were reviewed in order to collect additional data that can provide sufficient input for developing the system and triangulate the data collected through interview.

3.4.3 Observation

This involves systematically viewing or observing when employees of the University perform their tasks. The observation includes how records are kept, what type of record they have, how they classify the documents and how the University employees use the documentation process. This observation is helpful to get more context related information.

3.5 Development Tools

The following section discusses different types of development tools that will be used to design the newly proposed system.

3.5.1 Data Modeling

Enterprise Architect

Enterprise Architect is a UML modelling tool. It helps business users build robust and maintainable systems quickly and can easily scale to accommodate large teams collaborating on shared projects [42]. Enterprise Architect also has the capability of running some dynamic model simulations to verify the correctness of models and provide better understanding of how specific business systems operate. This software is used for UML design. Use case, class, activity and sequence diagrams.

3.5.2 Framework

Laravel

Laravel is an MVC (model view controller) and open source web development framework written in PHP. It has been designed to improve the quality of your software by reducing both the cost of initial development an ongoing maintenance costs, It also improves the experience of working with an application by providing clear expressive syntax and a core set of functionality that will save you hours of implementation time [43]. Laravel is a prominent member of a new generation of web frameworks and some of its features are listed as follows: -

- modular packaging system with a dedicated dependency manager
- different ways for accessing relational databases though Routing
- utilities that aid in application deployment and maintenance
- Easy authentication by providing a simple & easy to use interface.

Reason for using Laravel:

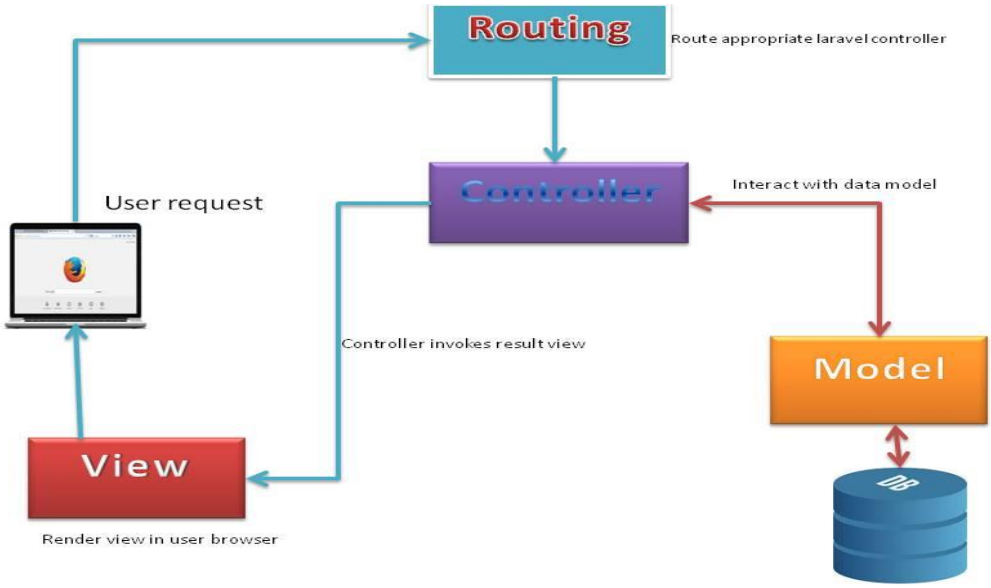
Object-Oriented Libraries:

Laravel can have Object Oriented libraries which are not found in any other popular PHP frameworks. One of the pre-installed libraries is the Authentication library. It is easy to implement and also many advanced features such as CSRF (Cross-site Request Forgery) protection and encryption.

MVC Support:

Laravel supports MVC Architecture ensuring clarity between logic and presentation. MVC helps in improving the performance, allows better documentation, and has multiple built-in functionalities. Here's how the MVC works for Laravel.

Figure 3: MVC Architecture for Laravel



Security:

Laravel takes care of the security within its framework. It uses salted and hashed password, which means that the password would never save as the plain text in database. It uses Bcrypt hashing algorithm for generating an encrypted representation of a password. Laravel uses prepared SQL statements which make injection attacks unimaginable. Along with this, Laravel provides a simple way to escape user input to avoid user injection of <script> tag [41].

Bootstrap (front-end framework)

Bootstrap is a front-end library for developing responsive web application. It is free and open source. It contains HTML and CSS-based design templates for typography forms buttons, navigation and other interface components as well as optional JavaScript extensions. Unlike many web frameworks it concerns itself with front-end development only. This library is also used to develop a responsive web application in this project.

Laravel: Contains

JavaScript

Java script is the most popular client-side programming language on the Web today and also the second fastest growing server-side programming language [44]. JavaScript

gives functionality to a page and it is interpreted programming language generally used at client side to control user input, control browser actions, load additional content to a browser. JavaScript works on web users' computers even when they are offline and it is very easy to implement. It is a lightweight compiled programming language with first-class function. It is well-known as the scripting language for web pages. JS is a prototype-based multi-paradigm, dynamic scripting language, supporting object-oriented, imperative, and declarative style.

Hypertext Markup Language (HTML)

HTML is a mark-up language used to create electronic documents called pages. Then the web will be displayed. Each page contains a series of connections to other pages called hyperlinks, HTML code ensures the proper formatting of text and images so that the Internet browser may display them as they are intended to look.

Cascading Style Sheet

It is a good practice to separate page structure from its design. To do so, CSS is used as a styling language. It defines layout, color, size and other attributes of page elements [45]. CSS helps to keep the informational content of a document separate from the details of how to display it. The details of how to display the document are known as its style. Keeping the style separate from the content helps to avoid duplication, make maintenance easier and use the same content with different style for different purposes. . It describes how HTML elements are to be displayed on screen. CSS can save a lot of work, by controlling the layout of multiple web-pages all at once.

3.5.3 Backend

MYSQL

MySQL is a freely available open source Relational Database Management System (RDBMS) that uses Structured Query Language (SQL). MySQL runs on virtually all platforms, including Linux, UNIX, and Windows. Although it can be used in a wide range of applications, MySQL is most often associated with web-based applications and online publishing is an important component of an open source enterprise stack called LAMP. LAMP is a Web development platform that uses Linux as the operating system, Apache as the Web server, MySQL as the relational database management system and PHP as the object-oriented scripting language [46]. For this project work

MYSQL is chosen for database management system because it is the most widespread open source database. It is a high performance and scalable web based and embedded database applications. It is also fast, reliable, free to download and easy to use.

3.5.4 Additional tool

Visual Studio Code

Visual Studio Code is a cross-platform, free and open-source text editor developed by Microsoft. It is built on the Electron framework and is extensible using extensions, which can be browsed from within the text editor itself. This software is used as a PHP editor, because it is fast to launch and integrate with Command Prompt.

3.6 Testing Methods

Different testing methods and tools were used to ensure the functionality and usability of document management. The primary purpose of these tests is to uncover the systems limitations and measure its full capabilities. The following test methods are applied in the study.

3.6.1 Unit testing

This test was conducted to check whether the internal logic is functioning properly and program inputs produce valid outputs that compare with the expected results. It is done after the completion of an individual unit. These tests are performing at component level and specific business process, application, and system configuration.

3.6.2 Functional test

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentations of the document management system.

3.6.3 System test

The System tests was focused on the behavior of the document management system. User scenarios were executed against the system as well as screen mapping and error message testing. Overall, the system tested the integrated system and verified that it meets the requirements defined in the requirements document.

3.6.4 Security test

The main objective of security test is preservation of availability, integrity and confidentiality of information:

- Availability insuring that authorized user has access to information and associated assets when required.
- Integrity is safeguarding the accuracy and completeness of information and processing methods.
- Confidentiality is insuring that information is accessible only to those authorized users to have access.

3.6.5 Usability Test

Usability testing is focused on User-friendliness check. In this testing section the application flow is tested so that the system user can understand the developed system easily.

3.7 Ethical Consideration

Ethical Memorandum letter has been given form St. Mary's University department of Computer Science. For all responsible employee of the university the copy of the Memorandum is distributed so that all are informed about the purpose of the study. Confidentiality is also considered during the entire process of the study.

CHAPTER FOUR

ANALYSIS AND REQUIREMENTS SPECIFICATION

4.1 Overview

System analysis is the process of gathering and interpreting facts, diagnosing problems and using the information to suggest improvements on the system. System is a problem solving activity that requires intensive communication with the system users and the system developers [22]. Collection and analysis of the requirement is one of the basic and essential steps in the software development life cycle. Analyzing the existing system will lead to identify all the functional and non-functional requirements of the new system to be designed and the way to identify problems in the existing system. Therefore, in this chapter the functional and non-functional requirements are identified and all essential use case related diagram are used to model the requirements.

4.2 Analysis and Requirement specification

A requirement is simply a statement of what the system must do or what characteristics it needs to have. During a systems development project, requirements will be created that describe what the business needs (business requirements); what the users need to do (user requirements); what the software should do (functional requirements); characteristics the system should have (nonfunctional requirements); and how the system should be built.

4.3 Hardware Requirement and Software Requirement

This section describes the hardware components and software requirements needed for effective and efficient running of the system.

Table 1: Hardware and Requirements for Database Server

Hardware	**Minimum requirement**	**Recommended**
Processor	2.4 GHZ processor speed	3.0 GHZ or fast, multi CPU
RAM	2GB	4 GB or Higher

Disk space	10 GB	100 GB or More

Table 2: Hardware and Software Requirements for Web Server

Hardware	**Minimum requirement**	**Recommended**
Processor	2.4 GHZ processor speed	3.0 GHZ or fast, multi CPU
RAM	2GB	8 GB or Higher
Disk space	100 GB	500 GB or More
Operating system	Windows Server 2008 physical or virtual	Windows server 2012 (32 bit or 64) physical or virtual
Web Service	IIS7	IIS8 or higher
.NET Framework	4.0	4.5 or higher
Internet Browser	Internet Explorer, Chrome, Firefox	Internet Explorer, Chrome, Firefox

4.4 The Current System

Currently most records at SMU are being processed manually. Manual processing and storing of those documents are causing number of challenges. To understand it in detail, interview is made with different employees found in different offices of the University. Some offices that were visited during the requirement gathering are listed below:

- Finance office
- HRM office
- Archive office
- Store and Purchase office
- Administrative vice president office
- Academic dean office
- Executive vice president office

Having interviewed with the above listed office employees helps to identify the following key aspects like: what common record type they have, how they currently classify the records and how they handle document maintenance and retention policy. According to the observation and interview made currently, almost all offices use their own local adopted techniques to manage the documents.

For example: Inside the academic dean office, they categorized their document types in seven different level using a box file. The categories are arranged on subject matter of the records like: Letters, Minutes, Memo, application letters, Guidelines, Monthly report and annual plan. Basically, when they need to route a document from one office to other office, they are manually route and track it. They also have letter dispatch list to control document routing, this dispatch will be registered manually every time whenever the document moves from one office to another office. Dispatch record example includes: Date, Subject, Received by, Office, Signature and Enclosure. One single office may have several records that are separate and different from one another. For example, in executive vice president offices records include Agreements, Accreditation, Conference, Policies, Guidelines, Reports, Plans, Payments, External and internal letters, Faculty related Letters, Applications, letters, minutes and memos. Each of the aforementioned functions could use document management for a different purpose in different office.

The other point is that, each offices or departments use their own technique to classify and arrange records. For example: HRM office arrange and classify records Alphabetically for incoming and outgoing letters. In line to this to arrange plans and reports they are also using date based classification. Similarly, all offices use their own classification techniques.

According to the respondents the current system working condition has different drawbacks. Some of the drawbacks mentioned were:

- Documents can be damaged by different reasons: There are many categories of original documents in side every office in SMU, including internal and external letters, legal records, applications, report and plans and so on. But all of this records are vulnerable to effects of disasters like fire, flood and animal like mouse.
- Documents may be lost before reaching the destination: Every documents at SMU are routed through the manual process. This opened up the possibility that a document could be lost in transition. Even they have a manual tracking mechanism and copy is kept for security, the lost document would have to go through the approval process again once the loss was discovered. The impact of

a lost document would take some time to determine and would likely cause a delay in other office tasks.

- Sometimes it is hard to find the document: Since all the document management is done manually, it takes a lot of time to identify the record type, its classification and to retrieve the document of previously stored records. And also searching previous records is boring and time taking.
- Not secure: Manual document storage is not secured; it can be stolen by anyone who has access to the place where manual records are kept. For example, this security issues are a big concern for the employees who works in SMU specially, employees for archive office. In order to solve this problem and add security to the records, they several times request a file cabinet that can be locked to prevent others from having access to its contents.
- Classifying and tracking a file being dependent on the employee: Since, each office applying individual filing structures, when the employee who structured the filing takes a leave: it will be difficult to know where the particular documents are and other employees will have spent their time on searching. Due to this or lack of standardization, the filing structure is dependent on the one who classify it.
- Not Attractive: Paper documents are delivered and stored locally in filing cabinets. File cabinets are bulky and it takes some valuable office space. Paper documents are difficult to search, carry, copy, and modify. As well as paper documents are easily damaged, misfiled or misplaced. This and all its manual process creates unattractive office structure.
- Space problem: Currently, all the records of the University is stored in filling cabinets. The amount of this records increased are increased every time. As a result, it takes massive amount of room size, this space could be used for other purposes.

Description of Solution

The proposed document management system is expected to provide a solution to the problems identified. It is capable to eliminate the drawbacks of the existing manual process. Among its capabilities and functionalities:

- The system enables users to Create, index, mange, store, retrieve and accessing documents All softcopy records are collected and stored in a central repository in two ways: the first one is the system user can scan the records using any type of scanner and stored in to a central repository. This day's scanners have got many features and contain a twain driver, which allows to interface directly into other software. This scanning interface allows users to rearrange pages, invert, and rotate documents before saving them. Furthermore, documents can have pages added to them prior to the save or be split apart without a pdf editor. Network scanners also automatically drop documents into a specific file folder. Typically, dropped documents are given a numeric name, auto batched, and edits, name changes, and the proper storage location all have to be changed by hand. So that this avoids the time and energy usually required by scanning process. The second one is the records that are already converted to a soft copy but not sent to a central repository. So that all the necessary softcopy records should be collected and stored to the central repository. Starting from that point this system allows the user to index and add records to the system.
- Establish responsibilities: who archives what and who has the right to delete documents from the records or to move documents. Each user has specific rights in specific directories or sub-directories, according to the authorization that they are given for example, a user may view the documents in one part of the repository, add and edit documents in another part or delete documents and create sub-directories in another part.
- Create simple structures for the records that are based on classification schemes that respond to the needs of each office. Digitizing paper-based documents into electronic format and capturing record attributes and archival record metadata (for example Record subject, number (PK), name, type, registration date, status, record classification, retention schedule, modification date, archival date). Filing documents into different categories or other identifiable parameters which enables faster retrieval of documents.
- Archival recodes: Records refers to all types of information created regardless of format, sent and received by the University, in the sequence of carrying out its daily business. Examples of records are Letters, Minutes, Memos, Agreements, Accreditation, Conference, Policies, Guidelines, Reports, Plans,

Payments, External and internal letters, Faculty related Letters, Applications etc. All these records that have gone through the appraisal processes and kept as archival records. There is a specific reason for records to be archived. One obvious reason is that when the record is no longer active or in other words the record is no longer actively referred to, it is then selected to be archived.

- To protect records from the effects of disasters documents are securely stored in an electronic form. There will be a backup solution including offsite backup, this will help the University to reduce risk.
- The system will provide reporting; the reporting will be made available to the users based on their role permissions. The reporting will be in the form of normal document which can satisfies a particular system user and export reports to different document format like PDF. Example of reporting: How much incoming/outgoing letters are recorded in a certain office, the reporting is not restricted only in incoming and outgoing letters. It includes: reporting related to Users, offices, departments, document created and even it includes physical document related reports.
- The system administrator will have access to all the office management, user management, role management, document management, message management, backup and archival management, and many more features of the system.
- The system will also have an Email notification. Currently SMU subscribed to Microsoft office 365 for business. Office 365 is an integrated experience of apps and services that are enabled over the internet, this service supports to get Microsoft app services both in personal computers and mobile devices. The new system will support email notification so that users of this new system can get notification with their own cell phone device. suppose, one document is being raised and it requires an approval. In a situation like this notification will be sent to remind the approver that approval is pending.

4.5 System Requirement specification

Software Requirements Specification is the requirements work product that formally specifies a design of document management system.

4.5.1. Functional Requirements

Functional requirements should describe all the required functionality or system service and deals with what the system should do or provide for users. They include description of the required functions, outlines of associated reports or online queries, and details of data to be held in the system [47]. Functional requirements are associated with specific functions; tasks or behaviors that the proposed system must support. The functional requirement of the proposed system described as follows.

Manage File Creation: - The system should have a facility for maintaining category. In this facility users must be able to create file and folder. For this feature to function as intended the following requirements must be met:

- Create Folder and give name
- Create file and register information
- Save the file in the folder
- Save the folder to database

Manage File and document Storing: - This system will have a facility for maintaining location information for physical documents. In this facility users must be able to create, save, update and delete location information of physical documents in the database. For this feature to function as intended the following requirements must be met:

- The document should be uploaded
- Metadata information about the document will be registered
- The file stored in the folder

Manage File retrieving: - This system feature helps to search or retrieve a document using different parameters like date, time, document name, location information, folder name category information and by document contents. For this feature to function as intended the following requirements must be met:

- The file should be created
- The file need to be Indexed

Manage workflow: - The system should have a facility to send documents in the workflow in predetermined flow (document state) as a message. For this feature to function as intended the following requirements must be met:

- Send message as the business process of the organization to the receiver, who is responsible user.
- Follow-up and auditing the workflow.
- Receiving the message.

Manage User: - The system should have a facility for managing user. In this facility system administrator create user, department and structure of the organization. For this feature to function as intended the following requirements must be met:

- Create user and give role.
- Create department/faculty of SMU.

4.5.2 Non-Functional Requirements

Non-functional requirements (NFRs) are the behavioral properties that the system must have and define system attributes such as security, reliability, performance, maintainability, scalability, and usability, error handling, availability and efficiency [44].

Performance: Since the DMS is a web application, it can easily support more users concurrently. In addition, the information transfer mostly contains text data's; this will provide more performance for DMS.

Security: Administration part of the system is handy only for the authorized Administration staffs as per their assigned rights. An unauthorized user of the system ought to not access the administration page by any means. Some of the resources and activity shall be restricted and allowed for authorized users. Consequently, the system must use authorization methods and it must render or deny accesses to users as per their assigned privileges.

Availability: The system will be accessible from any computer with local area connection and will be accessible anytime a user would want to use the system.

User interface: The system must have an interactive, dynamic and consistent graphical user interface. The interface should not be distractive. Most inputs should be done by using list box and drop box hence saving time and making it user friendly.

Error handling: It should be able to respond descriptive error messages. Appropriate error message must be displayed when the users inserts unexpected/wrong data. With this features, users will be informed about the errors they have committed and what to do to rectify the problem in easy way.

Reliability: the ability of a system to perform its required functions under stated conditions for a specific period of time. There shall be a frequent and full back up mechanism to avoid any information loss and inconsistency.

Maintainability: The proposed system should be developed through MVC architectures. It is easy future maintenance and enhancement if there are additional user requirements and system failure.

4.6 Analysis Model

Analysis model operates as a link between the 'system description' and the 'design model [48]. in the analysis model, information, functions and the behavior of the system is defined and these are translated into the architecture, interface and component level design in the 'design modeling'.

Table 3: List of Actors and description

Actors	Description
Users	Must be a staff in SMU. The company management would select a group of individuals with enough experience by creating guidelines and policies who would be responsible for particular office or department.
Administrator	The Admin would be responsible for managing the entire system.

4.6.1 Use Case Model

The Use Case Model describes the proposed functionality of the new system. A Use Case represents a discrete unit of interaction between a user (human or machine) and the system [25]. A Use Case captures the functional requirements of the system and tells what the system is doing. It may also ‘include’ another use case’s functionality or 'extend' another Use Case with its own behavior and it is typically related to actors of the system. An actor is a human or machine entity that interacts with the system to perform meaningful work. Generally, a use case diagrams serve as a visual table of content written use cases. For each of use case the written use case describe the steps involved in an interaction between an actor and the system. The functionalities of the proposed system, as mentioned in the previous sections, are explained in terms of system use cases in the following section. The dynamic models of the use cases, the interaction with respect to time are described using activity diagrams and sequence diagram.

4.6.2 Use Case Diagram

Figure 4: Use case diagram for Electronic Document Management System

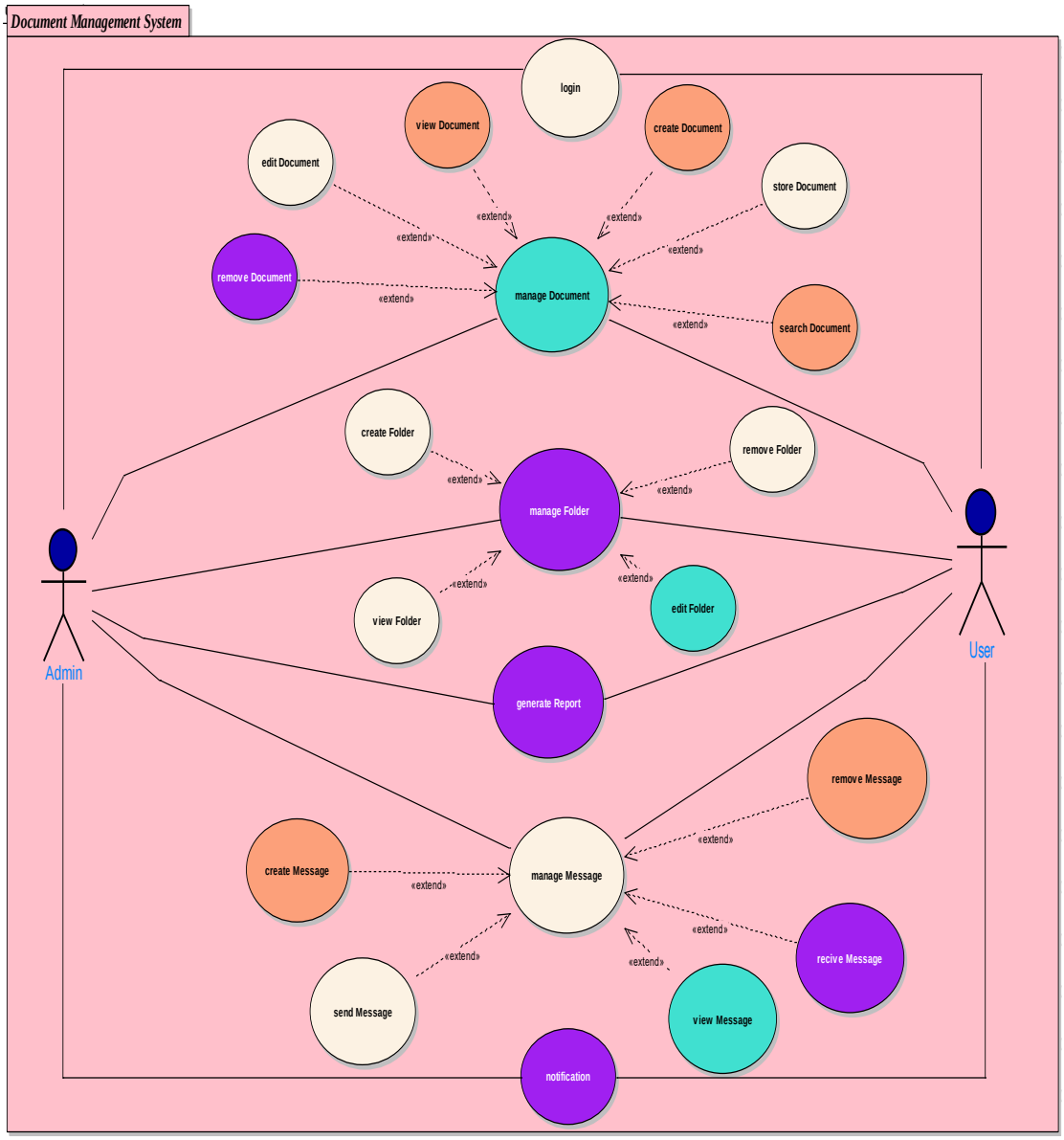
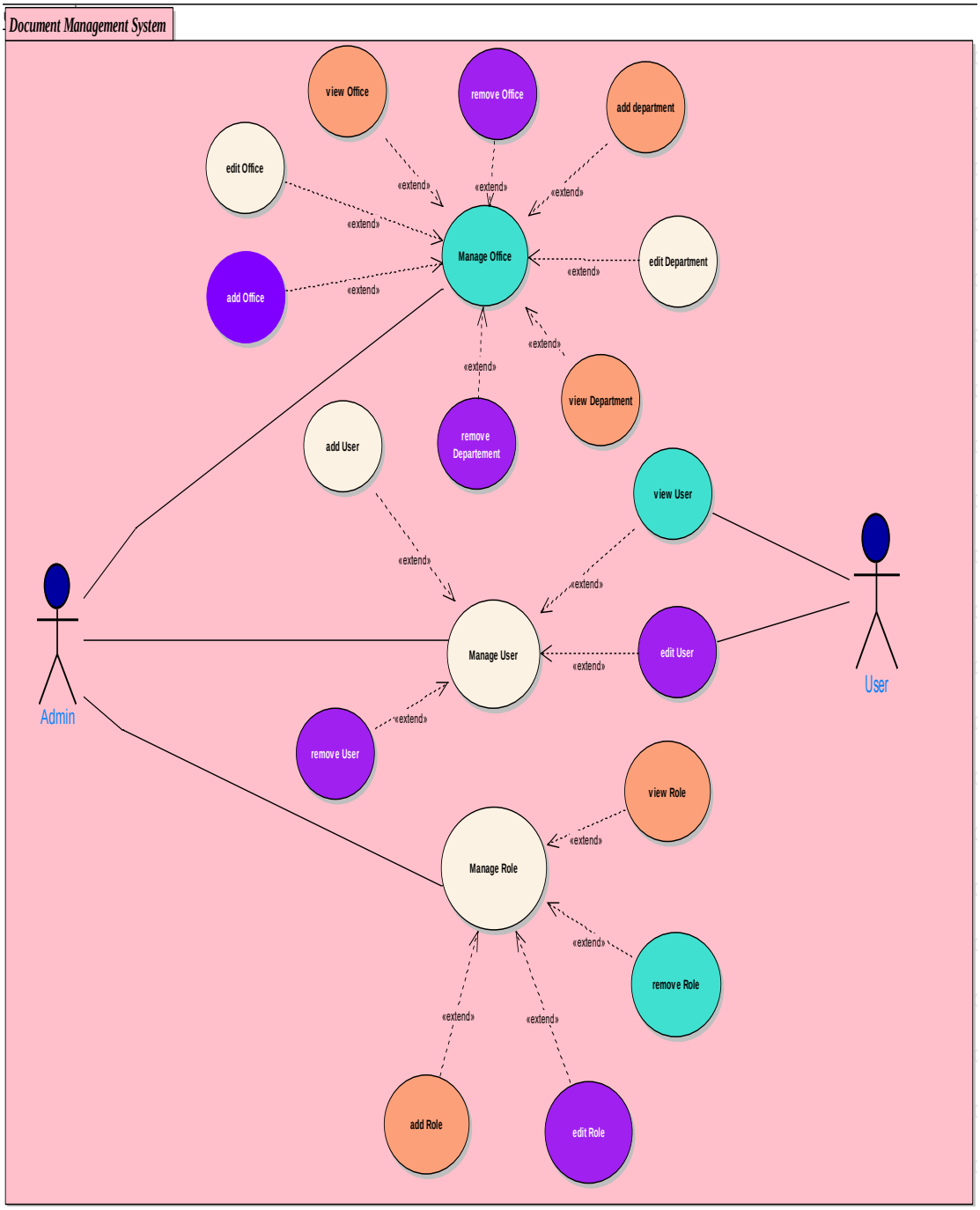


Figure 5: Use case diagram for Electronic Document Management System



4.6.3 Use Case Description

Use case Description is to describe the main system goal of the specific use case, it shows how and what accomplished.

Table 4: Use Cases

UC001	Login
UC002	Create User
UC003	Remove User
UC004	View User
UC005	Edit User
UC006	Create document
UC007	Edit document
UC008	View document
UC009	Remove document
UC010	Search document
UC010	Create folder
UC011	View folder
UC012	Remove folder
UC013	Edit folder
UC014	Generate report
UC015	Send message
UC016	Receive message
UC017	Remove message
UC018	View message
UC019	Create message
UC020	Notification
UC021	Add office
UC022	View office
UC023	Edit office
UC024	Remove office
UC025	Add department

UC026	View department
UC027	Edit department
UC028	Remove department
UC029	Add role
UC030	View role
UC031	Edit role
UC032	Remove role

Table 5: Use case Description to Login

Name	**Login**
Identifier	UC001
Description	This details the login process of the system to access it. The user should login to the system using a username and password.
Actor	Admin and User
Pre- Condition	The user must have an account.
Post Condition	The user logs in to obtain to the system.
Includes	
Extends	
Main Flow 1. The user enters the URL on browser address bar 2. The system displays the login page 3. The system requests the user to enter username and password. 4. Click on Submit 5. System checks validity of the username and password 6. System opens the appropriate page. 7. Use case ends.	
Alternative Flow	**1.1. User enters invalid system IP and/or the URL on the address bar** 1. The page will not be displayed.

	2. Use case ends **4.1. invalid user name and password** 1. System display error message 2. Use case ends.
exit conditions:	Login to the appropriate page.

Table 6: Use Case Description to create user

Name	Create User
Identifier	UC002
Description	This use case will help the Admin to create user account.
Actor	Admin
Pre- Condition	The administrator must be logged into the system before this use case begins.
Post Condition	Admin are able to create user.
Includes	Login
Extends	
Main Flow The use case starts when the administrator wishes to add a user to the system. 1. The admin clicks User Registration link from registration sub menu. 2. The system requests the admin to enter full information about the user. 3. The admin enters all the necessary information about the user. 4. The system validates entered information about user. 5. The users successfully add to the system. 6. The use case ends	
Alternative Flow	If the admin enters incorrect information: 1. The system validates the information and displays the incorrect places. 2. Use case ends

Exit conditions	If the use case was successful, the admin create user to the system. Otherwise, the system state is unchanged

Table 7: Use Case Description to remove user

Name	Remove User
Identifier	UC003
Description	This use case will help the Admin Remove the user account from the system.
Actor	Admin
Pre- Condition	The administrator must be logged into the system before this use case begins.
Post Condition	Admin are able to Remove users from the system.
Includes	Login
Extends	
Main Flow The use case starts when the admin wishes to remove a user to the system. 1. The admin select Remove user from registration sub menu. 2. Admin selects the user that will be removed from the system. 3. The system validates to the admin are sure to remove. 4. The user will be removed from the system. 5. Use case ends.	
Exit conditions	If the use case was successful, the administrator removes a user from the system. Otherwise, the system state is unchanged.

Table 8: Use Case Description to view user

Name	View User
Identifier	UC004
Description	This use case describes how the admin and user can view users of the system.
Actor	Admin, User
Pre- Condition	The admin and User must be logged into the system before this use case begins.
Post Condition	Admin and User are able to view users from the system.
Includes	Login
Extends	
Main Flow The use case starts when the admin wishes to view users. 1. The admin select view user from registration sub menu. 2. The system display list of user. 3. The admin select the user that they want to view. 4. Use case ends.	
Alternative Flow	If the user wishes to view their user detail. 1. The user select view user from name submenu. 2. Select change password link 3. The user detail will be viewed 4. Use case ends.
Exit conditions	If the use case was successful, the admin and user can view users of a system. Otherwise, the system state is unchanged.

Table 9: Use Case Description to edit user

<table>
<tr><td>Name</td><td>Edit User</td></tr>
<tr><td>Identifier</td><td>UC005</td></tr>
<tr><td>Description</td><td>This use case describes how the admin and user can edit users of the system.</td></tr>
<tr><td>Actor</td><td>Admin, User</td></tr>
<tr><td>Pre- Condition</td><td>The admin and User must be logged into the system before this use case begins.</td></tr>
<tr><td>Post Condition</td><td>Admin and User are able to edit users from the system.</td></tr>
<tr><td>Includes</td><td>Login</td></tr>
<tr><td>Extends</td><td></td></tr>
<tr><td colspan="2">Main Flow

The use case starts when the admin wishes to edit users.
1. The admin select edit user from registration sub menu.
2. The system displays the list of users.
3. The admin select the user that they want to edit
4. The admin modified with correct information.
5. Use case ends.</td></tr>
<tr><td>Alternative Flow</td><td>If the user wishes to edit their user detail.
If the user wishes to edit passwords
5. The user select password change from name sub menu.
6. The system displays user detail information
7. The user enters a combination of upper and lowercase, special character and number with a minimum six character password.
8. Use case ends.</td></tr>
</table>

Exit conditions	If the use case was successful, the admin and user can edit users of a system. Otherwise, the system state is unchanged.

Table 10: Use Case Description to create document

Name	Create document
Identifier	UC006
Description	This use case describes how the admin and user can create a document
Actor	Admin, User
Pre- Condition	The admin and User must be logged into the system before this use case begins.
Post Condition	Admin and User are able create document and store to the system.
Includes	Login
Extends	

Main Flow

The use case starts when the system user wishes to create and store documents in the system.

1. The system user selects soft document link from document management sub menu.
2. Select create document and enter necessary information about the document.
3. Upload the soft copy files to the system.
4. The system validated the information
5. The document will be created.
6. Use case ends.

Alternative Flow	If the system user click physical document link from document management sub menu. 1. Select physical document and enter the necessary information about the document. 2. The system will validate the information. 3. The new document will be stored in the sytem.

	4. Use case ends.
Exit conditions	If the use case was successful, the admin and user can create and store documents to the system. Otherwise, the system state is unchanged.

Table 11: Use Case Description to edit document

Name	Edit document
Identifier	UC007
Description	This use case describes how the admin and user can edit a document
Actor	Admin, User
Pre- Condition	The admin and User must be logged into the system before this use case begins.
Post Condition	Admin and User are able to edit stored system document.
Includes	Login
Extends	
Main Flow The use case starts when the system user wishes to edit stored documents of a system. 1. The system user click on soft document from document management sub menu. 2. System displays a list of document. 3. Select a document and provide valid information. 4. System will validate information. 5. The document will be edited successfully. 6. Use case ends.	
Alternative Flow	If the system user click physical document link from document management sub menu. 1. System displays a list of document. 2. Select a document and provide valid information.

	3. System will validate information. 4. The document will be edited successfully. 5. Use case ends.
Exit conditions	If the use case was successful, the admin and user can edit a document to the system. Otherwise, the system state is unchanged.

Table 12: Use Case Description to view document

Name	View document
Identifier	UC008
Description	This use case describes how the admin and user can view document
Actor	Admin, User
Pre- Condition	The admin and User must be logged into the system before this use case begins.
Post Condition	Admin and User are able to view stored system document.
Includes	Login
Extends	
Main Flow The use case starts when the system user wishes to view stored documents of a system. 1. The system user click on soft document from document management sub menu. 2. System displays a list of document. 3. Select a document to view from the list. 4. The document will be viewed successfully. 5. Use case ends.	
Alternative Flow	If the system user click physical document link from document management sub menu.

	1. System displays a list of document. 2. Select a document to view from a list of document. 3. The document will be viewed successfully. 4. Use case ends.
Exit conditions	If the use case was successful, the admin and user can view a document. Otherwise, the system state is unchanged.

Table 13: Use Case Description to remove document

Name	Remove document
Identifier	UC009
Description	This use case describes how the admin and user can remove a document from the system.
Actor	Admin, User
Pre- Condition	The admin and User must be logged into the system before this use case begins.
Post Condition	Admin and User are able to remove stored system document.
Includes	Login
Extends	
Main Flow The use case starts when the system user wishes to view remove documents of a system. 1. The system user click on soft document from document management sub menu. 2. System displays a list of document. 3. Select a removed document from a list of document. 4. The system will validate are you sure to remove this document. 5. The document will be removed successfully. 6. Use case ends.	

Alternative Flow	If the system user click physical document link from document management sub menu. 1. System displays a list of document. 2. Select a removed document from a list of document. 3. The system will validate are you sure to remove this document. 4. The document will be removed successfully. 5. Use case ends.
Exit conditions	If the use case was successful, the admin and user can remove a document. Otherwise, the system state is unchanged.

Table 14: Use Case Description to create folder

Name	Create folder
Identifier	UC010
Description	This use case describes how the admin and user can create a folder or directory.
Actor	Admin, User
Pre- Condition	The admin and User must be logged into the system before this use case begins.
Post Condition	Admin and User are able to create and store in the system.
Includes	Login
Extends	

Main Flow The use case starts when the system user wishes to create a folder on the system. 1. The system user click on soft document from document management sub menu. 2. System displays a list of folders on the left side. 3. Select a parent folder and click on create folder. 4. The user enters the required necessary information. 5. The system will validate the information. 6. The folder will be created. 7. Use case ends.	
Exit conditions	If the use case was successful, the admin and user can create a folder. Otherwise, the system state is unchanged.

Table 15: Use Case Description to generate report

Name	Generate report
Identifier	UC014
Description	This use case describes how the admin and user can generate a system report.
Actor	Admin, User
Pre- Condition	The admin and User must be logged into the system before this use case begins.
Post Condition	Admin and User are able to generate system report.
Includes	Login
Extends	
Main Flow The use case starts when the system user wishes to generate report. 1. The user click on report sub menu. 2. The system generates a report in table format.it can be converted to pdf format. 3. Use case ends.	

Exit conditions	If the use case was successful, the admin and user can generate system report. Otherwise, the system state is unchanged.

Table 16: Use Case Description to send message

Name	Send message
Identifier	UC015
Description	This use case describes how the admin and user can send message
Actor	Admin, User
Pre- Condition	The admin and User must be logged into the system before this use case begins.
Post Condition	Admin and User are able send message.
Includes	Login
Extends	

Main Flow

The use case starts when the system user wishes to send message.

1. The system user selects compose from message sub menu.
2. The users enter a correct receiver email address and other necessary information.
3. The system will validate the information provided.
4. The message will be sent to receiver.
5. Use case ends.

Exit conditions	If the use case was successful, the admin and user can send message. Otherwise, the system state is unchanged.

Table 17: Use Case Description to receive message

Name	Receive message
Identifier	UC016

Description	This use case describes how the admin and user can receive message
Actor	Admin, User
Pre- Condition	The admin and User must be logged into the system before this use case begins.
Post Condition	Admin and User are able receive message.
Includes	Login
Extends	
Main Flow The use case starts when the system user wishes to receive message. 1. The system user selects inbox from message sub menu. 2. The system displays a list of inbox message. 3. Use case ends.	
Exit conditions	If the use case was successful, the admin and user can receive message. Otherwise, the system state is unchanged.

Table 18: Use Case Description to notification

Name	Notification
Identifier	UC020
Description	This use case describes how the admin and user can notify
Actor	Admin, User
Pre- Condition	The admin and User must be logged into the system before this use case begins.
Post Condition	Admin and User are able notify through email.
Includes	Login
Extends	

Main Flow The use case starts when the system user wishes to notify through email. 1. The system user selects notification from system sub menu. 2. The user click on notify and add receiver email address and subject. 3. The system will validate the email address 4. The notification will be send. 5. Use case ends.	
Exit conditions	If the use case was successful, the admin and user can notify. Otherwise, the system state is unchanged.

Table 19: Use Case Description to add office

Name	Add office
Identifier	UC021
Description	This use case describes how the can add office to the system
Actor	Admin
Pre- Condition	The admin must be logged into the system before this use case begins.
Post Condition	Admin are able to add offices to the system.
Includes	Login
Extends	
Main Flow The use case starts when the admin wishes to add office. 1. The admin click on office management from registration sub menu. 2. The admin click on add office and provide a necessary information. 3. The system will validate the required information 4. The office will be added to the system. 5. Use case ends.	

Exit conditions	If the use case was successful, the admin can add office to the system. Otherwise, the system state is unchanged.

Table 20: Use Case Description to add department

Name	Add department
Identifier	UC025
Description	This use case describes how the can add departments to the system
Actor	Admin
Pre- Condition	The admin must be logged into the system before this use case begins.
Post Condition	Admin are able to add departments to the system.
Includes	Login
Extends	
Main Flow The use case starts when the admin wishes to add departments. 1. The admin click on department management from registration sub menu. 2. The admin click on add department and provide a necessary information. 3. The system will validate the required information 4. The department will be added to the system. 5. Use case ends.	
Exit conditions	If the use case was successful, the admin can add department to the system. Otherwise, the system state is unchanged.

Table 21: Use Case Description to add role

Name	Add role
Identifier	UC029
Description	This use case describes how the can add roles to the system user.

Actor	Admin
Pre- Condition	The admin must be logged into the system before this use case begins.
Post Condition	Admin are able to add roles to the system users.
Includes	Login
Extends	

Main Flow

The use case starts when the admin wishes to add roles.

1. The admin click on user management from registration sub menu.
2. The admin click on add user and provide a necessary information.
3. The admin give a role to the user.
4. The system will validate the required information
5. The role will be added to the system.
6. Use case ends.

Exit conditions	If the use case was successful, the admin can add role to the system user. Otherwise, the system state is unchanged.

4.6.4 Sequence diagram

UML offers a very large set of constructs for each of its diagram and UML Sequence Diagrams are interaction diagrams that detail how operations are carried out. Sequence diagram shows interaction between objects over specific of time [49]. One sequence diagram typically represents a single Use Case development or flow of events. Sequence diagrams are an excellent way to document usage scenarios and to both capture required objects early in analysis and to verify object usage later in design. Sequence diagrams show the flow of messages from one object to another, and as such

correspond to the methods and events supported by a class or object. The diagram illustrated below shows a sequence diagram for SMU EDMS, with the user or actor on the left initiating a flow of events and messages that correspond to the Use Case scenario. The messages that pass between objects will become class operations in the final model.

Figure 6:Sequence diagram for Login

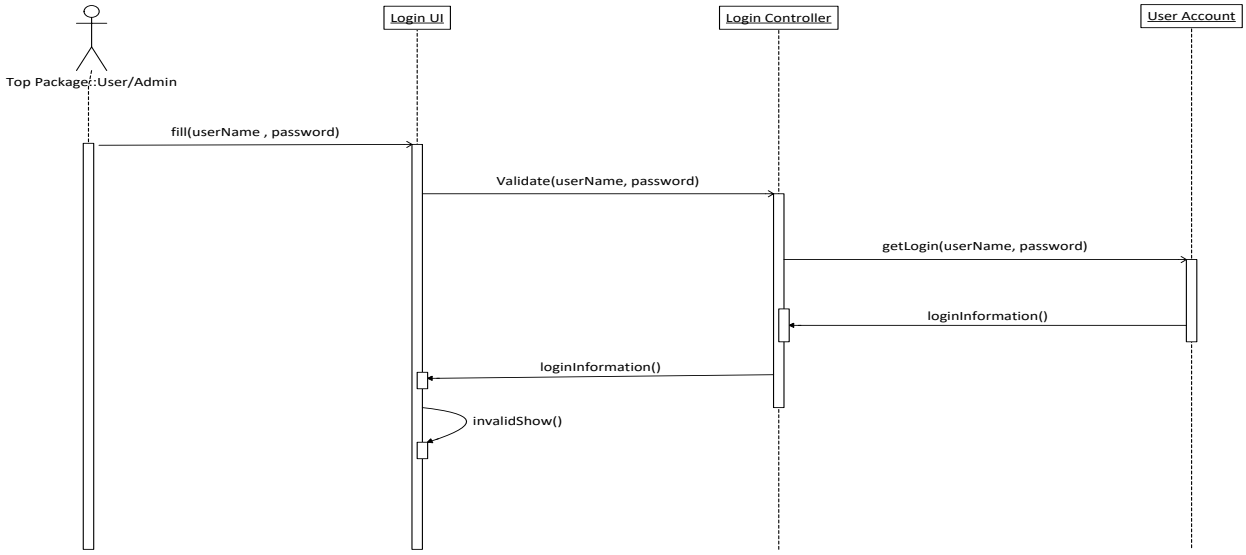


Figure 7: Sequence diagram for user creation

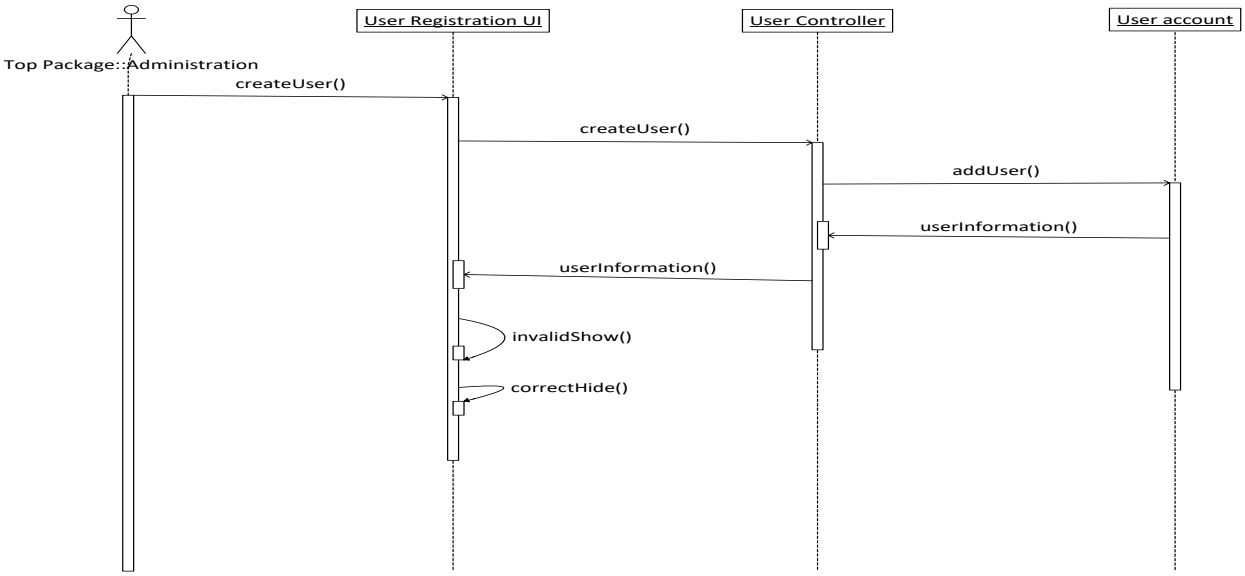


Figure 8:Sequence diagram for User View

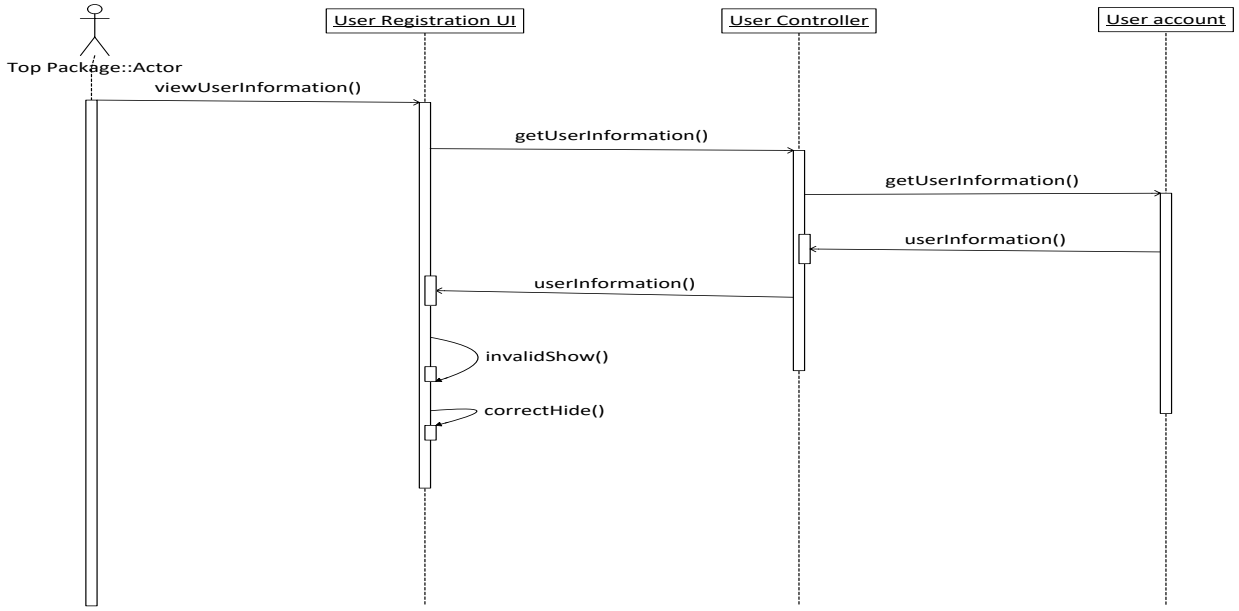


Figure 9:Sequence diagram for Remove User

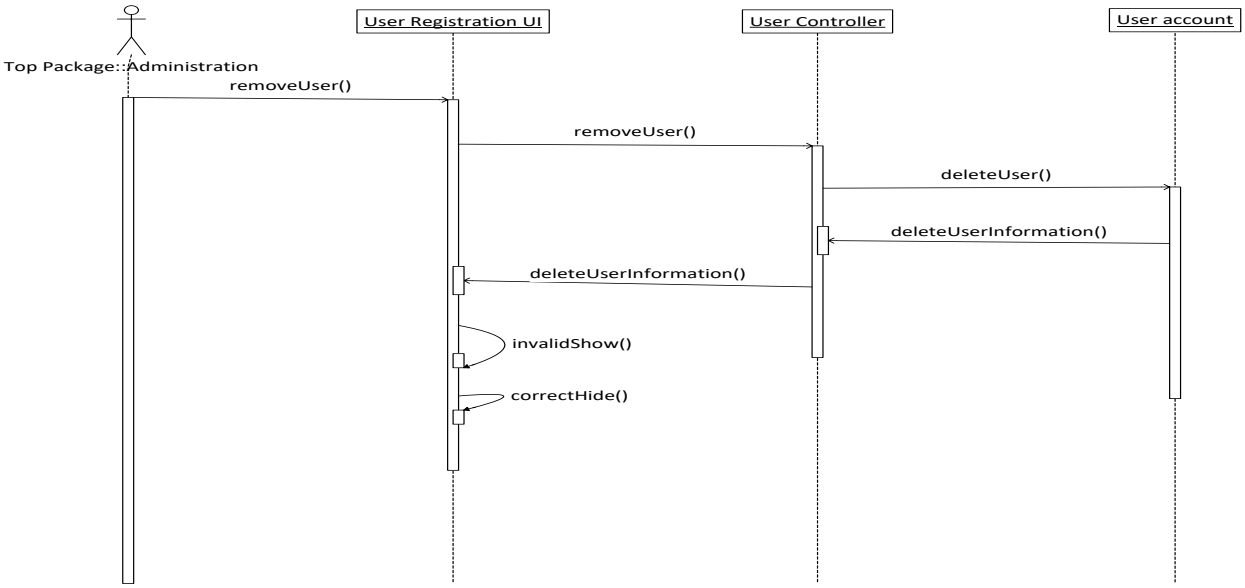


Figure 10: Sequence diagram for Edit/Update User

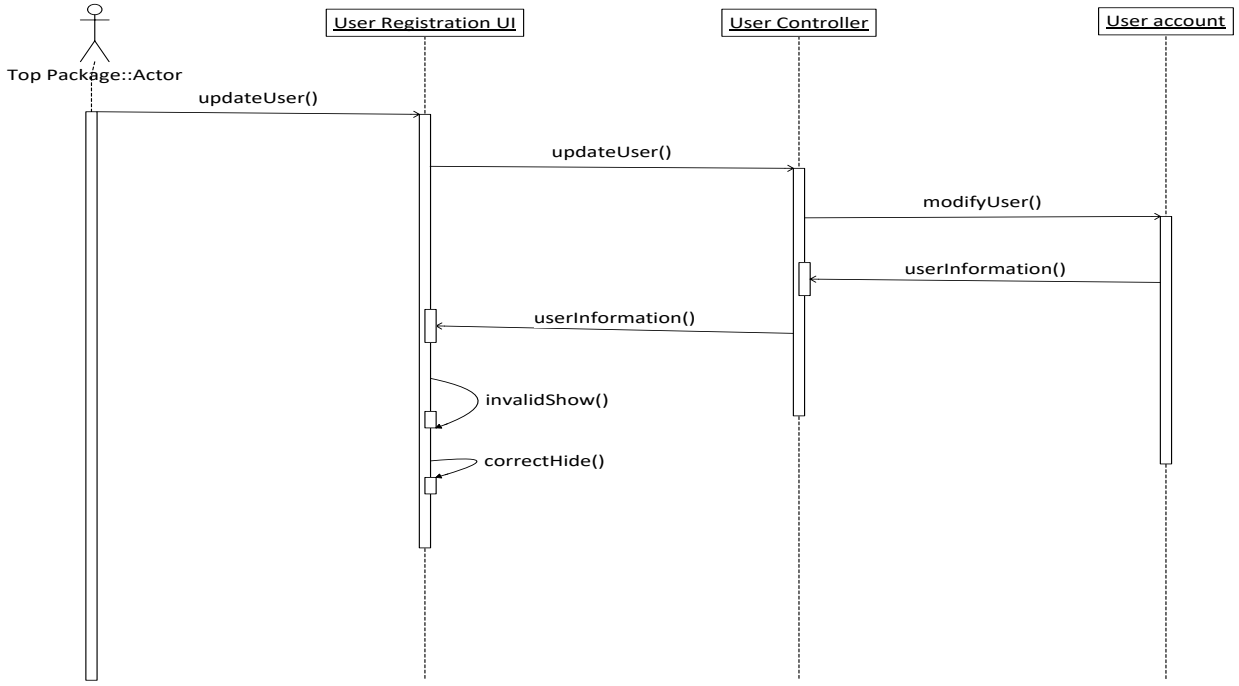


Figure 11: Sequence diagram for Document Creation

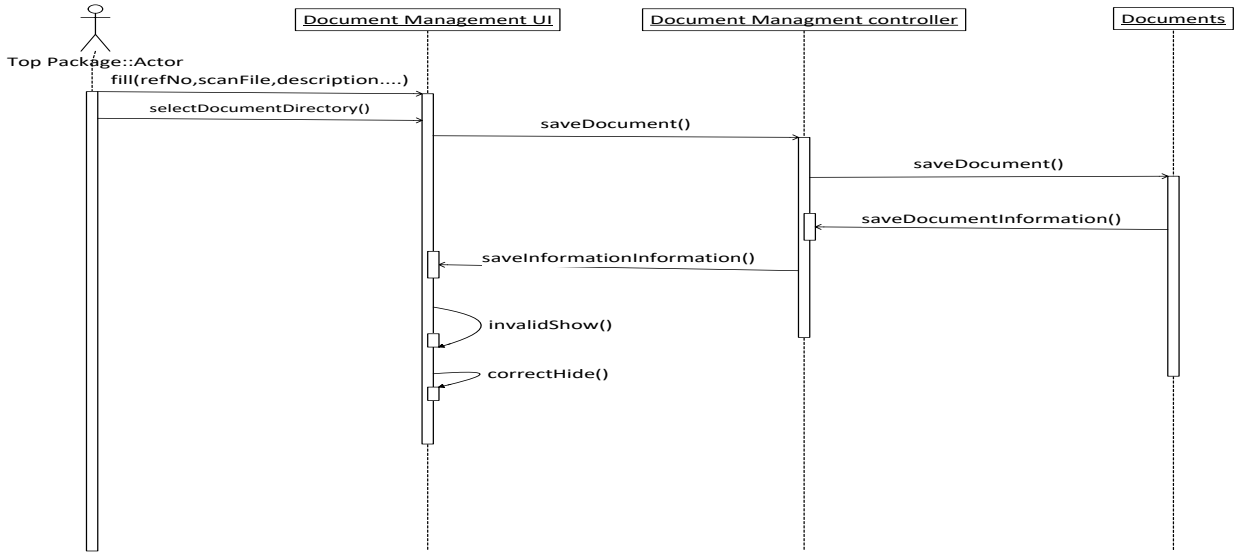


Figure 12: Sequence diagram for Document View

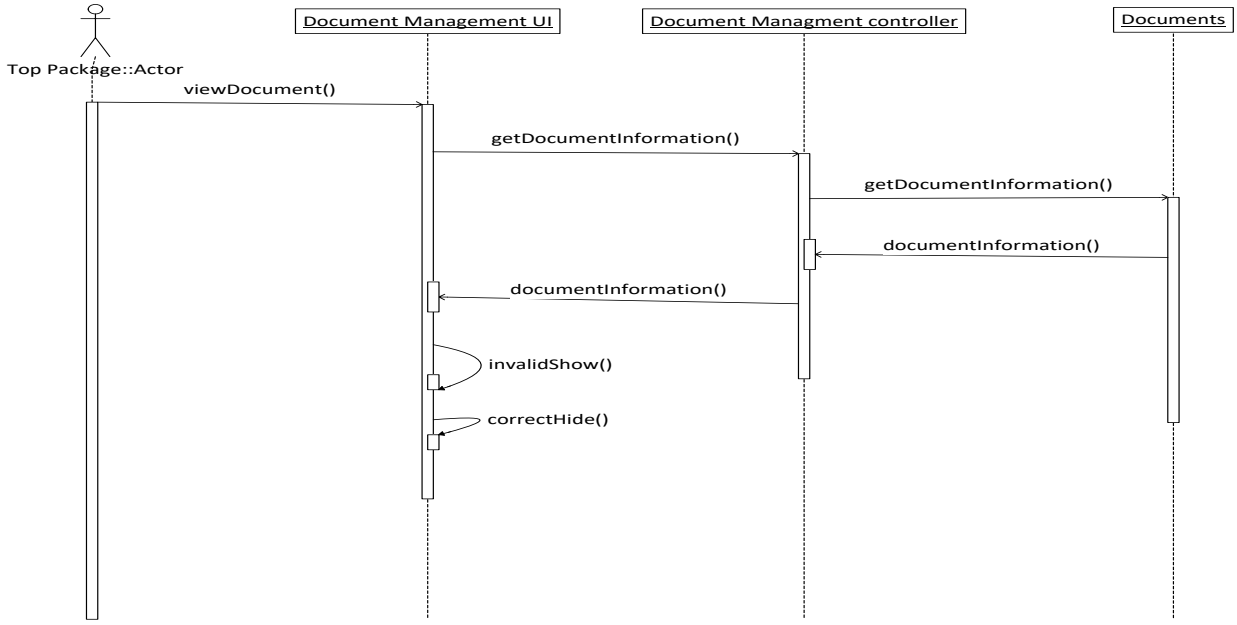


Figure 13: Sequence diagram for Folder Creation

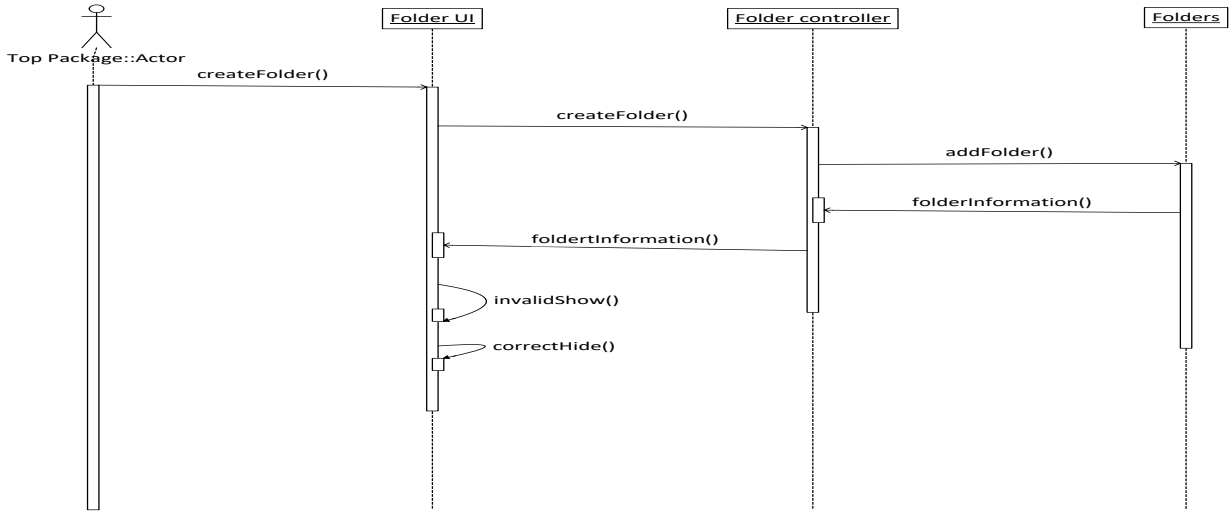


Figure 14: Sequence diagram for Messages create and send

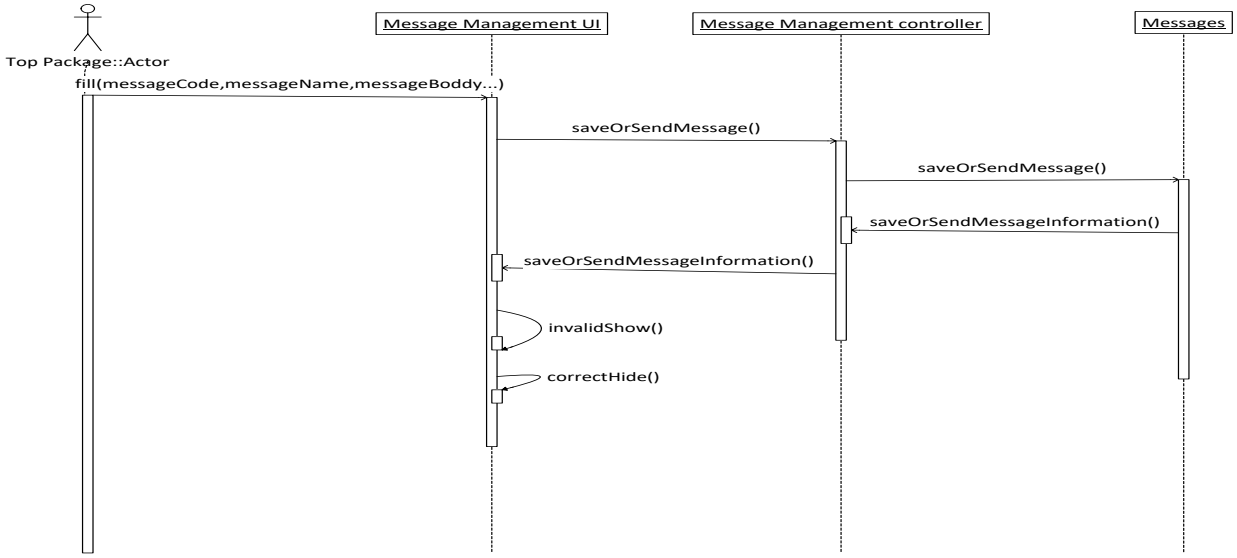
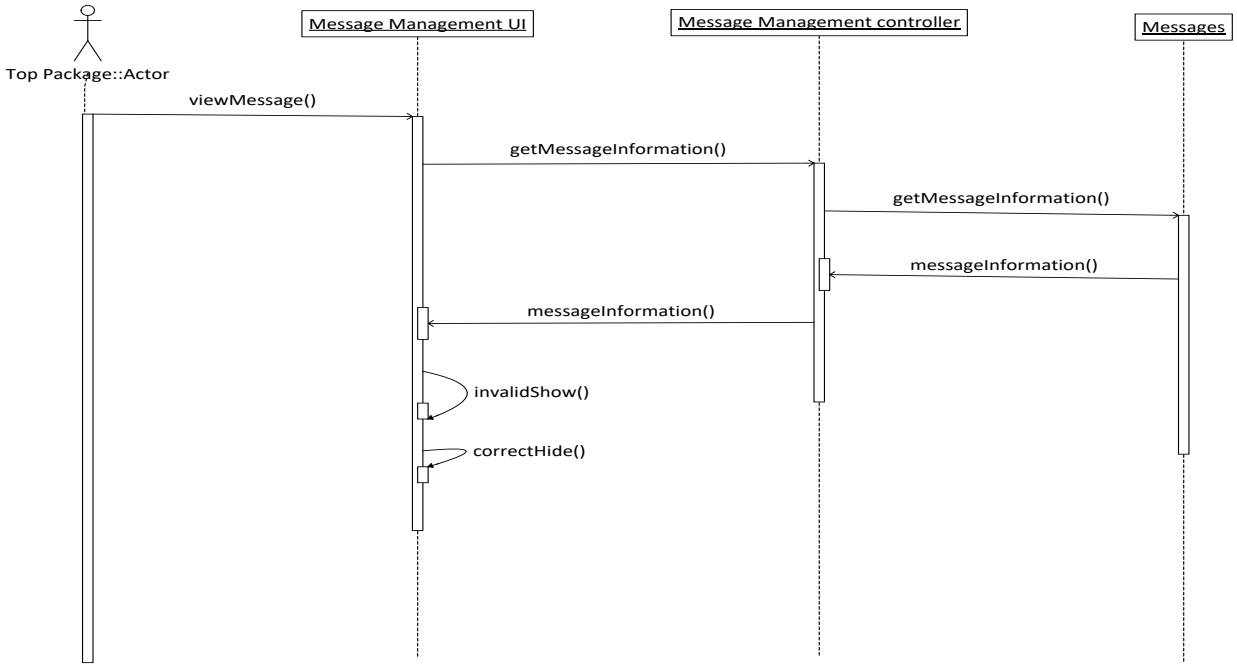


Figure 15: Sequence diagram for Message view



4.6.5 Activity Diagram

Activity diagram is another important behavioral diagram in unified modeling language diagram to show a graphical representation of an executed set of procedural system activities and considered a state chart diagram variation. It is represented by shapes that are connected by arrows. Arrows run from activity start to completion and represent the sequential order of performed activities. Black circles represent an initial workflow state. A circled black circle indicates an end state. Rounded rectangles represent performed actions, which are described by text inside each rectangle [46]. The Activity diagram for the new system is illustrated as follows.

Figure 16: Activity Diagram for login

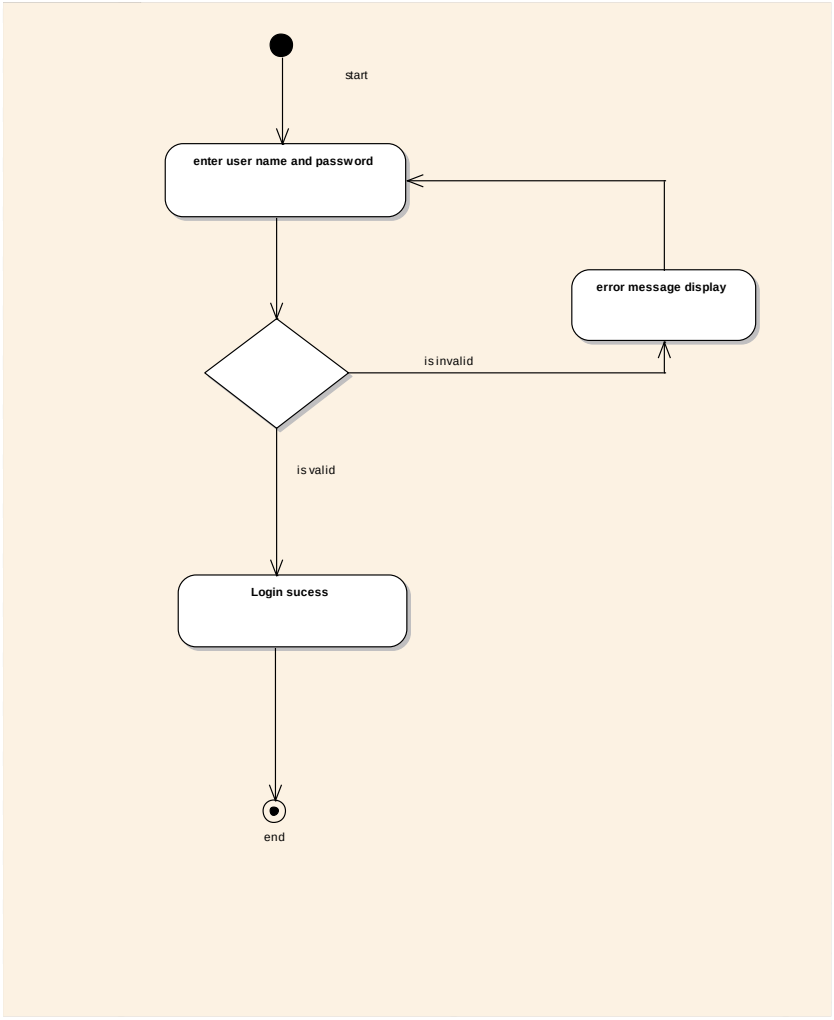


Figure 17: Activity Diagram for user creation

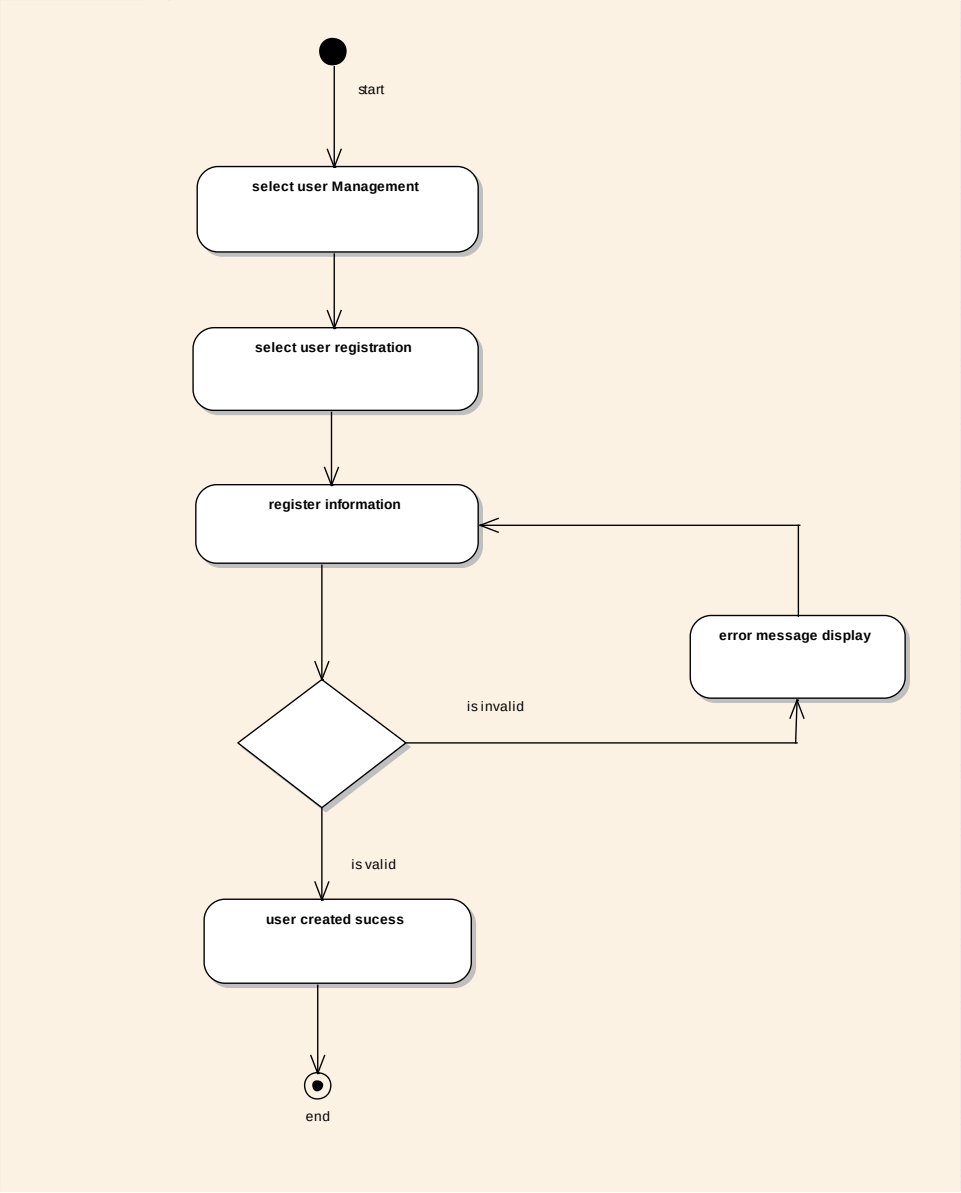


Figure 18: Activity Diagram for category/ Folder Creation

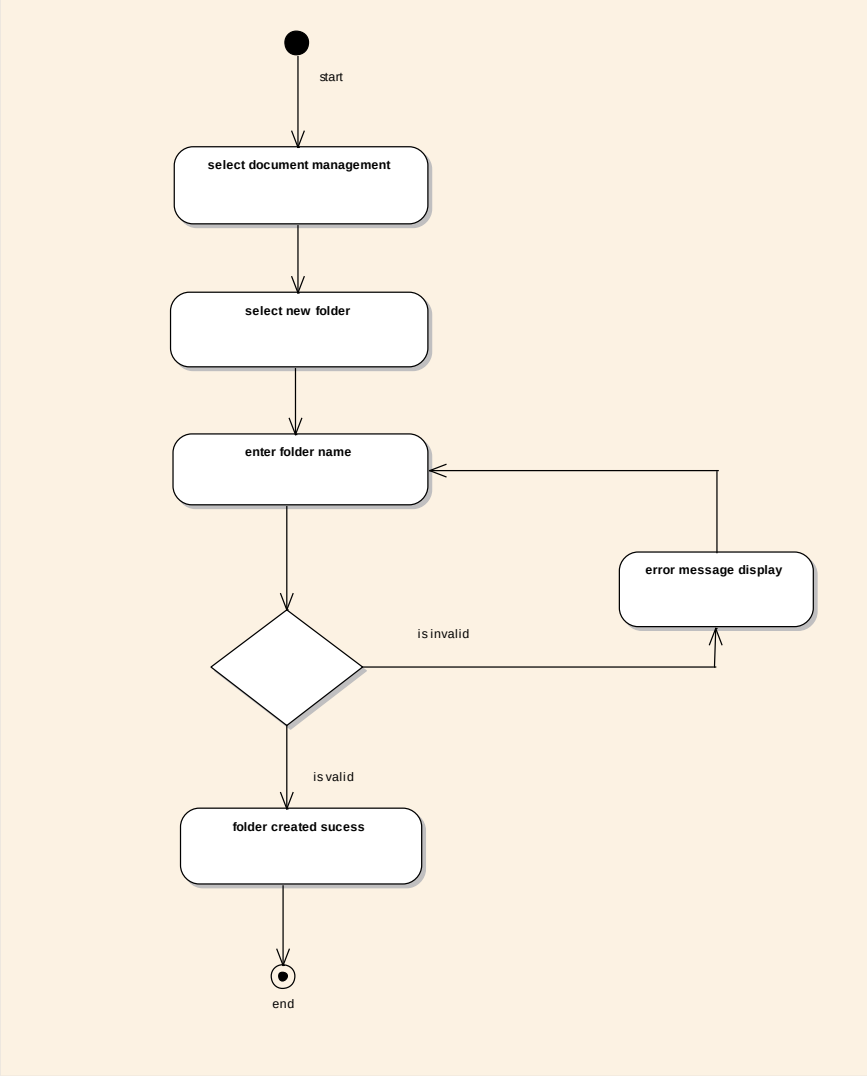


Figure 19: Activity Diagram for document creation

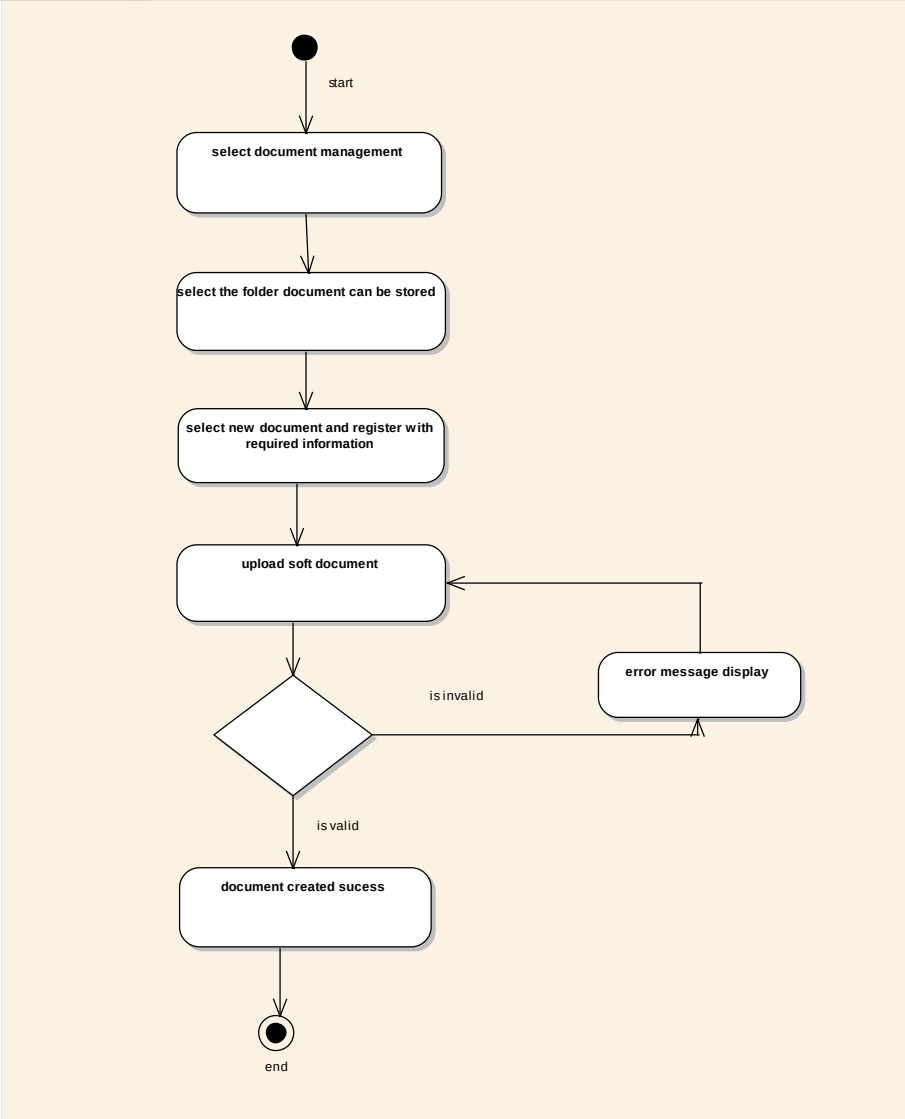


Figure 20: Activity Diagram for document view

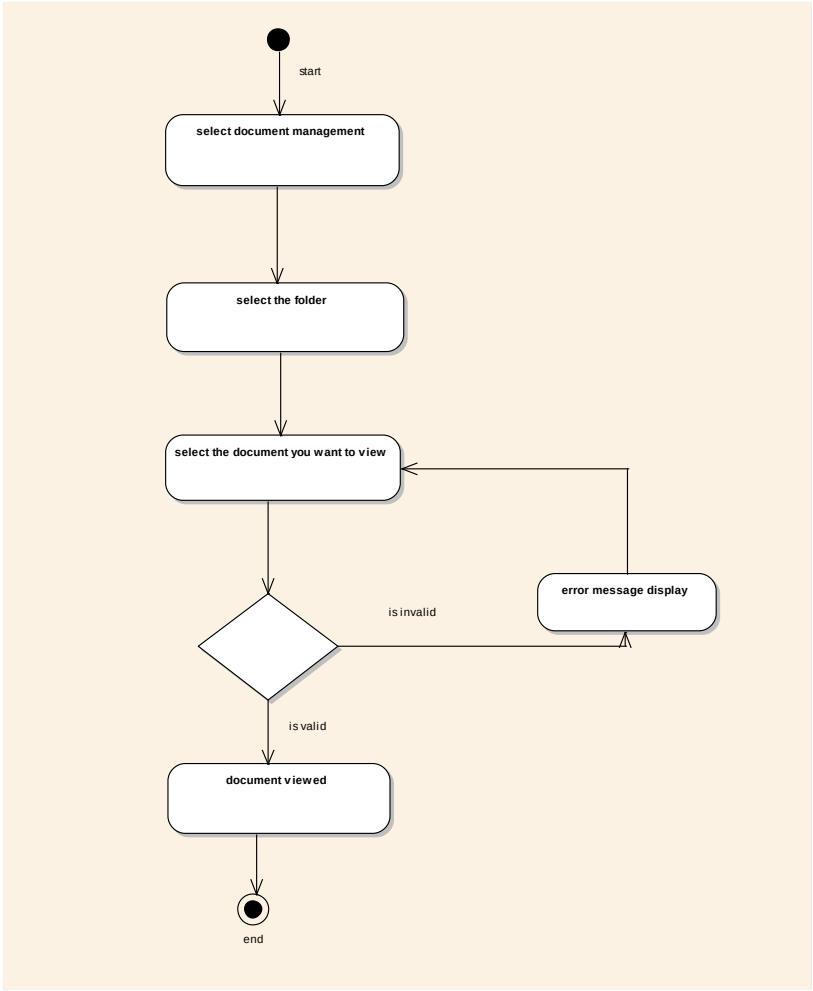


Figure 21: Activity diagram for message creation and send

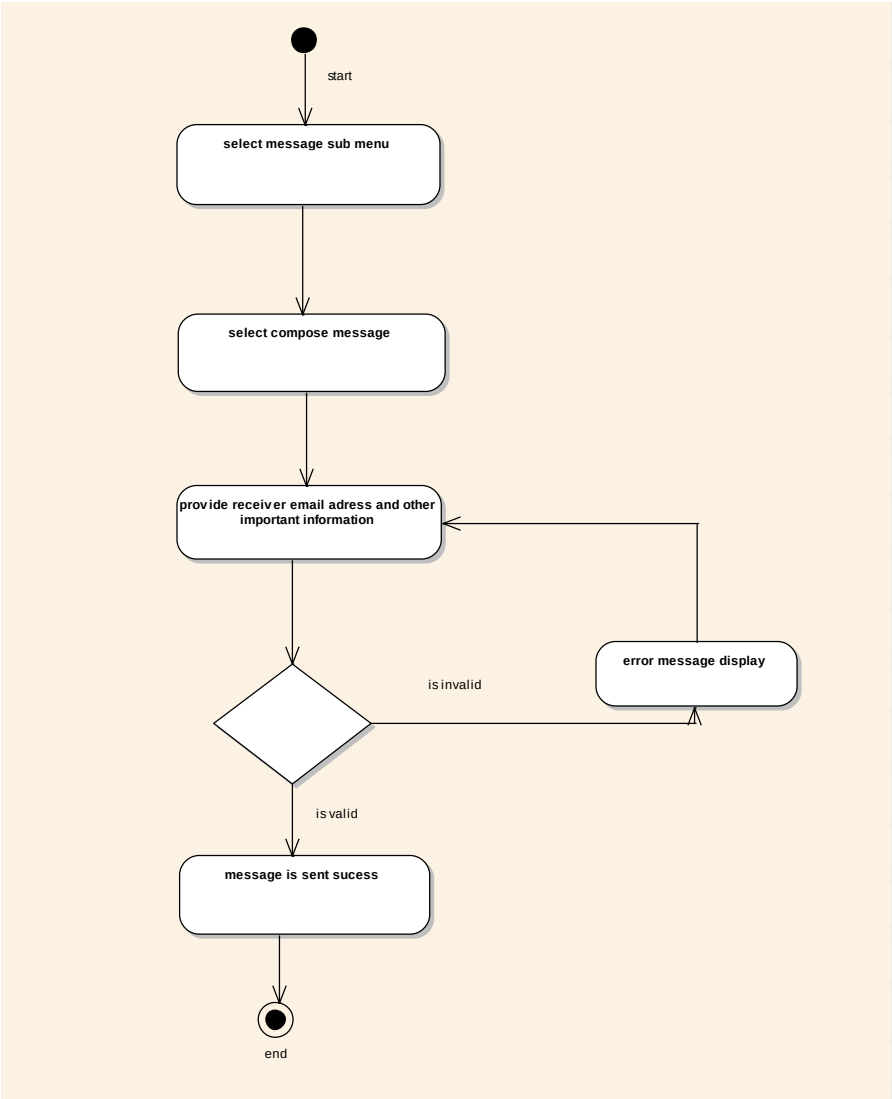
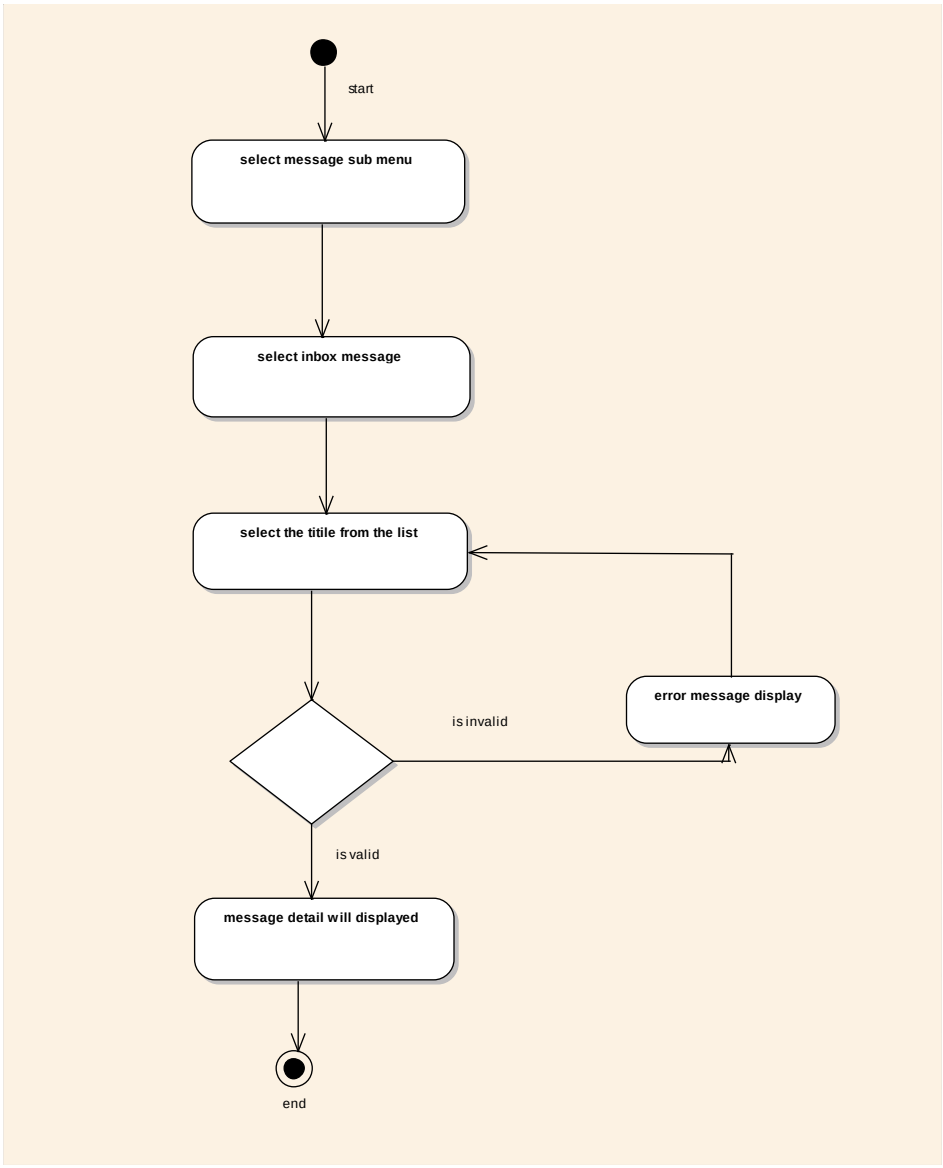


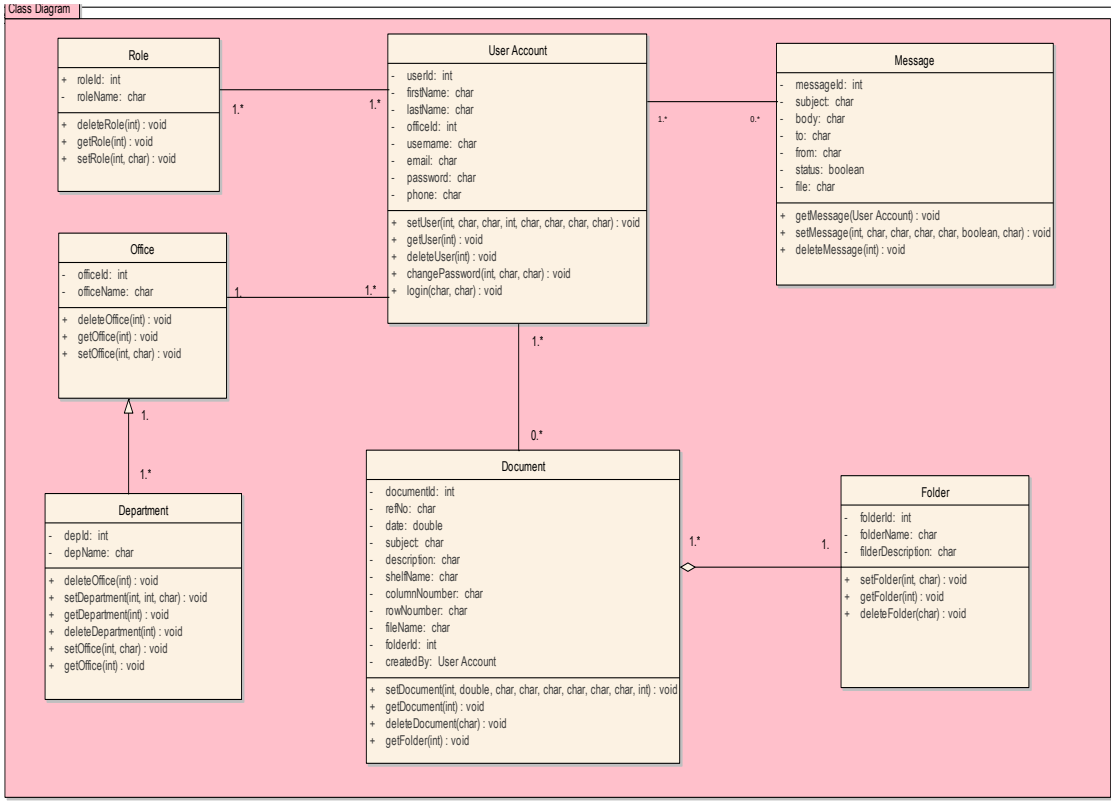
Figure 22: Activity diagram for message view



4.6.6 Class Diagram

Class diagram is an essential part of the unified modeling language to show the object class in the system and associations between these classes. Class diagrams are most useful in illustrating relationships between classes and interfaces. Generalizations, aggregations, and associations are all valuable in reflecting inheritance, composition or usage, and connections respectively [46].

Figure 23: Class Diagram



CHAPTER FIVE

SYSTEM ARCHITECTURE

5.1 System Design

This section provides the design of the new system. Systems design is the process of defining the architecture, modules, interfaces, and data for a system to satisfy specified requirements. The system requirement document is coming from the previous phase and develops the specific technical details required for the system. In design phase the business requirements are translated into specific technical requirements [50]. In this phase the architecture of the system, subsystem decomposition, hardware: software mapping, user interface and database design are presented and the final result of this phase is system-design document.

5.2 Architecture of the system

The new system is expected to replace the existing manual system by an automated system in all facets. It is mainly based on the system Analysis document and the architecture used for the system is a Three Tier Client/Server Architecture where a client can use Internet browsers to access the report provided by the system. Three Tier Web Architecture is that unique system of developing web database application which works around the 3 tier model, comprising of database tier at the bottom, the application tier in the middle and the client tier at the top. This comprehensive 3 tier architecture module is the framework for most Web Applications on the Internet. This system helps to separate the Business Logic from the Application, Data Storage and database [51].

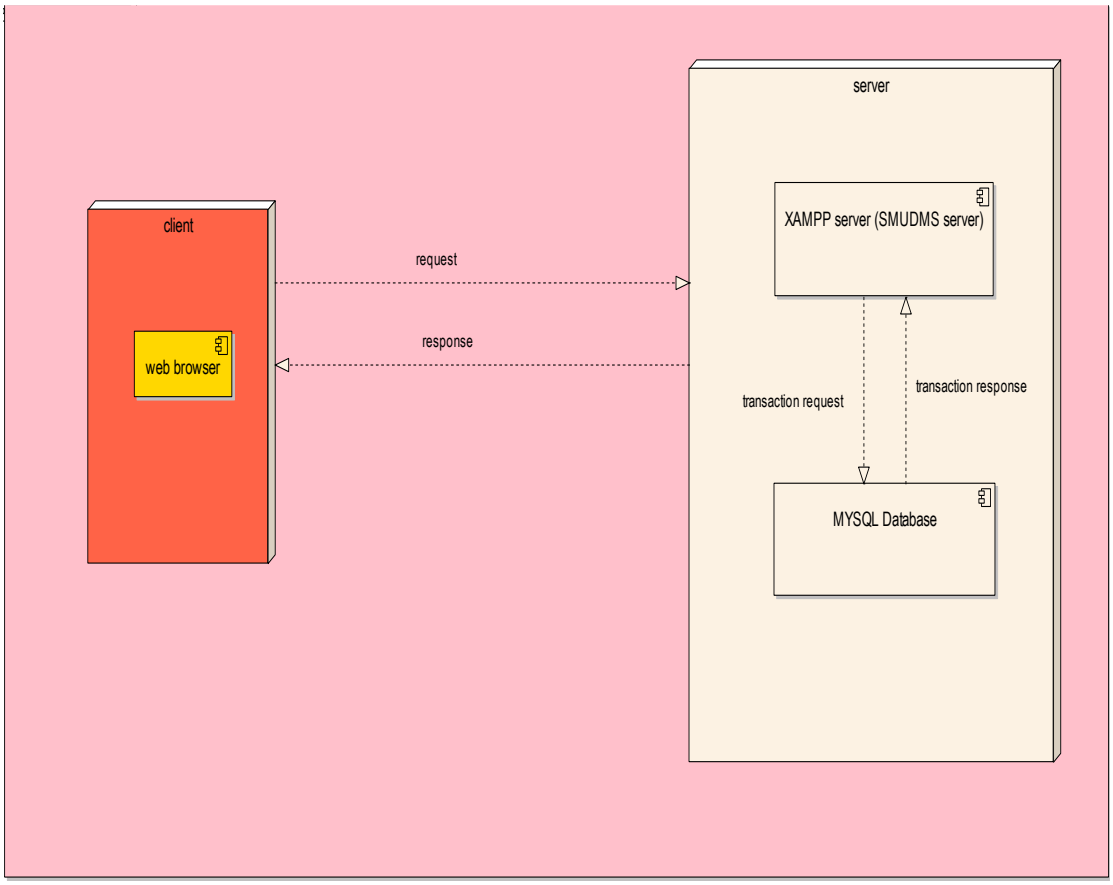
Three tier architectures consist of three components distributed in Three layers: client (requester of services) the business logic (data handler) and server (provider of services). The three components are

- User System Interface (such as session, text input, dialog, and display management services)
- Processing Management (such as process development, process enactment, process monitoring, and process resource services)
- Database Management (such as data and file services)

The three tier design allocates the user system interface exclusively to the client. It places the application logic on the second layer and places database management on the third layer. Few reason for Three-tier architecture is chosen:

- The system works on homogeneous environments with processing rules (business rules) that do not change very often.
- Separation of business logic from application logic minimizes the work load of server and enhances the security of data.
- Flexible application will have
- Only one part can be deployed

Figure 24: Architecture of the system



The proposed data tier

This maintains the applications data such as event data, report data, documented data etc. It stores these data in a relational database management system (RDBMS).

The proposed Middle Tier (Web Application server or web server)

This implements the business logic, controller logic and presentation logic to control the interaction between the application's clients and data. The controller logic processes client requests such as requests to crate and view documents, to generate report, to record document or to retrieve data from the database. Business rules enforced by the business logic dictate how clients can and cannot access application data and how applications process data.

The proposed client tier

The client tire is the applications user interface containing data entry forms and client side applications. It displays data to the user. Users interact directly with the application through user interface. The client tier interacts with the web/application server to make requests and to retrieve data from the database. It then displays to the user the data.

5.3 Subsystem Decomposition

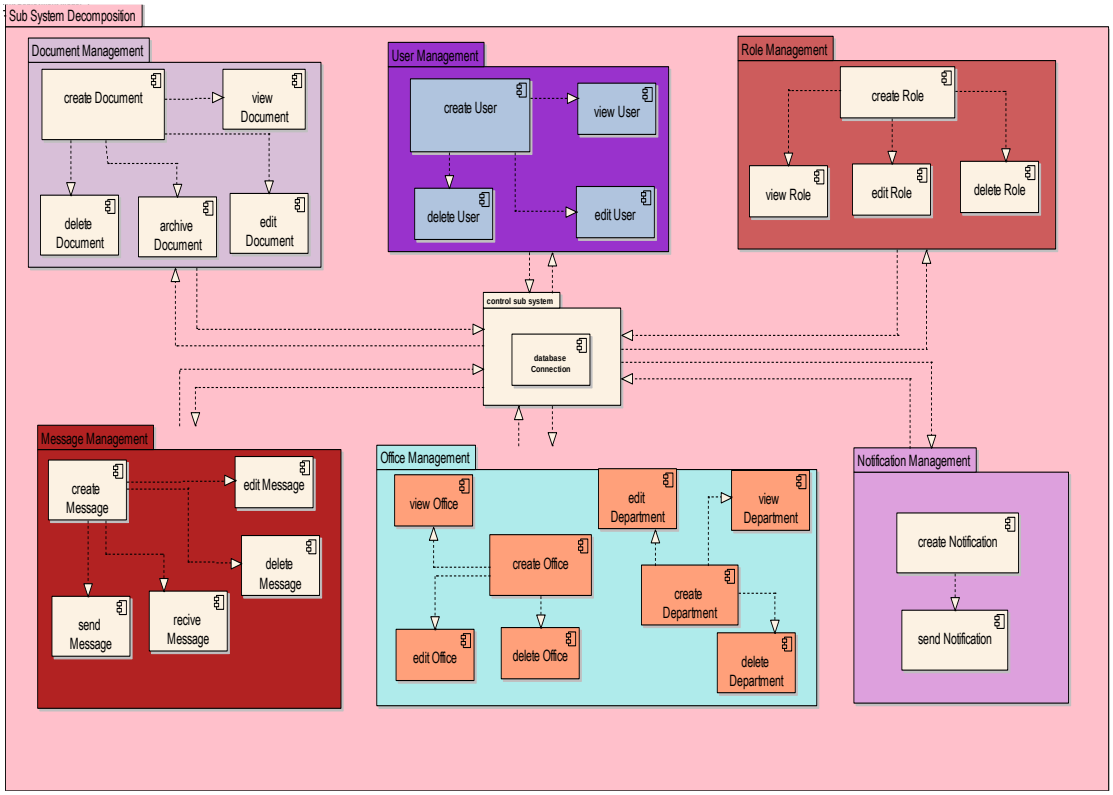
Subsystem decompositions is a smaller, simpler part of a larger system and it helps to reduce the complexity of the system. The subsystem can be considered as a packages holding related classes or objects. This system is broken down into different separate subsystems:

Subsystem decompositions will help reduce the complexity of the system. The subsystems can be considered as packages holding related classes/objects. During subsystem decomposition of the system, it is essential to consider the following issue:

- ✓ Divide the system into smaller subsystems with a strong cohesion.
- ✓ The instruction between subsystems should have a loose coupling.

The document management system under consideration is decomposed into subsystems. The diagram below shows a connection between different system components.

Figure 25: Subsystem Decomposition



5.4 Hardware and Software Mapping

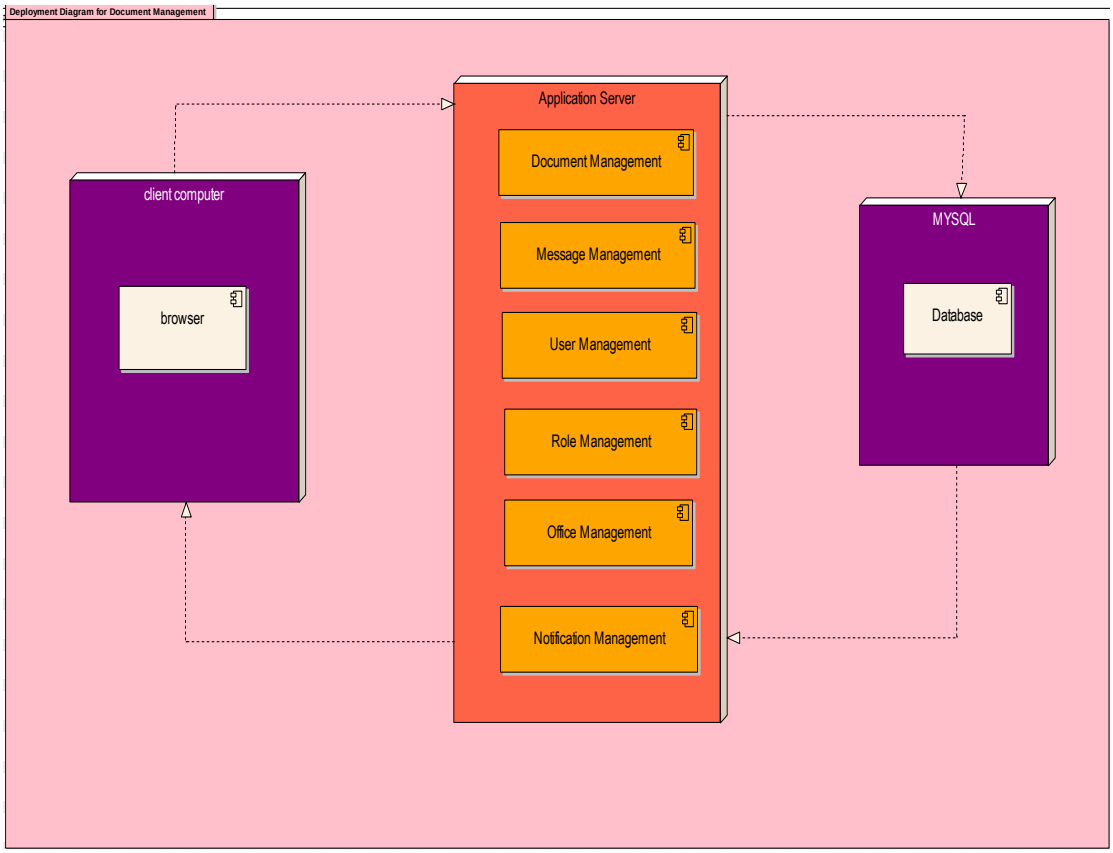
One of the major tasks in system design deals with hardware/software mapping which deals with which components would be part in which hardware and so on.

- User interface and processing management will be deployed on the application machine. EDMS (The new system) will present the Graphical User Interface (GUI) which allows the user to perform different functions.
- The client/server architecture of the system enables different clients to connect to the server remotely through internet/LAN connection.
- The applications of the system will run on the application server connected to the database.

The deployment diagram is the implementation diagram in UML. It models the physical deployment nodes of the systems. The boxes are the nodes; the components can be drawn inside the rectangle i.e. on the node, indicating which node holds which

components. Nodes may have sub-nodes, appearing as nested boxes. This system includes three separate nodes as shown in the following diagram.

Figure 26: Deployment Diagram



CHAPTER SIX

SYSTEM IMPLEMENTATION AND TESTING

6.1 System Implementation

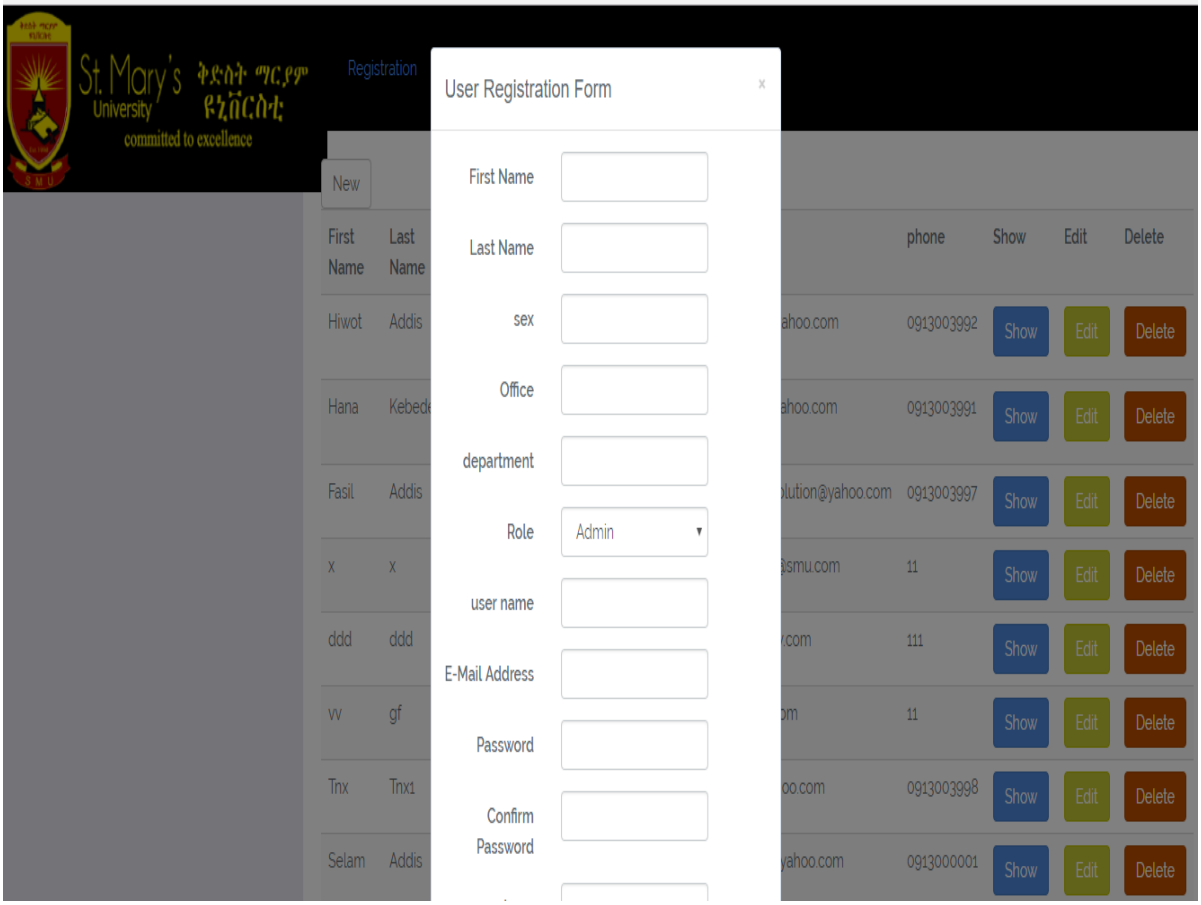
To implement this web-based system different technology were used. The technology solution includes PHP, HTML with MySQL as the back-end integration database. The choice of these programming languages is based on the features of the languages that make them very appropriate for this Project. HTML, CSS and PHP is used (for the front-end interface) and MYSQL (for the backend) and served through a web server, APACHE. The use of HTML and CSS, which is a markup language for information presentation and a styling language respectively, allow for the user-interface to be designed and properly laid out. To enable dynamic content generation, PHP (a web scripting language) is used to generate dynamic contents based on the user of the system and the corresponding content stored in the backend database which is managed by MySQL. The web server is used to serve the webpages to users when they are needed, and also to interpret the PHP scripting commands contain in the page. Bootstrap is another collection of tools used for creating web application for this project. It contains HTML and CSS-based design templates for typography, forms, buttons, navigation and other interface components as well as optional JavaScript extensions. The reason for choosing to use this tool is:

- It is compatible with all major browsers.
- It supports responsive design: Which means the layout of web pages adjusts dynamically, taking into account the characteristics of the device used by personal computer, mobile phone and tablets.

User Interface Design

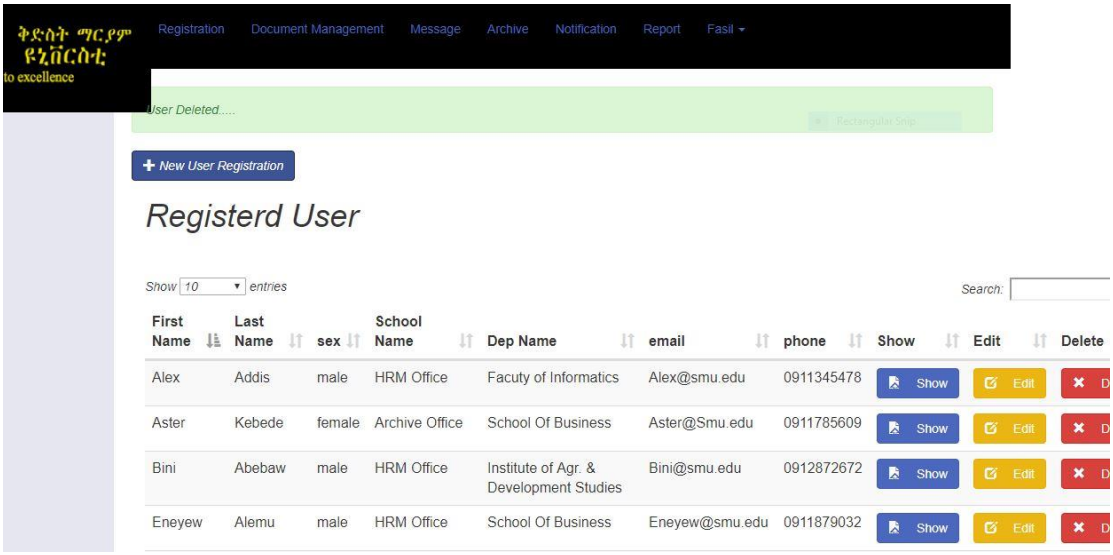
Below is a user interface screen design to meet user and process requirements of the system.

Figure 27: User Registration



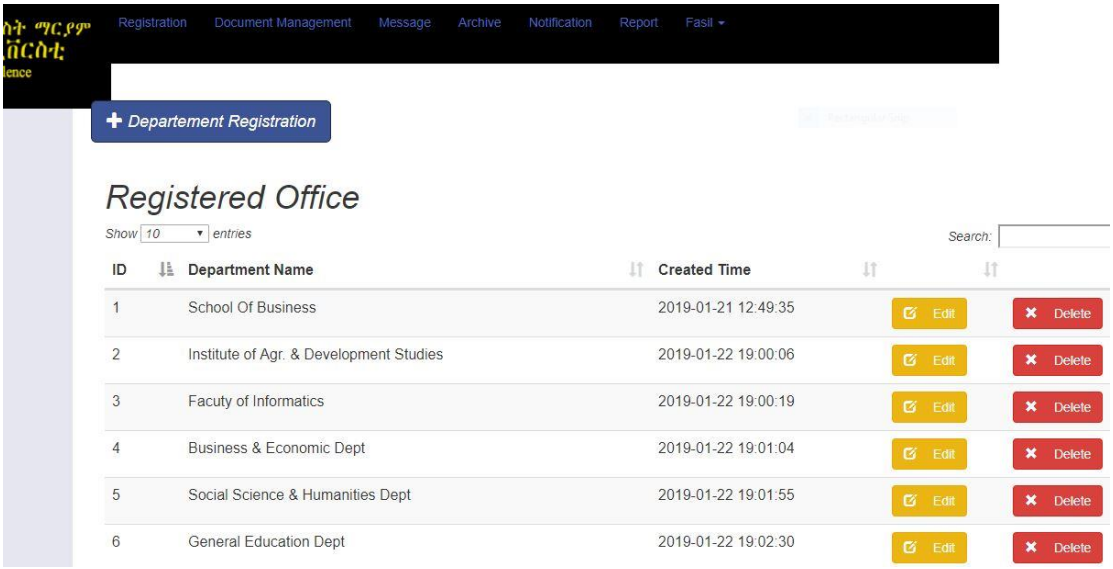
Description: An administrator is responsible to register the system users. A registration form is a list of fields that encourage the users to sign in for the new system.

Figure 28: Registered user View page



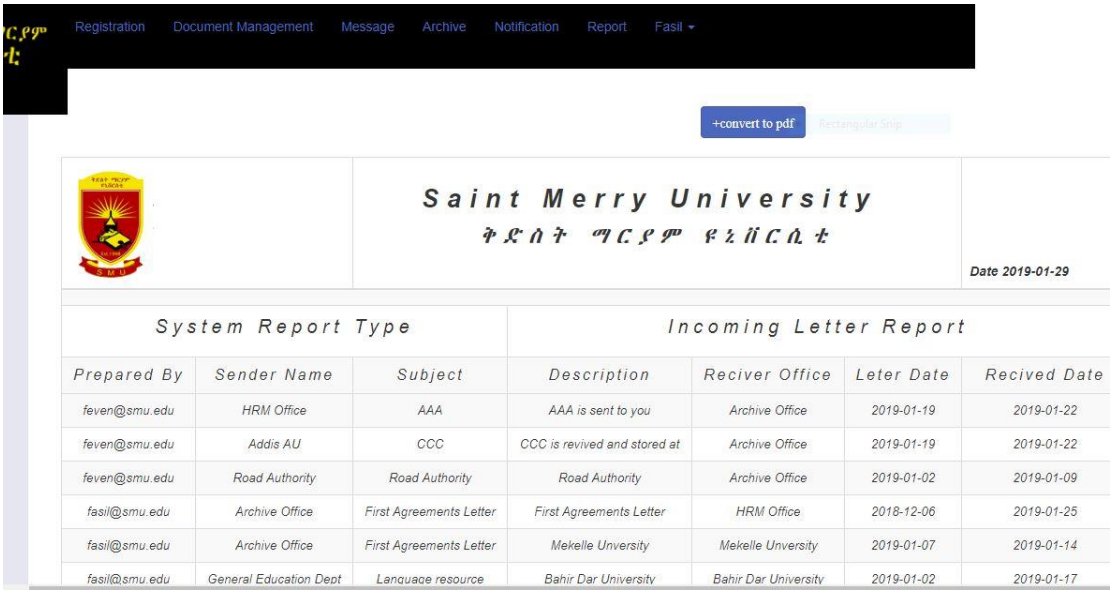
Description: All registered users are viewed and modified with one screen.

Figure 29: Department registration Page



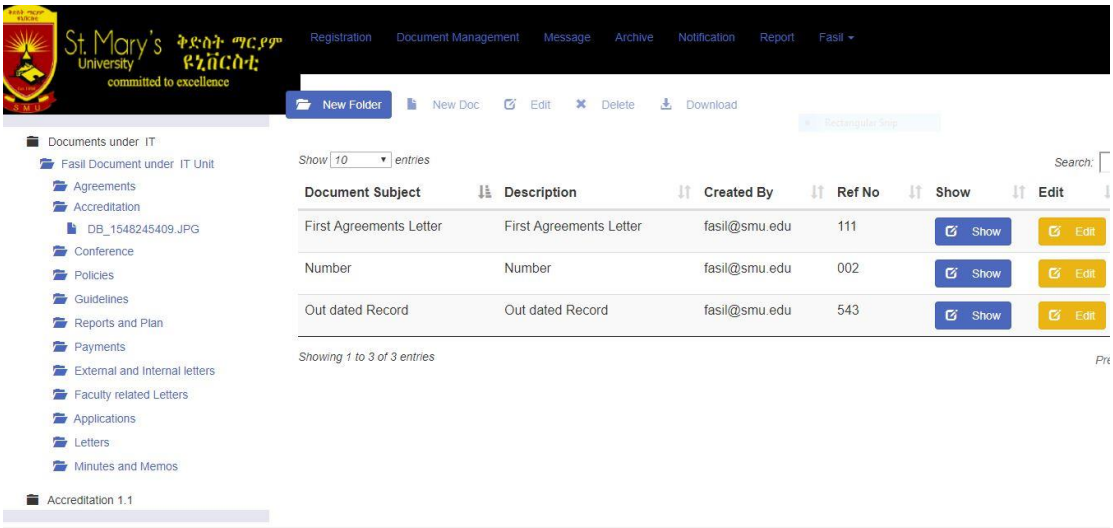
Description: Departments are registered and displayed with their created date. At the same time the registered offices can be modified.

Figure 3027: Report page



Description: The report page will display all the required reports.

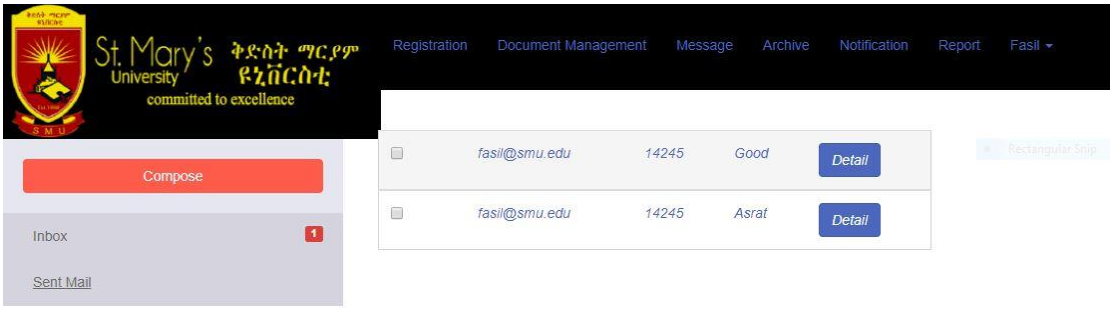
Figure 281: Document tree page



Description: The system displays the structure of a document in a hierarchical format in a document tree as shown on the left side of the page. The document tree appears on

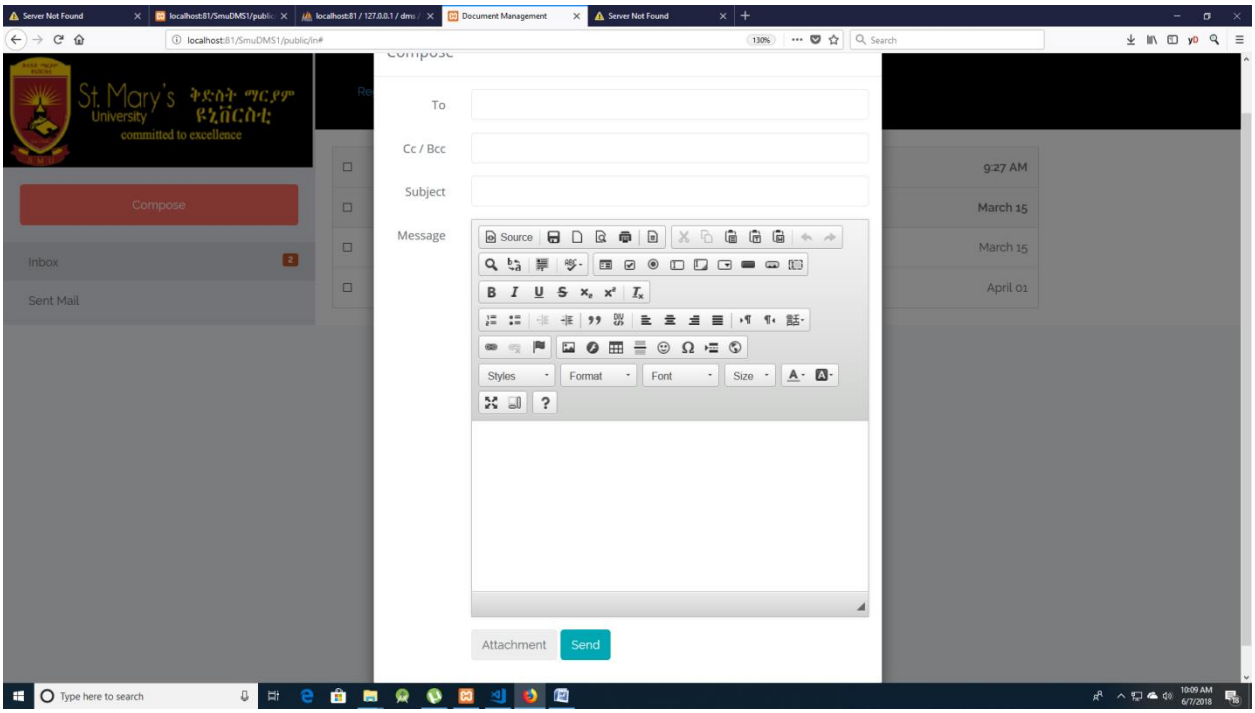
each element when you click it. In most cases, when you click an element name, additional information appears for you to view, edit, delete and download. The document can be check and maintained through this screen.

Figure 292: Message inbox page



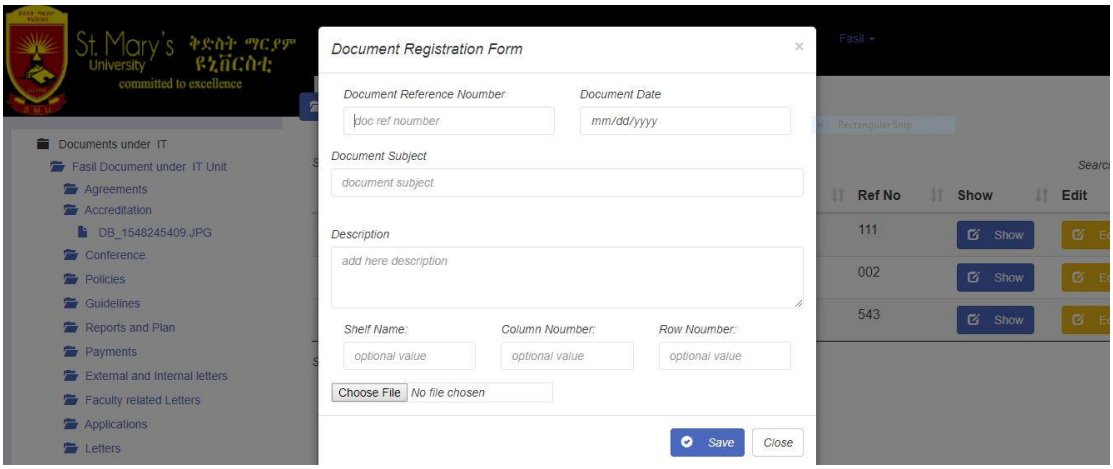
Description: When the message tab is clicked, this is the first page that will be displayed. Here in this page it is possible to see the snapshot of every inbox messages. It is also possible to see if there are any new messages to view and send new messages.

Figure 303: Message Compose Page



Description: When the compose button clicked, new compose message will be initiated to compose new message, add documents and send it to the appropriate person.

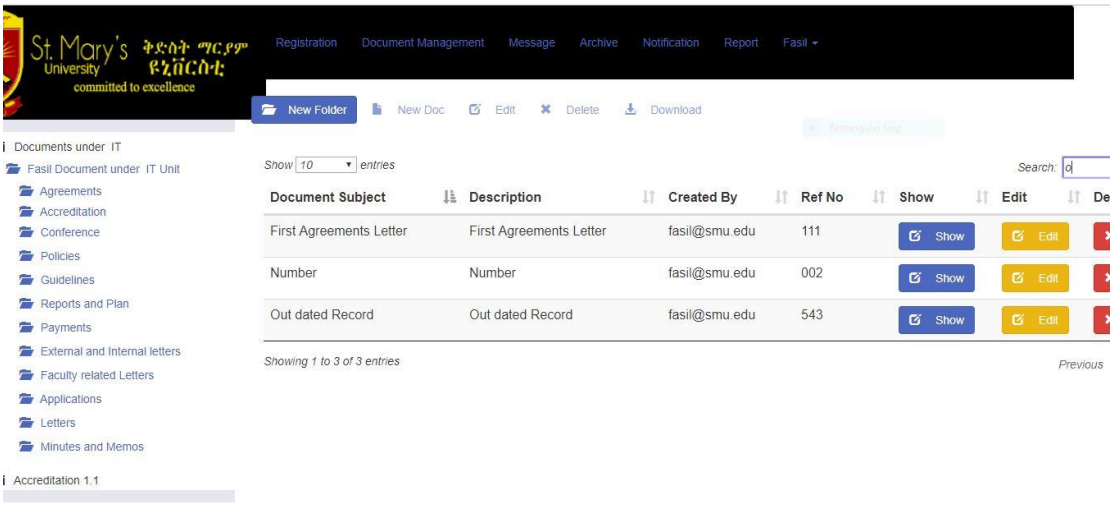
Figure 34: Document Creation



Description: Here in this screen, the document creation has two options. The first one: creating, storing and indexing the already scanned document. The second one: creating, storing and indexing the physical document. This physical document managing will also help to effectively point where the exact physical document can be found.

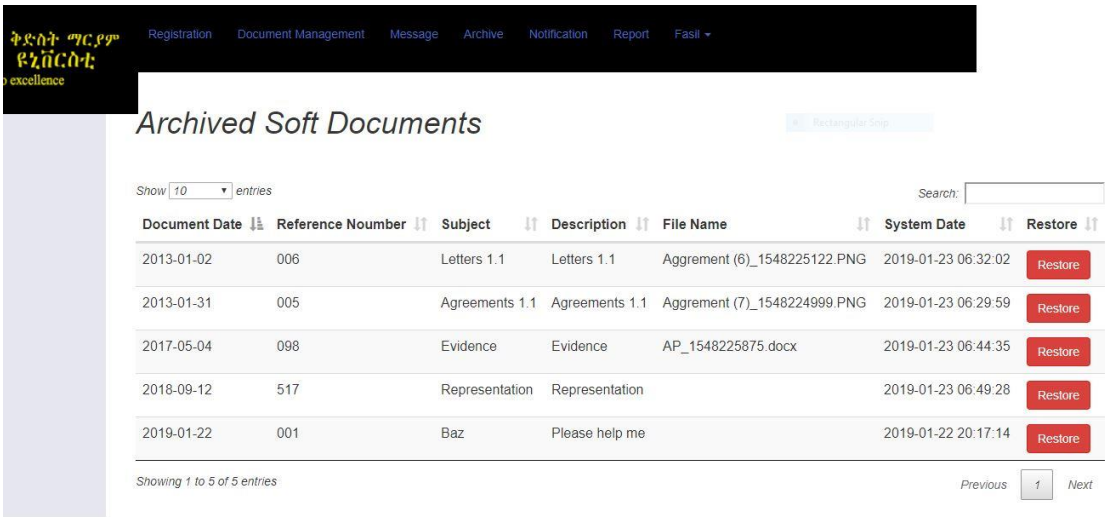
The documents will be created and stored based on classification schemes with the need of each office. The already scanned document will be captured through browsing to it destination. After that an additional meta data information will be added to it like: Document reference number, Document type, Document subject, description, shelf name column number and column row. This Meta data process is an additional metadata attributes that describes the scanned document. So that, for later use of the system it enables faster retrieval of documents.

Figure 35: Document Retrieval



Description: Document retrieval allows the system user to search documents according to the category of the indexing made. The users can look up the documents or retrieve the documents by selecting the keywords, then the document retrieval will be made according to the keywords given previously.

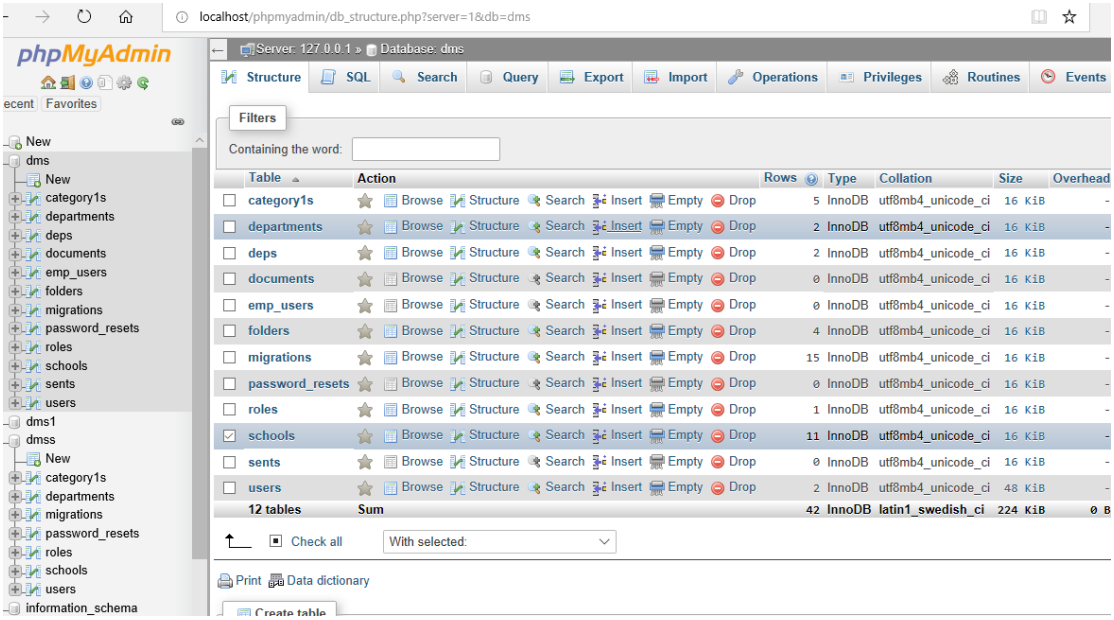
Figure 36: Document archiving



Description: This archiving process will store documents for longer period of time, based on their defined retention policy. The document that have not been used or referred in 2 years/ the document that has been created for the past 2 years will automatically become inactive. When files become inactive it does not mean that they

are no longer important so that the system move it to other storage destination. This process will make easy the offsite backup process.

Figure 37: Backup/ Database Design



Description: Database design is the process of producing a detailed data model of a database. This logical data model contains all the needed logical and physical design choices and physical storage parameters needed to generate a design in a Data Definition Language, which can then be used to create a database. The database of the system is presented above.

6.2 System Testing

System testing is a techniques used to perform to evaluate the complete system against specific requirements and it is an important and critical stage in software development. Testing plays an important role in the determining the quality and reliability of the application [22]. Different testing methods and tools were used to ensure the functionality and usability of document management. The primary purpose of these tests is to uncover the systems limitations and measure its full capabilities.

Following are testing tools used for all testing types:

Manual test: Manual Testing is a type of software testing where testers manually execute test cases without using any automation tools. Manual testing is selected because it is the most primitive of all testing types and helps find bugs in the newly implemented system.

Testing were made with different employees found in different offices of the University, such as Executive vice president office, Archive office, store and HRM office. These office users are the one who involved in the requirement gathering and repeatedly interact with. The key concept of having manual testing with those office users help; ensure that the implemented system is error free and it is working to the specified functional requirements.

The process of testing is implemented with repetitive discussion between the system developer and system user. Finally, the end user fills the checklist form which stated in each testing type. The checklist form is attached in Appendix B:

6.2.1 Unit testing

This test is conducted to check whether the internal logic is functioning properly and program inputs produce valid outputs that compare with the expected results. It is done after the completion of an individual unit. These tests are performing at component level and specific business process, application, and system configuration. In this testing module interface is tested to assure that information properly and correctly flows into and out of the module. This testing involves the testing of data truncation, the structure of the data, and whether the program correctly accepts the input data. The whole validation of the program is encountered in this testing.

Unit testing has been implemented and successfully tested by the system developer, until it reaches a point where a set of methods are ready for the system user. For instance, the system developer is testing a web application, following are the various dimensions from which it needs to be tested, each component being a single 'unit' or 'entity'.

Table 22: Checklist for Unit Test

Testing Activity	**Yes**	**No**	**Remark**
The first page appears on the very first call to a webpage.			
The system notifies the user if he tries to login with only user id or only password.			
System text fields and buttons are aligned properly.			
The system forms display text fields in an order.			
Links for ‘previous’ and ‘next’ pages works fine the system.			
The system pages navigate according to a proper sequence.			
The search button works for searching any content in the page.			
The CSS styles work as per its design specifications.			
The system fonts and background colors are soothing to the user’s eyes.			

6.2.2 Functional test

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentations of the document management system. The goal of this testing is to verify the functionality of the proposed system.

Table 23: Checklist for Functional Test

Testing Activity	**Yes**	**No**	**Remark**
All the links of webpages are working correctly and successful redirect to another page			
All Forms are working as expected and if user doesn't feel a mandatory field in form an error message is shown.			
All URL pages of the applications are displayed and working fine.			
Login functionality is working with valid inputs.			
Login functionality with invalid inputs displayed error message.			
All data manipulation is working like: Delete/Edit operations			
All elements or objects of the web is working like: Buttons			
Is the system allowing the system users to add additional meta data information about the record, during document creation?			

Does the system allow the users to store records based on the classification schemes with the need of each office?			
Is the system allowing the system user to search documents according to their need?			
Is the system send and receive a routing message to other system users?			
Does the system send a notification to system users email address?			
Does the system allow to destroy or move records based on their retention policy?			

Figure 38: login Functionality with invalid inputs displayed error message

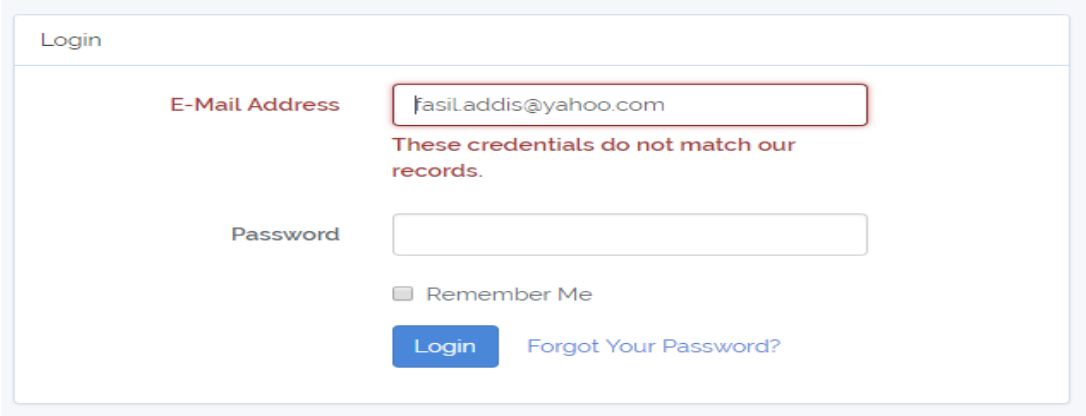
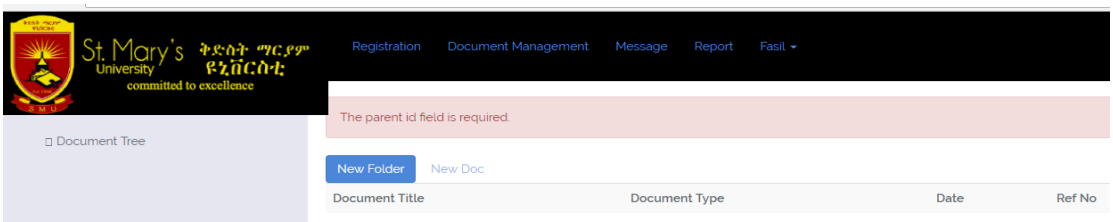


Figure 39: Error message when mandatory field in form are missed



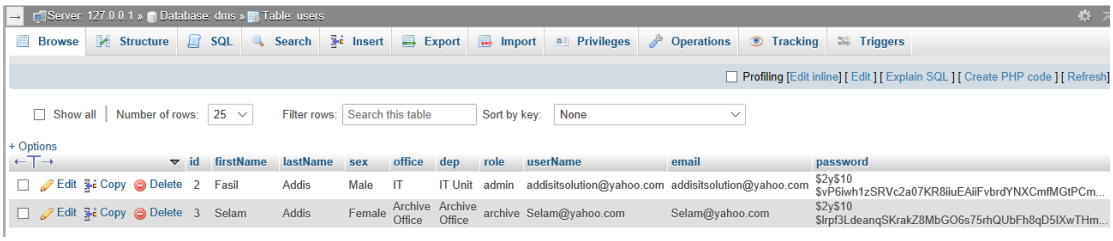
6.2.3 Security test

The main objective of security test is Preservation of availability, integrity and confidentiality of information:

Table 24: Checklist for security Test

Testing Activity	Yes	No	Remark
Does the system check access privileges and validated against authorized users			
Is the system Verify the "View Source code" option is disabled and should not be visible to the user.			
If functionality is not working? the system displays an error page, instead of displaying any application, server, or database information.			
Does the system Verify the important information like password, and display in encrypted format.			
Is the system verifying passwords in all authentication pages?			

Figure 40: Storing Password Secure Bcrypt hashing



6.2.4 Usability Test

Usability testing is one of the most used methods to define the level of usability of a software product [52]. It is intended to determine the extent an interface facilitates a user's ability to complete routine tasks. Users are asked to complete a series of routine tasks. Sessions are recorded and analyzed to identify potential areas for improvement to the web based system.

Table 25: Checklist for usability Test

Testing Activity	**Yes**	**No**	**Remark**
Is the interface of the system user friendly?			
Is the system attractive (regarding the font size and color combination) for use?			
Is the system easy to understand and to be used?			
Does the elements or objects of the web is easily visible?			
Is the system allowing the system users to add additional meta data information about the record easily?			
Is the system allowing the system user to search documents effectively?			

Testing result is extracted from the manual testing made with different system testing participants. Repetitive interaction where made with each participants and finally, they give their last response using the checklist found in each testing types. Their checklist response is attached in the appendix section.

Whole testing participants are executing test cases manually and agreed:

- The new system is developed as their intended use.
- The system is easy to use
- The system reduces security vulnerabilities that could put users at risk
- The system is well organized and helpful

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

This paper shows the initial step for developing a web based Electronic document management system for St. Mary's University. It provides an Electronic form of Crating, storing, retrieving and controlling documents. Moving from a current manual work system to an Electronic Document Management system helps the SMU to reduce costs, automating processes increased document security and minimizing errors. The main information collection method was interview; the nature of the interview was semi- structure with a basic guideline. During the interview numerous discussions with different employees made and challenges of the manual recording process are identified. To design and format the web system different kinds of tools are used like: Hypertext Preprocessor, Hypertext Markup Language, Cascading Style Sheet, Laravel, Bootstrap and some other tools. The database was created using MySQL database management system. Generally, the developed Electronic Document Management system will benefit the University Employee's, and the university itself. It reduces the time spent looking for documents and ensures that the system users will find important information timely. This will enhance and improve their personal productivities.

7.2 Recommendations

Based on the developed EDMS the following recommendations are made for future works.

- Mobile based document management system integrated with Mobile Cloud Computing.

Mobile cloud computing is an infrastructure where both

  - The data storage and data processing happens outside of the mobile device. The recommended mobile document management system moves the computing and data storage away from the mobile devices into powerful & centralized computing platforms located in clouds. Then all the records accessed over the wireless connection.

- Multi-lingual – The document capturing and the entire system support Multiple language.
- Thesis and project portal system to need to be integrated with EDMS.
- Office 365 is one of a cloud service offered by Microsoft that includes access to most office applications. and additional services like Lync web conferencing, exchange online hosted email for business, skype world minutes for home and additional online storage including OneDrive. The recommendation of this system is to link it with this cloud service. Doing so will help the system to include and use plenty of services as one. There for it can enable advanced document sharing and collaboration environment.

References

[1] T.Leikums, "a study on electronic document management system integration needs in public sector," *International Journal of Advances in Engineering & Technology,* vol. 5, no. 1, pp. 194-205, 2012.

[2] M.Sebastian, K. Azametii and E. Adjeii, "Challenges in Academic Records Management in Tertiary Institutions in Ghana," *International Journal of Scientific Research in Education,* vol. 6(3), pp. 287-296, 2013.

[3] E.Soegoto, "Implementing Laravel framework website as brand image in higher-education institution," in *in IOP Conference Series: Materials Science and Engineering*, west java, 2018.

[4] Y.Levy and J. Ellis, "A Systems Approach to conduct an effective Literature Review in Support of Information Systems Research," *Information Science Journal,* vol. 9, pp. 182-183, 2006.

[5] K.Latham, L. W and T. Gorichanaz , "A Discussion on Document Conceptualization," *The document academy,* vol. 3, no. 2, 2016.

[6] C. Mangialardi, "The Paperless office," Thesis, University of South Florida , St. Petersburg, 2001.

[7] F.Mackenna, Classification Scheme with records management system, North Sydney: Knowledge one, 2009.

[8] B.Bjork, "The Impact of Electronic Document Management on Construction Information Management," *International Council for Research and Innovation in Building and Construction,* p. 48, June 2002.

[9] J.Valkanen, "Document Management system for small business," Thesis, University of Turku, Finland, 2015.

[10] "Docuvantage.com," Docuvantage.com, 16 Jan 2018. [Online]. Available: http://www.docuvantage.com/document-capture. [Accessed 12 Dec 2017].

[11] A. Nijman, "A Proposal and Selection of a Document Management System for Staatsolie Suriname," Final Thesis project report, Delft University of Technology, Delft, 2009.

[12] M.Hansen, "A case study of university archives," Thesis, Illinois State University, United States, 2015.

[13] S.Gupta, A. Kumar and R. Prasad, Document Retrieval Using Efficient Indexing Techniques, India: IGI Global Disseminator of knowledge, 2018.

[14] A.Pandey, S. Paanchnahi and N. Hedaoo, "Optical character recognition (OCR)," *International Journal of Engineering and Management Research.*

[15] R.Kumar, "Information Retrieval System: An Overview, Issues, and Challenges," *International Journal of Technology Diffusion,* vol. 9, no. 1, pp. 1-10, 2018.

[16] S.Shah, "Review of Indexing Techniques Applied in Information Retrieval," *Pakistan Journal of Engineering, Technology and Science,* vol. 5, pp. 1-15, 2015.

[17] E.Heindl, "Paperless office," Business Consulting Master,Hochschule Furtwangcn University, Germany.

[18] L.Braniff and X. Faz , "Background what is an Information System," in *Information System a practical Guide to implementing microfinance information systems*, Washington, 2012, pp. 1-2.

[19] J.Lockett and E. M, The Agile System Framework: Enterprise Content Management case, Cham : Switzerland: Springer, 2017.

[20] V. Shah, "Building a Web Content management system," Master of science. Thesis, San Diego University, California, 2012.

[21] D.Barker, "Web content management: systems, features, and best practices," O'Reilly Media, Inc., St.Georges, 2016.

[22] H.Krasniqi, "File Tracking system," Bachelor's degree thesis,University of Epoka, Albania, 2013.

[23] S.Menon, "Document Management system," Project report Master of science application, Cochin University of science and technology, India, 2011.

[24] R.Demong, L. Faizah, T. Badrol, T. Besar and Z. Zulkifli, "Electronic Document Tracking System," University of Technology MARA, Malaysia , Malaysia , 2009.

[25] K.Ugale, B. Musande and J. Patil, "Document management system: A notion towards paperless office," in *in 1st International Conference on Intelligent Systems and Information Management (ICISIM)*, Aurangabad, Oct 2017.

[26] "Proprietary software," Proprietary software, 2018. [Online]. Available: https://www.techopedia.com/definition/4333/proprietary-software. [Accessed 13 March 2018].

[27] A.Ghadah and S. Alyahya, "Open Source Software Hosting Platforms: A Collaborative Perspective's Review," *Information Systems Department, ,* vol. 4, pp. 274-291, 2017.

[28] P.Sousa, P. Faria, M. correia, R. J and L. Antunes, "CRACS- Articles in international Conferences," in *CRACS*, 2016.

[29] K.Delonix, The Best Open Source Document Management Systems, Australia: Lera, 2013.

[30] J.Santos, "PM Managemet," 18 Jan 2014. [Online]. Available: https://project-management.com/feng-office-software-review. [Accessed 13 March 2018].

[31] T.Choppy and P. Nerden, Open Source Solutions for Document Management Systems, France: Smile Open Source, 2017.

[32] T.Shaikh, Total Cost of Ownership of Open, London: UK Cabinet Office supported by OpenForum Europe, 2011.

[33] J.Lawler, The True Cost of Open source Software, Vancouver: ActiveState Software, 2016.

[34] R.Alam, "Challenges in open source Software," *Sindn Unveristy Research Journal,* vol. 48, pp. 49-52, 2016.

[35] M.K.Stol, "Challenges in Using Open Source Software in Product Development: A Review of the Literature," Lero, the Irish Sofware Engineering Reserach Center, Limerick, 2010.

[36] "The Benefits of Closed-Source Platforms for Enterprise," B.Pay, 2015. [Online]. Available: https://www.efilecabinet.com/the-benefits-of-closed-source-platforms-for-enterprise. [Accessed 7 Nov 2017].

[37] T.Aho, "Creating a management system for customer information for a small business," Bachelor's thesis,Haaga-Helia Unversity,Finland, 2012.

[38] J.Vaclavek, "Web Front-End for Student Data Analysis Application," Bachelor's thesis ,Unversity of Prague, Czech Republic, 2015.

[39] N.Kwatsha, "Factors affecting the implementation of an Electronic Document and records Managment System (Modefiy by thesis arrangement)," Unversity of Stellenbosch, Stellenbosch South Africa Thesis, 2010.

[40] S.Jamshed, "Qualitative research method-interviewing and observation," *Disclaimer,* pp. 87-88, 2014.

[41] U.Zartler, "Developing an analytical framework for multiple perspective,qualitative longitudinal interviews," *International Journal of Social Research Methodology,* vol. 21, no. 2, pp. 177-190, 2018.

[42] S.E.Niemi, "Using enterprise architecture artefacts in an organisation," *Enterprise Information Systems,* vol. 11, no. 3, pp. 313-338, 2017.

[43] H.yu, "Design and implementation of web based on Laravel framework," in *in International Conference on Computer Science and Electronic Technology*, Tianjin, 2014.

[44] A.Kadam, M. Patil, R. Chaudhari and P. Chavhan, "Web Application Development by Using MEAN Stack," *International Journal of Science Technology Management and Research,* vol. 2, no. 4, 2017.

[45] J.Vaclavek, "Web Front-End for Student Data Analysis Application," Bachelor's thesis ,Unversity of Prague, Czech Republic, 2015.

[46] I.Medeiros, "Demonstrating a Tool for Injection Attack Prevention in MySQL," in *in Dependable Systems and Networks (DSN), 2017 47th Annual IEEE/IFIP International Conference*, Denver, 2017.

[47] K. Wiegers, "Software Requirements, third edition," in *Requirements Development*, Washington, Microsoft Press, 2013, pp. 77-101.

[48] J.Horkoff, "Interactive goal model analysis for early requirements engineering," *Springer link,* vol. 21, p. 29–61, 2016.

[49] Reggio, M. Leotta, F. Ricca and D. clerissi, "What Are the Used UML Diagram Constructs?A Document and Tool Analysis Study Covering Activity and Use Case Diagrams," in *in International Conference on Model-Driven Engineering and Software Development,* , Springer International Publishing Switzerland, 2015.

[50] J.George, J. Hoffer and J. Valacich, Essentials of Systems Analysis and Design, NJ,USA: Prentice Hall Press, 2014.

[51] A.Alufeishat, M. Alshawabkeh, H. Barham and M. Habahbeh, "The software engineering of a three-tier web-based student information system (MyGJU)," *Wiley Periodicals,* vol. 25, no. 2, pp. 242-263, 2017.

[52] F.Paz, D. Villanueva and J. Pow-sang , "Heuristic Evaluation as a Complement to Usability Testing: A Case Study in Web Domain," in *in International Conference on Information Technology - New Generations (ITNG)*, Las Vegas, 2015.

[53] M.buede and D. Miller, The Engineering Design of systems, Hoboken,Newjersey: Innovative Decisions, 2016.

Appendices

Appendix A : Interview Guide

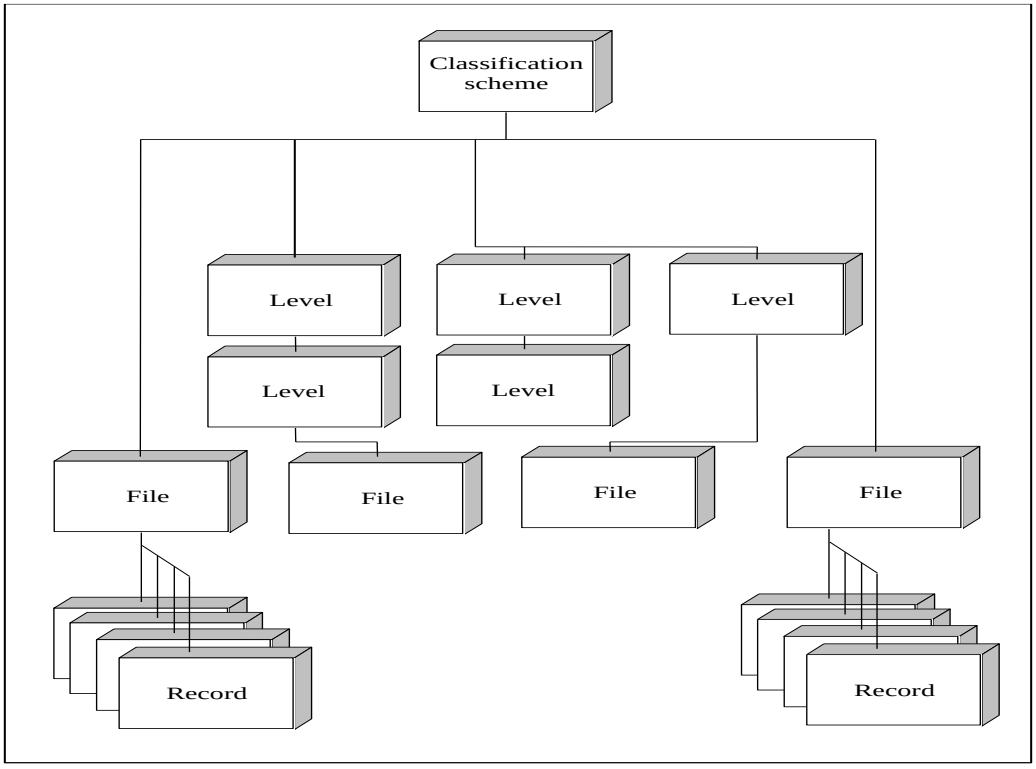
1. How the current System works?
2. What types of documents stored currently?
    1. What record type you have?

       Your Department captures a diverse range of types of documents with different formats and structures.

       - What are they?
       - The new system must be able to capture all document format types and structures you have currently?
       - Are there any guidelines of how to store documents today?

3. How do you classify it? Classification Scheme:
    - Since the number of available documents has become quite large. The first step in solving such large-scale problems involves structuring the data, which can be done by introducing a classification scheme.
    - Since many classification schemes can be used, the question is which classification schemes you are currently use?

      Note: a classification scheme is often represented as a hierarchy. Please see Examples below.



- The new system: Tring to consider the classification scheme which is compatible with your organizational classification scheme.

4. Does SMU follow any standards, such as, ISO 15489?

   ISO 15489 Information and documentation -- Records management is an international standard for the management of business records, consisting of two (2) parts:
   Part 1: Concepts and principles and
   Part 2: Guidelines.

5. How do you Maintaining the Classification Scheme?
6. Do you have a planned disposal program?

   - What is the defined records retention schedule period to make documents inactive?

- Are there any needs to access the stored material again, and if so, is the current system good?
-

7. Do you think the current system is secure?
    - Do you have requirements for controlling access by user and group?
    - If you are insecure of how to store documents, what do you do?
8. Do you experience the document handling problem?
9. Do you have any specific archiving guidelines for your division?
    - What do they look like? Formalized/ written?
    - Do these policies cover all record formats (e.g papers, electronic including email)?
10. Do you consider the current process to be efficient?
11. What is your preferred way of searching to FIND Documents?
12. What challenges you face with the current system?

Appendix B: Consent to participate

Project work Title: Electronic Document Management System for SMU

You are invited to participate in the project work that aims to develop Electronic Documents Management System for St. Mary's University.

You have been chosen for the interview and all information collected from the participants will be kept secure and only made available to the project worker and the supervisor. Participation is entirely voluntary and the participants can withdraw any time before the completion of the data collection.

Interviews will be audio taped and might transcribed so that the researcher can review the discussions. In the recorded information and final report your name would not be revealed.

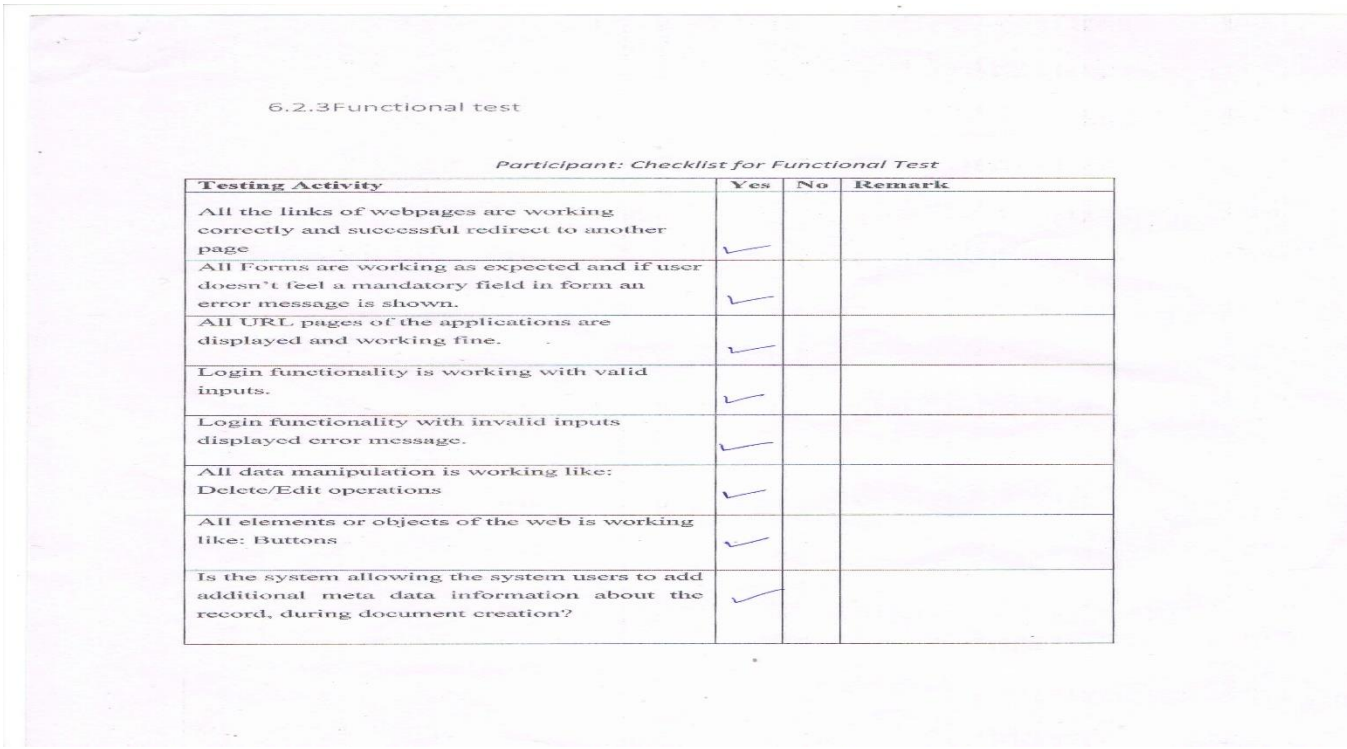
Any concerns regarding the nature and the conduct of this project work should be directed to the St. Mary's University Faculty of Informatics Department of Computer Science.

I agree to participate and be audio taped for this Project work. The Project work has been explained to me to my satisfaction.

Signature/Name of Participant Date

Signature/Name of the Student Da

Appendix B: Participants response attachment



6.2.3Functional test

Participant: Checklist for Functional Test

Testing Activity	Yes	No	Remark
All the links of webpages are working correctly and successful redirect to another page	✓		
All Forms are working as expected and if user doesn't feel a mandatory field in form an error message is shown.	✓		
All URL pages of the applications are displayed and working fine.	✓		
Login functionality is working with valid inputs.	✓		
Login functionality with invalid inputs displayed error message.	✓		
All data manipulation is working like: Delete/Edit operations	✓		
All elements or objects of the web is working like: Buttons	✓		
Is the system allowing the system users to add additional meta data information about the record, during document creation?	✓		

Does the system allow the users to store records based on the classification schemes with the need of each office?	✓		
Is the system allowing the system user to search documents according to their need?	✓		
Is the system send and receive a routing message to other system users?	✓		
Does the system send a notification to system users email address?	✓		
Does the system allow to destroy or move records based on their retention policy?	✓		

Sinishat Abebaw
Signature/Name of the Participant

NOV 28/2018
Date

6.2.5 Usability Test

Participant: Checklist for usability Test

Testing Activity	Yes	No	Remark
Is the interface of the system user friendly?	✓		
Is the system attractive (regarding the font size and color combination) for use?	✓		
Is the system easy to understand and to be used?	✓		
Does the elements or objects of the web is easily visible?	✓		
Is the system allowing the system users to add additional meta data information about the record easily?	✓		
Is the system allowing the system user to search documents effectively?	✓		

Sinishat Abebaw
Signature/Name of the Participant

NOV 23/2018
Date

6.2 System Testing

6.2.2 Unit testing

Participant: Checklist for Unit Test

Testing Activity	Yes	No	Remark
The first page appears on the very first call to a webpage.	✓		
The system notifies the user if he tries to login with only user id or only password.	✓		
System text fields and buttons are aligned properly.	✓		
The system forms display text fields in an order.	✓		
Links for 'previous' and 'next' pages works fine the system.	✓		
The system pages navigate according to a proper sequence.	✓		
The search button works for searching any content in the page.	✓		
The CSS styles work as per its design specifications.	✓		
The system fonts and background colors are soothing to the user's eyes.	✓		

Sinishat Abebaw — NOV·23/2018

Signature/Name of the Participant — Date

6.2.4 Security test

Participant: Checklist for security Test

Testing Activity	Yes	No	Remark
Does the system check access privileges and validated against authorized users	✓		
Is the system Verify the "View Source code" option is disabled and should not be visible to the user.	✓		
If functionality is not working? the system displays an error page, instead of displaying any application, server, or database information.	✓		
Does the system Verify the important information like password, and display in encrypted format.	✓		
Is the system verifying passwords in all authentication pages?	✓		

Sinishaw Abebaw — NOV 23/2018

Signature/Name of the Participant — Date

6.2 System Testing

6.2.2 Unit testing

Participant: Checklist for Unit Test

Testing Activity	Yes	No	Remark
The first page appears on the very first call to a webpage.	✓		
The system notifies the user if he tries to login with only user id or only password.	✓		
System text fields and buttons are aligned properly.	✓		
The system forms display text fields in an order.	✓		
Links for 'previous' and 'next' pages works fine the system.	✓		
The system pages navigate according to a proper sequence.	✓		
The search button works for searching any content in the page.	✓		
The CSS styles work as per its design specifications.	✓		
The system fonts and background colors are soothing to the user's eyes.	✓		

Signature/Name of the Participant

23 NOV. 18
Date

6.2.5 Usability Test

Participant: Checklist for usability Test

Testing Activity	Yes	No	Remark
Is the interface of the system user friendly?	✓		
Is the system attractive (regarding the font size and color combination) for use?	✓		
Is the system easy to understand and to be used?	✓		
Does the elements or objects of the web is easily visible?	✓		
Is the system allowing the system users to add additional meta data information about the record easily?	✓		
Is the system allowing the system user to search documents effectively?	✓		

Signature/Name of the Participant

23 NOV. 18
Date

6.2.4 Security test

Participant: Checklist for security Test

Testing Activity	Yes	No	Remark
Does the system check access privileges and validated against authorized users	✓		
Is the system Verify the "View Source code" option is disabled and should not be visible to the user.	✓		
If functionality is not working? the system displays an error page, instead of displaying any application, server, or database information.	✓		
Does the system Verify the important information like password, and display in encrypted format.	✓		
Is the system verifying passwords in all authentication pages?	✓		

Signature/Name of the Participant — Date: 23 NOV. 18

Does the system allow the users to store records based on the classification schemes with the need of each office'?			
Is the system allowing the system user to search documents according to their need?	✓		
Is the system send and receive a routing message to other system users'?	✓		
Does the system send a notification to system users email address?	✓		
Does the system allow to destroy or move records based on their retention policy?	✓		

Signature/Name of the Participant — Date: 23 NOV. 18

6.2.3Functional test

Participant: Checklist for Functional Test

Testing Activity	Yes	No	Remark
All the links of webpages are working correctly and successful redirect to another page	✓		
All Forms are working as expected and if user doesn't feel a mandatory field in form an error message is shown.	✓		
All URL pages of the applications are displayed and working fine.	✓		
Login functionality is working with valid inputs.	✓		
Login functionality with invalid inputs displayed error message.	✓		
All data manipulation is working like: Delete/Edit operations	✓		
All elements or objects of the web is working like: Buttons	✓		
Is the system allowing the system users to add additional meta data information about the record, during document creation?	✓		

6.2.5 Usability Test

Participant: Checklist for usability Test

Testing Activity	Yes	No	Remark
Is the interface of the system user friendly?	✓		
Is the system attractive (regarding the font size and color combination) for use?	✓		
Is the system easy to understand and to be used?	✓		
Does the elements or objects of the web is easily visible?	✓		
Is the system allowing the system users to add additional meta data information about the record easily?	✓		
Is the system allowing the system user to search documents effectively?	✓		

Signature/Name of the Participant — Date: ADDU. 23/2018

6.2.4 Security test

Participant: Checklist for security Test

Testing Activity	Yes	No	Remark
Does the system check access privileges and validated against authorized users	✓		
Is the system Verify the "View Source code" option is disabled and should not be visible to the user.	✓		
If functionality is not working? the system displays an error page, instead of displaying any application, server, or database information.	✓		
Does the system Verify the important information like password, and display in encrypted format.			
Is the system verifying passwords in all authentication pages?	✓		

Signature/Name of the Participant — Date: ADDU. 23/2018

Does the system allow the users to store records based on the classification schemes with the need of each office?	✓		
Is the system allowing the system user to search documents according to their need?	✓		
Is the system send and receive a routing message to other system users?	✓		
Does the system send a notification to system users email address?	✓		
Does the system allow to destroy or move records based on their retention policy?	✓		

Signature/Name of the Participant

Date 23/2018

6.2.3Functional test

Participant: Checklist for Functional Test

Testing Activity	Yes	No	Remark
All the links of webpages are working correctly and successful redirect to another page	✓		
All Forms are working as expected and if user doesn't feel a mandatory field in form an error message is shown.	✓		
All URL pages of the applications are displayed and working fine.	✓		
Login functionality is working with valid inputs.	✓		
Login functionality with invalid inputs displayed error message.	✓		
All data manipulation is working like: Delete/Edit operations .	✓		
All elements or objects of the web is working like: Buttons	✓		
Is the system allowing the system users to add additional meta data information about the record, during document creation?	✓		

6.2 System Testing

6.2.2 Unit testing

Participant: Checklist for Unit Test

Testing Activity	Yes	No	Remark
The first page appears on the very first call to a webpage.	✓		
The system notifies the user if he tries to login with only user id or only password.	✓		
System text fields and buttons are aligned properly.	✓		
The system forms display text fields in an order.	✓		
Links for 'previous' and 'next' pages works fine the system.	✓		
The system pages navigate according to a proper sequence.	✓		
The search button works for searching any content in the page.	✓		
The CSS styles work as per its design specifications.	✓		
The system fonts and background colors are soothing to the user's eyes.	✓		

Signature/Name of the Participant

Date Nov. 23/2018