



WOLKITE UNIVERSITY

COLLEGE OF COMPUTING AND INFORMATICS

Industrial Project Guideline Version 2

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Our special gratitude goes to Wolkite University, College of Computing and Informatics College Academic Council for selected us for preparation of this guideline and reviewed by another instructor's member of the college. We would also like to acknowledge with much appreciation the crucial role of the Guideline preparation team in conducting the survey and the identifying the possible project template with support of research aspect and developing the document. Our gratitude goes also to College of Computing dean office, CCI Instructors and department heads for supporting our efforts in one way or another.

II. Preface

This document is a generic Industrial Project document for use by all first degree Computer Science, Information Systems, Software Engineering, and Information Technology Students for their final projects. It provides guidance and template material which is intended to assist the relevant outline to prepare documentations for System (Web and Mobile), Expert System, Artificial Intelligence (Machine Learning, Natural Language processing ,Image Processing and Others), Networking and Security related final projects in the College. It describes detail outlines of contents and their descriptions with necessary examples that help students to properly document their project progresses in their final year senior project. It is also useful background reading for anyone involved in developing or monitoring the final year student projects in Wolkite University or in other universities.

GENERAL PROVISION

1. OVERVIEW OF INDUSTRIAL PROJECT

1.1. Industrial Project Guideline

The industrial Project is intended to be a capstone experience that draws on the previous four years of course work. The industrial Project should therefore be sufficient in scope and technical content in order to expose students' technical competence developed during their education at Wolkite University. The Project's specific topic can be in any field of computer Science, Software Engineering, Information Sciences and Information Technology or similar areas. It is also expected that the project be carried out by a team of 3-6 senior students under the supervision of related department instructor (s). The project's duration is expected to run over two semesters and graded at the end of each semester.

Industrial Project is an important part of computing discipline at undergraduate level. The main purpose of these projects is to encourage students to apply the knowledge acquired during their studies. Students are also expected to show how proficient they are in solving real world problems with certain constraints for the outcome-based evaluation set by the department of computing discipline. Consequently, all college of computing and Informatics students are required to participate in group based industrial projects provided in the first and second semesters of their final year. The industrial projects involve a significant software development techniques and principles.

To this end, each departments under college of computing and Informatics requires its students to demonstrate knowledge right from project planning to implementation. This project guideline is to assist students on the rules and procedures that should be followed in order to plan and execute a productive and successful industrial project. This guideline is also used as a reference for all participants in the industrial project: department advisors and the industrial project evaluation committee members.

This document contains information on how to successfully compile a written industrial project report for Computing Students. This guideline plays an integral role in your project work, in your report preparation. The sections and sub sections tries to elaborate the general report structure including content, formatting style, and referencing style to be used. Students are encouraged to stick to the guideline as far as possible. Badly formatted and/or nonstandard styled reports are

irritants to reading and distract attention from the main contents of the report (that is, the work done).

1.2. Project Standards

This project guideline tries to put the minimum requirements that your project must include. For the purpose of this section we classify projects into four broad categories:

1. System Development (mobile and web based)
2. Networking and Security
3. Expert System
4. Artificial Intelligence (Natural Language , Machine Learning and others)

1.2.1. System Development

- **Web based System Development**

Your web based system should be client/server based. The client part should be developed using HTML/HTML5, CSS, JavaScript, Ajax, JQuery and other similar technologies. The server part should be developed using server side scripting languages like PHP, Perl, ASP, JSP, JSF, and other similar technologies. On the server side you need to have implemented your database using database server such as MySQL, PostgreSQL, Microsoft SQL Server, Oracle, MongoDB and other relational, object oriented, Document, Spatial or other database technologies.

- **Mobile Development**

- If you are designing software for mobile devices, your application should meet requirements of good mobile application development guide lines such as, using screen, battery, storage, computing and other resources efficiently.
- You can develop standalone application or an application that work in collaboration with other servers, mobile devices, sensors or websites like Facebook, Google, and Twitter.
- For developing your mobile application, you can use technologies such as Android, IOS, and Microsoft phone.

1.2.2. Networking and Security

It is any activity designed to protect the usability and integrity of your network and data. It includes both hardware and software technologies. Effective network security manages access to the network. It targets a variety of threats and stops them from entering or spreading on your network.

1.2.3. Expert System

An expert system is a software system that attempts to reproduce the performance of one or more human experts, most commonly in a specific problem domain, and is a traditional application and/or subfield of artificial intelligence.

1.2.4. Artificial Intelligence (AI)

Artificial intelligence (AI) is an area of computing that emphasizes the creation of intelligent machines that work and react like humans. Some of the activities computers with artificial intelligence are designed for includes: *speech recognition, expert systems, handwriting recognition and robotics*. Your artificial intelligence projects can be developed by using prolog, python, java and other similar technologies.

- **Other Systems**

Any other software system that can solve real world problems can come under this category.

Your software under this category can be an application that follows client/server architecture, peer-to-peer architecture, or it can be standalone software. You can use C#, Java, Python, Ruby or any other programming language to develop your software. Use of IDE such as Microsoft Visual Studio, IntelliJ Idea, Net beans, Eclipse, or any other Software development environment that will assist you in accomplishing your task is highly recommended.

You are expected to provide setup file or deployment mechanism for your system.

Note: For all of your systems

- Appropriate user interface which apply the major user interface design principles is expected.
- Unit Testing, input validation and exception handling components are expected to be included
- Appropriate login and logout mechanisms must be there.
- In your database there must be at least three related tables
- All your database tables should have appropriate field names, primary key, foreign key and indexes.
- All relational databases must be normalized at least up to third normal form

1.3. General Instruction to Prepare Document

This document is divided into six major sections. Section two describes the objective of this document and sections three and four explain about document and presentation slide formats.

Section five discusses about the general rules and principles that students, their advisors, examiners, and project committee members should follow in order to have a homogeneous communication and evaluation setup. Finally, section six details about the major phases that students should pass through to complete their project.

1.4. Objective

This Industrial project guideline aims to:

- Help students to have a good insight on the rules and procedures that should be followed in industrial project planning, design and implementation phases.
- Assist students use consistent formatting throughout their documentation.
- Inform Instructors and students about the evaluation and grading policies.

2. DOCUMENT STYLE AND FORMATTING

College of Computing and Informatics sets the minimum documentation preparation format for the industrial project work, while issues like document content and length are decided by the group and the advisor. Grammar, punctuation, spelling and other mechanical issues are the sole responsibilities of the group members.

2.1. Language

- The industrial project document must be prepared in English.

2.2. Paper Size and Specification

- You have to use a standard A4 (8.27" X 11.69") paper size.

2.3. Font

The specifications below should be strictly followed throughout your document. For the title page(s), refer appendix II.

- Body:
 - Font type: Times New Roman
 - Font size: 12
- Heading 1:
 - Font type: Times New Roman [**UPPER CASE**]
 - Font size: 16[**Bold**]
- Heading 2:
 - Font type: Times New Roman
 - Font size: 14[**Bold**]
- Heading 3:
 - Font type: Times New Roman
 - Font size: 12[**Bold**]
- Heading 4:
 - Font type: Times New Roman
 - Font size: 12[**Bold**]
- Font Color: **Black** (Recommended unless and otherwise other colors carry some sort of message) for all documents.

2.4. Spacing

- Document line spacing should be **1.5** with the exceptions of captions, lists, graphs, charts, items with tables and lists in the appendices.
- The alignment of each paragraph should be **justified**.
- Lengthy tables may be **1 line** spaced.
- Format paragraphs with 6-point spacing after paragraph end. New paragraphs to start on next line (that is, there is no need of an extra line between paragraphs if paragraphs are formatted as suggested). No paragraph indents necessary.
- Each chapter must start on a new page. *Chapter title* should be *centered* and a *Heading 1*.

2.5. Tables

- Tables should be consecutively numbered and labeled. Table numbering should indicate the chapter where it resides in. The table label should be above the tables.

2.6. Figures

- Figures should be consecutively numbered and labeled. Figure numbering should indicate the chapter where it resides in. The figure label should be below the figures.

2.7. Margins

- Use the custom margins bellow for your document
 - Top : 1
 - Bottom : 1
 - Left : 1.25
 - Right : 1

2.8. Page Numbers

- Except for the title page, number all pages which come before the first page of the body chapters consecutively with lower case roman numerals (i, ii, iii, iv...).
- The first page with Arabic numeral (1, 2, 3, and so on) starts from the page of the introduction. Put page numbers right aligned.

2.9. References

Reference numbers should be cited within the text as well as figure/table captions either as *superscripts* or *enclosed in square brackets*. In this way of citation, all references should be

numbered (Arabic numerals) in the order in which they are first cited in the report. Another alternative is citing references using the author's last name and the year the material published. Here, all references should be arranged in a chronological ascending order. Strictly avoid citing references in *chapter/section/subsection titles*. References are cited to convey to the reader that the idea, concept, formulation, data, inference or information being discussed is attributable to the cited literature. All figures/tables, which are taken from literature, must be acknowledged by citing the reference number or the author and the year of publication at the end of the caption.

The main reference sources include books/monographs/ handbooks, archived journal papers, conference papers in published proceedings, institutional technical reports, theses/ project documents, dissertations and other archived reports and standards. Internet websites are also increasingly becoming an important source. However, it should be noted that Internet references should not form the entire list of references. Allowing URLs as references must not be misunderstood to mean that all Internet material is acceptable. Internet material may be transitory, may not be technically reviewed and may have questionable authenticity, that is, it may not be proper archival material. It may be used as secondary information source to supplement the main sources.

List references at the end of the paper in either numerical order or chronologically ascending order. Sample references could be as listed below:

- For a book: author(s), book title (bold), publisher, city, year.

Example:

[1]. Thomas, B. (2016). ***OCA: Oracle Database 12c Administrator Certified Associate Study Guide: Exams 1Z0-061 and 1Z0-062***. John Wiley & Sons.

For a journal paper: author(s), paper title (bold), journal name, volume number, issue number, page numbers (inclusive), publisher, year.

3. PRESENTATION SLIDE FORMATTING

You are expected to defend your project by preparing an attractive presentation. Developing an outline or structure for your presentation will help you communicate a clear and meaningful message to your audience.

3.1. Slide Layout

- Your slides should have white background with little or no graphics.

- Your bullet points should be short and quick hits and try to keep the number of bulleted items around six per slide.

3.2. Font

- Use Times New Roman font type with color black.
- Main body contents should be coined in 20-24 pts.
- Font type, size and style of the main content area on all slides except for the title slide should be the same.
- Title of your project should be maximum of 36 point-size
- Each content slide should have a title and should solely reflect the comprised content.
- The titles should be brief and descriptive. They should not be full sentences.
- The title of each slide should be 30- point size

3.3. Total Number of Slides

A general rule of thumb is one slide per minute. If you have a 20-minute presentation, you should include about 20 slides. You don't want to overwhelm your audience with too much information. Focus on the key concepts you want your audience to remember. However, for the sake of your defense up to 26 slides are allowable.

Notice: This is one of the biggest mistakes students make with PowerPoint: They cram too much text onto their slides. Your text-only slides should be short, quick-hit highlights written as phrases rather than complete sentences. If your audiences are busy reading your slide, they are not going to be paying attention to you. Or they may not read the slide at all, which renders your Power Point presentation useless. So, make sure to leave some white space around the main content on your slide. This helps to focus the reader's attention on the key information.

4. INDUSTRIAL PROJECT EVALUATION CRITERIA

This section contains progress evaluations, semester end evaluations, and advisor evaluation forms.

Wolkite University
College of Computing and Informatics
Semester I Progress Evaluation Form

Project Title: _____ **Date:** _____

No.	Evaluation Criteria	Marking (15%)	StudID1	StudID2	StudID3	StudID4	StudID5	StudID6
1.	Is the data collected?	2%						
2.	Is the existing system studied?	2%						
3.	Do the requirements clearly articulated?	3%						
4.	Does the system analysis perform well?	3%						
5.	Is the presenter well prepared?	2%						
6.	Does the presenter respond well to questions and critiques?	3%						
	Total							

General Comments (use extra sheet if required): _____

Name of Examiner 1: _____ Signature _____

Name of Examiner 2: _____ Signature _____

Name of Examiner 3: _____ Signature _____

Wolkite University
College of Computing and Informatics
Semester I Phase I Evaluation Form

Project Title: _____ **Date:** _____

No.	Evaluation Criteria	Marking (55 %)	StudID1	StudID2	StudID3	StudID4	StudID5	StudID6
1.	Does the problem, objective, scope and limitations are clearly stated?	2 %						
2.	Does the methodology and tools are appropriate to develop the system?	3 %						
3.	Is the existing system studied?	3 %						
4.	Are the functional requirements and use case model matched?	5 %						
5.	Does the system model, object model and dynamic model are illustrated clearly?	5 %						
6.	Documentation Quality	4 %						
7.	Does the presenter understand the system?	12 %						
8.	Are the proposed system architectures designed properly?	3 %						

9.	Does the presenter respond well to questions and critiques?	13 %						
10.	Communication, code of conduct, Time Managements dressing and Presentation Protocol	5 %						
	Total							

General Comments (use extra sheet if required):_____

_____.

Name of Examiner 1: _____ Signature _____.

Name of Examiner 2: _____ Signature _____.

Name of Examiner 3: _____ Signature _____.

Wolkite University
College of Computing and Informatics
Semester II Progress Evaluation Form

Project Title: _____ Date: _____

No.	Evaluation Criteria	Marking (15%)	StudID1	StudID2	StudID3	StudID4	StudID5	StudID6
1.	Completeness and interactiveness of GUI of the project (Forms and control objects like menus, buttons, textbox, radio buttons, links etc).	5%						
2.	Completeness of database design (Tables and its attributes are designed based on class diagrams, relationship among tables explicitly implemented.)	3%						
3.	Implementation of some functionalities	5%						
4.	Participation of students and their role compared with other group member.	2%						
	Total							

General Comments (use extra sheet if required): _____

Name of Examiner 1: _____ Signature _____

Name of Examiner 2: _____ Signature _____

Name of Examiner 3: _____ Signature _____

Wolkite University

College of Computing and Informatics
Semester II Phase II Evaluation Form

Project Title: _____ **Date:** _____

No.	Evaluation Criteria	Marking (65%)	StudID1	StudID2	StudID3	StudID4	StudID5	StudID6
1	Does the project achieve the objective and significance of the system for the community?	3 %						
2	Complete Implementation of functionalities	5 %						
3	Completeness of system design	5%						
4	Security of the system, Completeness and inter-activeness of GUI of the project	10 %						
5	Does the system taste using the right test case and testing technique?	5 %						
6	Do the presenters understand the system?	13 %						
7	Does the presenter respond well to questions and critiques?	12 %						
	Communication ,code of conduct ,dressing and protocol	3 %						

	Total							
--	--------------	--	--	--	--	--	--	--

General Comments (use extra sheet if required):_____

_____.

Name of Examiner 1: _____ Signature _____.

Name of Examiner 2: _____ Signature _____.

Name of Examiner 3: _____ Signature _____.

Wolkite University
College of Computing and Informatics
Project Advisor Evaluation Form

Project Title: _____ **Date:** _____

No	Student ID	Discipline (5 %)	Attendance (5 %)	Student understanding of the system and Participation (20 %)
1				
2				
3				
4				
5				
6				

Name of Advisor: _____ **Signature** _____.

5. PRELIMINARY PAGE

5.1. Cover Page

The cover page should be informative and consist of the names of the university (Wolkite University), college name (College of Computing and Informatics), department name (the academic degree sought), project title, the name and identification Number of students, advisor name, the location followed by the month and year are the last items on the cover page. For more detail information about cover page please refer **Appendix I**.

5.2. Title Page

The title page of a project must include the following information:

1. The title of the project work is in capitalize each first word font sized 14 and centered 2" below the top of the page.
2. Project member names, centered 1" below the title. Do not include titles, degrees, or identifiers.
3. The following statement, centered, 1" below your name: "A [project] submitted to Wolkite University in partial fulfillment of the requirements for the degree of [insert degree] in the [insert department or program name] in the [named College]." End this statement with a period, for more detail refer sample title page on **Appendix II**.

5.3. Declaration Page

This page should declare that the project comprises one's own work. In compliance with internationally accepted practices, it should acknowledge and refer all materials used in the work, refer sample declaration page on **Appendix III**.

5.4. Approval Page

Before submission the project work you should be approved by an advisor, department heads, and examiners; use **Appendix IV**.

5.5. Acknowledgements

Acknowledgements are the project work member's statement of gratitude to and recognition of the people and institutions that helped in project work.

5.6. Table of Contents

Include a table of contents following these guidelines:

- Include the heading 1 “**TABLE OF CONTENTS**” in all capital letters, and center it 2” below the top of the page.
- Include one double-spaced line between the heading and the first entry.
- The table of contents must list all parts of the industrial project work that follow it.
- If relevant, be sure to list all appendices and a references section in your table of contents. Include page numbers for these items but do not assign separate chapter numbers.
- Page numbers listed in the table of contents must be located just inside the right page margin with leaders (lines of periods) filling out the space between the end of the entry and the page number. The last digit of each number must line up on the right margin.
- Information included in the table of contents must match the headings, subheadings, and numbering used in the body of the industrial project.
- Subdivisions of headings should not exceed four levels.
- The Table of Contents page(s) must be numbered with consecutive lower case Roman numerals. Refer **Appendix V**.

5.7. List Figures and Tables

If applicable, include a list of table and list of figures, following these guidelines:

- Include the heading 1 “**LIST OF FIGURES**” and “**LIST OF TABLES**” in all capital letters, centered 1” below the top of the page.
- Include one double-spaced line between the heading and the first entry.
- Each entry must include a number, title, and page number.
- Page numbers must be located just inside the right page margin with leaders (lines of periods) filling out the space between the end of the entry and the page number.
- Numbers, titles, and page numbers must each match the corresponding numbers, titles, and page numbers appearing in the thesis.
- All Lists of Tables, Figures, and Illustrations page(s) must be numbered with consecutive lower case Roman numerals. Refer **Appendix VI**.

5.8. List of Abbreviation

- Include the heading “**LIST OF ABBREVIATIONS**” in all capital letters, and center it 1” below the top of the page.

- Arrange your abbreviations **alphabetically**.
- Abbreviations must align with the document's left margin or be indented to the right of the left page margin using consistent tabs.
- If an entry takes up more than one line, single-space between the two lines.
- The List of Abbreviations page(s) must be numbered with consecutive lower case Roman numerals centered with a 1/2" margin from the bottom edge.

5.9. Abstracts / Executive Summary/

Include an abstract page according to the following guidelines:

- Use **Executive Summary** for your Projects and use **Abstracts** for the purpose of Research Works (Network and Security, Artificial Intelligence and Expert System outlines).
- Include the heading 1 "ABSTRACTS" in all capital letters, and center it 2" below the top of the page.
- Your abstract should contain introduction (2-3 lines), statement of the problem (2-4 lines), general objective, methodology of the project (3-5 lines), proposed solutions (3-6 lines), testing result and discussion (at least 2 lines) and conclusion and recommendation (2-4 lines).
- The text of your abstract must be similar fonts with the body of the text and aligned with the document's left margin with the exception of indenting new paragraphs. Do not center or right-justify the abstract.
- Abstracts cannot exceed one page for a project work.
- Abstract page number should be with the lower case Roman numeral.
- Avoid mathematical formulas, diagrams, references and other illustrative materials in the abstract.

6. MAIN BODY OF THE PROJECT WORK

In the main body of the project work, the group member presents the narrative argument. The text is divided into major divisions (Chapters), each presenting a main point in the argument. Each major chapter usually contains subdivisions that will aid the reader in understanding the given information. Main body of the industrial project work contains four outlines with its description you can refer below:

It provides guidance and template material which is intended to assist the relevant outline to prepare documentations for System, Expert System, Artificial Intelligence (Machine Learning, Natural Language processing ,Image Processing and Others), Networking and Security related final projects in the College. It describes detail outlines of contents and their descriptions with necessary examples that help students to properly document their project progresses in their final year senior project.

SYSTEM DEVELOPMENT OUTLINE

CHAPTER ONE

1. INTRODUCTION

Reasons for studying the problem selected should be listed. Project works already done in that area should be mentioned. In here, you need to discuss about the significance of your focus area. Besides, the problem area and motivation to the need for your project work is described. Moreover, if your focus area leans on a specific organization you need to say so about the organization.

1.1. Background of the Organization

Here you are expected to describe mission, vision and objective of the organization for which you are going to develop the new system, organization structure etc...

1.2. Statement of the Problem

Here you are expected to describe specifically what the problem is and the problem that you intend to solve. Describe how the existing system functions (manual, semi –automated, automated) and then list and describe the problems in the existing system.

1.3. Objectives of the Project

General and specific objectives of the project to be achieved by the proposed system should be discussed. Your objective should be SMART (Specific, Measurable, Achievable, Relevant and Time bounded).

1.3.1. General Objective

Your general objective should incorporate a sentence that begins with “The general objective of this project is ...”, “The main objective of this project is ...” and include the applicable area of your project work. It should be general.

1.3.2. Specific Objectives

Here you are expected to list a number of activities which has to be done to achieve the general objective. It should be specific and systematically address the various aspect of the problem as defined under “*Statement of the Problem*” and the key factor that are assumed to influence or cause of the problem.

1.4. Feasibility Analysis

Here you are expected to assess the strengths and weaknesses of a proposed project and present directions of activities which will improve a project and achieve objectives according to section 1.4.1 – 1.4.4.

1.4.1. Technical Feasibility

Here you are expected to analysis the project in terms whether the required technology is available or not, whether the required resources are available, Manpower- programmers, testers & debuggers, and Software and hardware.

1.4.2. Operational Feasibility

Operational feasibility is mainly concerned with issues like whether the system will be used if it is developed and implemented. And also, does management support the project? Are the users not happy with current business practices? Will it reduce the time (operation) considerably?

1.4.3. Economical Feasibility

For any system if the expected benefits equal or exceed the expected costs, the system can be judged to be economically feasible. In economic feasibility, cost benefit analysis is done in which expected costs and benefits are evaluated. Economic analysis is used for evaluating the effectiveness of the proposed system. In economic feasibility, the most important is cost-benefit analysis.

1.4.4. Other Feasibility (if any)

In this section students are expects to discuss other feasibility issues according to the project they are going to develop like political feasibility, cultural feasibility and others.

1.5. Scope and Limitation of the Project

Here you need to define specific boundaries of your project in terms of what the project does and what the project doesn't.

1.5.1. Scope of the Project

In this section you need to describe specific boundaries of your project in terms of what the project does.

1.5.2. Limitation of the Project

In this section you need to define specific boundaries of your project in terms of what the project doesn't.

1.6. Significance of the Project

The societal and technological importance of your project should be discussed in this part.

1.7. Beneficiary of the Project

Who will benefit from the system?

1.8. Methodology of the Project

State how the requirements are gathered, the tools used for analysis and design, model, implement, test etc.

1.8.1. Data Collection Tools/Techniques

In this section you may or may not include observation, questionnaire, interview and document analysis etc.

1.8.2. System Analysis and Design

In this section you should include object-oriented system analysis and design(OOSAD).

1.8.3. System Development Model

Here you are expected to mention software development life cycle models like iterative, spiral, V-model or waterfall etc. and describe why do you select the development model.

1.8.4. System Testing Methodology

In this section you should may or may not include unit testing, system testing, acceptance testing, integration testing etc.

1.8.5. Development Tools and Technologies

In this section and subsections, you should mention programing languages and its editor, database technologies, documentation tools, unified modeling language(UML) design tools, hardware tools for deployment purpose etc.

1.8.5.1. Frontend Technologies

1.8.5.2. Backend Technologies

1.8.5.3. Documentation and Modeling Tools

1.8.5.4. Deployment Environment

1.9. Budget and Time Schedule of the Project

*This section and its subsections **included only** in your proposal.*

1.9.1. Budget of the Project

Here you are expected to describe all costs (Paper cost, pen, mobile card, transport, laptop or desktop cost, etc.) by using table.

1.9.2. Time Schedule of the Project

Here you are expected to describe the time schedule of your project by using the Gant chart, pert chart or any other tool.

1.10. Team Composition

Here mention the responsibility and tasks of each group members by using table. *This section **included only** in your proposal.*

1.11. Document Organization

In this section include the chapters and what it describes about.

CHAPTER TWO

2. DESCRIPTION OF THE EXISTING SYSTEM

2.3. Introduction of Existing System

Describe the existing system how it works in detail step by step.

2.4. Users of Existing System

Here you are expected to describe the users and their responsibilities in the existing system ...

2.5. Major Functions of the Existing System

Describe the existing system major functions.

2.6. Forms and Other Documents of the Existing Systems (if any)

Here the includes sample scan image of reports, forms and other related documents that used in the existing system and the remaining forms and reports should be included in **Appendix section**.

2.7. Drawbacks of the Existing System

In this section describe the existing system disadvantages and many more difficulties to work well.

2.8. Business Rules of the Existing System

List any operating principles about the product, such as which individuals or roles can perform which functions under specific circumstances. These are not functional requirements in themselves, but they may imply certain functional requirements to enforce the rules.

CHAPTER THREE

3. PROPOSED SYSTEM

In this chapter you are expected to discuss the overall description of your proposed system, functional requirements, and non-functional requirements.

3.3. Functional Requirements

Here you are expected to mention what your system should do. Functional requirements specify a function that a system or system component must be able to perform. Mention product features or functions that developers must implement to enable users to accomplish their tasks.

3.4. Non-functional Requirements

In this section describe nonfunctional requirements place constraints on how the system will do so. Depend on your project the nonfunctional requirement may be vary. So, list all the nonfunctional requirements which are relevant to your system like:

3.4.1. User Interface and Human Factors

What kind of interface should the system provide? What is the level of expertise of the users?

3.4.2. Hardware Consideration

Are there hardware compatibility requirements? Will the system interact with other hardware system?

3.4.3. Security Issues

Should the system be protected against internal and external intrusions or against an authorized user? To what level? What security algorithm applied for your system?

3.4.4. Performance Consideration

How responsive should the system be? How many concurrent users should it support? What is a typical or extreme load?

3.4.5. Error Handling and Validation

How should the system handle exceptions? Which exceptions should the system handle? What is the worse environment in which the system is expected to perform?

3.4.6. Quality Issues

How reliable/available/robust should the system be? What is the client's involvement in assessing the quality of the system or the development process?

3.4.7. Backup and Recovery

How, when and where to take backup? How to recover the system when your system fail?

3.4.8. Physical Environment

Where will the system be deployed? Are there external factors such as weather conditions that the system should withstand?

3.4.9. Resource Issues

What are the constraints on the resources consumed by the system?

3.4.10. Documentation

What level of document is required? Should only user documentation be provided? Should there be technical documentation for maintainers? Should the development process be documented?

CHAPTER FOUR

4. SYSTEM ANALYSIS

In this chapter, you should have discussed about use case model, object model and dynamic models.

4.3. System Model

Here you are expected to mention an overview of system model.

4.3.1. Use Case Model

In this section, you are expected to model comprised use case diagram, use case definitions, and actor definitions to document the functional requirements of a system. Also, you should have to identify each actor and use cases of the system based on the functional requirement.

4.3.1.1. Use Case Diagram

Here draws a diagram that shows system boundary, use cases, actors and their relationships by using <<include>> or <<extend>>. Also, you should have to illustrate the interaction of each actor with each use case using modelling tools like E-Draw max, Visio and others.

Actor: Someone interacts with use case (system function), and named by *noun*.

Use Case: System functions, and *named by verb + Noun (or Noun Phrase)*.

4.3.1.2. Use Case Description

Here you are expected to write the description of each use case in tabular form by using narrative style or action response style.

4.3.1.3. Use case Scenario

Scenarios are an instance (example) of a use case explaining a concrete major set of action. Scenario or use case realizations are just a sequential narrative description of events or an instance of a use case.

4.4. Object Model

In this section, discussed an overview of object model.

4.4.1. Class Diagram

In this section you are expected to illustrate (diagrammatically) the conceptual relationship among objects/classes without including visibility of data and members, association, generalization, cardinality etc.

4.4.2. Data Dictionary

In this section mention attributes, data type, data size, key constraints and constraints of the identified entities or classes by using tabular form.

4.5. Dynamic Model

The dynamic model represents the time–dependent aspects of a system. It is concerned with the temporal changes in the states of the objects in a system. In this section you are expected to document the behavior of the object model, in terms of sequence, activity and state chart diagrams.

4.5.1. Sequence Diagram

In this section, you should have to illustrate (diagrammatically) a sequential logic, in effect, and the time ordering of messages. From business process perspective. How the business model is executed?

4.5.2. Activity Diagram

In this section you are expected to illustrate graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency.

4.5.3. State Chart Diagram

Here you are expected to define different states of an object during its lifetime and these states are changed by events.

CHAPTER FIVE

5. SYSTEM DESIGN

In this chapter provide a brief overview of the design goals, current and proposed software architecture, Hardware/software mapping, Persistent data management and Access control and security.

5.3. Design Goals

The Design Goals specify the qualities of the system that should be achieved and addressed during the design of the system like the list down with pair manner as you listed non-functionality of your project.

- **User Interface and Human Factors**
- **Hardware Consideration**
- **Security Issues**
- **Performance Consideration**
- **Error Handling and Validation**
- **Quality Issues**
- **Backup and Recovery**
- **Physical Environment**
- **Resource Issues**
- **Documentation**

5.2. Current System Architecture (if any)

Current system architecture describes the architecture of the system being replaced.

5.3. Proposed System Architecture

This section presents a general view of your system architecture and briefly describes the assignment of functionality to each subsystem.

5.3.1. Subsystem Decomposition and Description

Subsystem decomposition draws and describes the decomposition into subsystems and the responsibilities of each. This is the main product of system design. Here, use **UML component diagram** to diagrammatically illustrate your components.

5.3.2. Hardware/Software Mapping

Hardware/software mapping describes how subsystems are assigned to hardware and customized components (if any). Here, use **UML deployment diagram** to diagrammatically illustrate the hardware/software mapping.

5.3.4. Detailed Class Diagram

In this section show, classes, attributes, methods, attribute data types, visibility ((Public (+), Private (-), Protected (#)) of attributes and methods), inheritance, association, aggregation, composition, dependency, and municipality (cardinality and optimality). Here, uses the UML class diagram to specify attributes and operations with their visibility information.

5.3.5. Persistent Data Management

Persistent data management describes the persistent data stored by the system and the data management infrastructure required for it. This section typically includes the description of data schemes, the selection of database, and the description of the encapsulation of the database. Here, use relational database or Object diagram if you are using object database. In this section, map class diagram to table.

5.3.6. Access Control and Security

Access control and security describes the user model of the system in terms of an access privilege. Utilize global access table, describing the access relation between the actors, objects and operations in the system. You can use tables to show the privilege assigned to each users of the system. This section also describes security issues, such as the selection of an authentication mechanism, the use of encryption, and the management of keys.

5.4. Packages

This section describes the decomposition of subsystems into packages and the file organization of the code. This includes an overview of each package, its dependencies with other packages, and its expected usage. Here, use UML package diagram to diagrammatically depict your packages.

5.5. Algorithm Design

For the elements found in architectural design define the algorithm required for each element to accomplish its tasks.

In this section, students required to include **pseudo code** format.

5.6. User Interface Design

Describe the logical characteristics of each interface between the software product and the users.

This may include sample screen images, any GUI standards or product family style guides that are to be followed, screen layout constraints, standard buttons and functions (e.g., help) that will appear on every screen, keyboard shortcuts, error message display standards, and so on. Define the software components for which a user interface is needed.

CHAPTER SIX

6. IMPLEMENTATION AND TESTING

In this chapter, discuss about implementation of database, detailed class diagram, application server, application security,

6.3. Implementation of the Database

You should choose appropriate database management system, with justified reason and should perform the following activities:

- All tables which were identified and shown as persistent model in the design document should be created with their primary keys, foreign keys, check constraints and unique constraints.
- All tables should satisfy at least third normal form
- Whenever you found appropriate, implement the following: Indexes, Views, Triggers, Stored procedures
- Configure a schedule of database backup.
- Configure database level security

6.4. Implementation of the Class Diagram

Implement all the classes on the design of your class diagram by your target programming language. Define attributes with the appropriate data type and access visibilities (private, protected, public) and implement according to the business logic. Define all methods with appropriate return type, parameters and the corresponding data types and access visibility and implement with specified logic. Document all your object code with standard comments and implement all the reports as shown on your design document.

6.5. Configuration of the Application Server

Here uses an appropriate application server for their development and clearly justified the reasons about their application server selection. Also, perform the following activities:

- Properly start and shutdown the application server.
- Organize folders and files on the server properly.

- Configure the server to work on the same machine: Able to access contents from the same machine.
- Configure the server to work on from remote machine: Able to access contents from another/remote machine.
- Separation of application server and database: E.g. Not using web development environments like WampServer.
- Configure the server to work on different port number.

6.6. Configuration of Application Security

From the security aspect of any system, students should take in to account the following tasks.

- Implement all input validations properly
- Implement encryption/deception
- Roles must be defined clearly
- User accounts must be assigned with necessary access privileges
- Sessions should be implemented.
- All none functional requirements as described in the system feature part must be checked.

6.7. Implementation of User Interface

Regarding to the user interface, students are expected to apply the following.

- The user interface must be user centered design (Place users in control of the interface)
- Reduce users' memory load
- Make the user interface consistent.

6.8. Testing

In this section and subsections, you are expected to describe which kind of testing technique you are going to apply and also should mention the test results.

- 6.8.1. Test Case**
- 6.8.2. Testing Tools and Environment**
- 6.8.3. Unit Testing**
- 6.8.4. System Testing**
- 6.8.5. Integration Testing**
- 6.8.6. Acceptance Testing**

CHAPTER SEVEN

7. CONCLUSION AND RECOMMENDATION

Matching of the conclusions with the objectives framed and fulfillment of the objectives are taking into consideration in this part. Further scope and further enhancement of the work done also indicated here.

7.3. Conclusion

The conclusion is intended to help the reader understand why your project work should matter to them after they have finished reading the paper. A conclusion is not merely a summary of the main topics covered or a re-statement of your project problem, but a synthesis of key points. For most projects, one well-developed paragraph is sufficient for a conclusion, although in some cases, a two or three paragraph conclusion may be required.

When you write a conclusion for project, always remember that you have to make a summary of the content as well as the purpose that you have in mind without looking way too wooden or dry. Most conclusions of project tend to have a couple key elements. Of course there are some tactics that you should be using if you want to write a conclusion that is effective. Plus, there are some things that you should avoid as well.

When writing the conclusion to your paper, follow these general rules:

- State your conclusions in clear, and simple language. Re-state the purpose of your study then state how your project resolve issues in the existing system and how your system is different from other related projects.
- Do not simply reiterate your results or the activities done in the entire software development life cycle.
- Indicate opportunities for future project works if you haven't already done so in the design and implementation section of your project work. Highlighting the need for further project works provides the reader with evidence that you have an in-depth awareness of the existing problem.

7.4. Recommendation

Sometimes recommendations are included with a report's conclusion, although they serve different purposes. Whereas a conclusion offers you the opportunity to summarize or review your reports main ideas, recommendations suggest actions to be taken in response to the findings of a report. You can regard recommendations as a prompt to action for your readers. As you have seen from your planning, your report structure should lead up to the recommendations and provide justification for them.

What makes a good recommendation? Effective recommendations:

- Describe a suggested course of action to be taken to solve a particular problem that can't addressed yet in the project;
- Are written as action statements without justification;
- Are stated in clear, and specific language;
- Should be expressed in order of importance (i.e. it is better to start from the most important recommendation and proceeded to others based on their significance to the clients or users of the system);
- Are based on the case built up in the body of the report; are written in parallel structure to the developed system.

A word of caution about writing recommendations: you should always consider your relationship with the reader first. If you have no authority to make recommendations, the reader may be hostile to their presence.

8. REFERENCES

List all papers, books, book sections, web sites, monographs, URLs of Internet archives or of permanent information sources, strictly as per the specific format. The references should be ordered in a convenient way. You should use consistent referencing style such as (IEEE, APA etc.).

9. APPENDICES

Appendix I: Interview and Questionnaires (if any)

Appendix II: Existing System Forms and Reports

Appendix III: Sample Source Code

NETWORKING AND SECURITY OUTLINE

CHAPTER ONE

INTRODUCTION

Reasons for studying the problem selected should be listed. Project works already done in that area should be mentioned. In here, you need to discuss about the significance of your focus area. Besides, the problem area and motivation to the need for your project work is described. Moreover, if your focus area leans on a specific organization you need to say so about the organization.

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2.2. Statement of the Problem

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2.3. Objectives of the Project

General and specific objectives of the project to be achieved by the proposed system should be discussed. Your objective should be SMART (Specific, Measurable, Achievable, Relevant and Time bounded).

2.3.1. General Objective

Your general objective should incorporate a sentence that begins with “The general objective of this project is ...”, “The main objective of this project is ...” and include the applicable area of your project work. It should be general.

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Here you are expected to analysis the project in terms whether the required technology is available or not, whether the required resources are available, Manpower- programmers, testers & debuggers, and Software and hardware.

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Operational feasibility is mainly concerned with issues like whether the system will be used if it is developed and implemented. And also, does management support the project? Are the users not happy with current business practices? Will it reduce the time (operation) considerably?

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2.4.4. Other Feasibility (if any)

In this section students are expects to discuss other feasibility issues according to the project they are going to develop like political feasibility, cultural feasibility and others.

2.5. Scope and Limitation of the Project

Here you need to define specific boundaries of your project in terms of what the project does and what the project doesn't.

2.5.1. Scope of the Project

In this section you need to describe specific boundaries of your project in terms of what the project does.

2.5.2. Limitation of the Project

In this section you need to define specific boundaries of your project in terms of what the project doesn't.

2.6. Significance of the Project

The societal and technological importance of your project should be discussed in this part.

2.7. Beneficiary of the Project

Who will benefit from the system?

2.8. Methodology of the Project

State how the requirements are gathered, the tools used for analysis and design, model, implement, test etc.

2.8.1. Literature Review

In this section you should include a critical analysis of published sources (Journals, articles and others), or **literature**, on a particular topic.

2.8.2. Data Collection Tools/Techniques

In this section you may or may not include observation, questionnaire, interview and document analysis etc.

2.8.3. Network Design

In this section you should include both logical and physical network design of your project.

2.8.4. Performance Testing Methodology

In this section you should may or may not include possible networking and security testing techniques.

2.8.5. Simulation Tools and Technologies

In this section and subsections, you should mention simulation tools and technologies.

1.9. Budget and Time Schedule of the Project

*This section and its subsections **included only** in your proposal.*

1.9.1. Budget of the Project

Here you are expected to describe all costs (Paper cost, pen, mobile card, transport, laptop or desktop cost, etc.) by using table.

1.9.2. Time Schedule of the Project

Here you are expected to describe the time schedule of your project by using the Gant chart, pert chart or any other tool.

1.10. Team Composition

Here mention the responsibility and tasks of each group members by using table. *This section **included only** in your proposal.*

1.11. Document Organization

In this section include the chapters and what it describes about.

CHAPTER TWO

2. NETWORK NEEDS ANALYSIS

This chapter focuses on analyzing the needs of designing a new computer network infrastructure or modifying the existing one in the organization. This chapter is organizing as follows; it begins with defining the data types in the first section, next to this data sources, and Numbers of Users and Priority Levels are discussed. The chapter also includes storage, transmission-speed, security and reliability requirements of the existing and proposed network infrastructures. Finally, the chapter discussed about load variation estimation and description of existing network infrastructure¹ (if exist) in the organization. The chapter gives a clear introduction to the team members about contents included in the documentation with supported examples. Then the team uses this understanding to analyze the network requirement for the proposed system for their final project.

2.1. Data Types

This section of the chapter defines what kind of data to be expected in the network to be stored, processed and transferred from one station to the other. Therefore, the team can define types of data that are processed, stored and transferred in the company network infrastructure. The types of data served by the network will be reports (annual, quarter, monthly and daily), bulletins, accounting information, student information, personnel profiles, medical history, web pages and other.

The majority of the data will be vary company to company depending on the business domain of the company; in mean while every company have a text (ASCII and non-ASCII) data, graphics, audio files and possibly huge amount of voice and video (primarily for PC-based teleconferencing, web files, and other files) data.

For example: let consider the ICT infrastructure in Tokuma IT Solutions (i.e. the company targeted to develop software for different clients and other IT related business in Ethiopia). By

¹ Measuring the existing network infrastructure of the company by all network need assessment (analysis) measures to decide whether the existing network require advancement or not.

considering this, the companies have the following data sources for the local network in the organization vicinity:

- Detail company's clients information (i.e. business requirements, term of agreements, contract letter and others)
- Human resource information of the organization
- Previous developed software to different organizations
- Inventory information of the company
- Materials that supports software development (audio files, textbooks, web files, video files and other files that supports programmers in the software development processes in the company)

2.2. Data Sources

A data source is simply the source of the data. It can be a file, a particular database on a DBMS, or even a live data feed. The data might be located on the same computer as the program, or on another computer somewhere on a network.

Data will be created as well as used at all end stations on the network (depending on the size of the organization, the organization can have a dedicated server to be a main data source for its users). The data will be produced by software applications in different operating systems and platforms, web services, different programming languages and IDEs (Integrated Development Environment) and office application software (like Microsoft Office 2016, Office365, Open Office and other), audio and video editing software (media player, adobe Photoshop, and other software). Other data sources to be supported on at least a limited basis will Window10 Accessories (Paint, 3D paint, Notepad, etc.), Video conferencing, and NetMeeting (Viber, Facebook, WeChat etc.). Therefore, the team can clearly define the data sources of the proposed network infrastructure in the organization.

2.3. Numbers of Users and Priority Levels

The Priority is derived from the impact and the urgency of accessing information in the network, based on the context of an organization. The allocation of a priority code determines how the user is being taken care of by the tool, the support staff and access to different services in the company network.

Therefore, the team can categorize users of the infrastructure into different groups based the rules and regulations of the organization and define their priority based on the organization structure, privilege level and resources in the organization.

For Example: consider the network infrastructure in the Hawassa Senior Secondary and Preparatory School. In the school network, the users will be administrators (i.e. School principal and vice-principal), secretaries, teachers, students, students'-family and other workers. The maximum estimated users on the network at any given time are 260 (i.e. 200 students, 40 teachers and 20 other users in the school).

Three priority levels will be supported: administrators and teachers (top priority), students and other workers (medium priority), and students' family (low priority). Note that these designations do not correspond to administrative levels in the school; rather, they are network service levels (i.e. services delivered to the staffs and students). Network management processes (a packages in Simple Network Management Protocol) will receive top priority service; most network processes will receive medium-priority service; a few processes (e.g., e-mail transfers, backup, web access (WWW), FTP etc.) will be given low-priority service. It should be noted that network management will usually consume a small amount of the available bandwidth; this means that management and user processes will usually enjoy identical support. Background processes will also usually receive more than adequate service, but they will be delayed as needed to maintain support for management and user services.

2.4. Transmission Speed Requirements

Since the network is transparent to all users of the organization, the team is expected to calculate the network bandwidth requirements for both LAN and WAN in the organization. To estimate the bandwidth requirements of the organization properly, the team can consider the number of issues that have a direct impact to the network infrastructure of the organization. Some of the issues are listed below:

- Number of users
- Applications that can be accessed through connection (i.e. could the company access any forms of cloud services)
- File transfers

- Quality of service
- Voice, video and data transmissions percentage
- Live data transmission facilities and services
- Frequency to access remote servers for executing a business transaction (i.e. transaction dependencies on remote servers).

For example: consider network infrastructure in the Hawassa Referral Hospital (suppose the hospital have one thousand students, three hundred staffs both academic and administrative, researchers and clients of the hospital). The hospital could provide email, video and audio file accesses, web accesses, social network sites accesses, communication, application download, uploads, accesses hospital specific system and other services.

By considering the number of staffs, researchers and students of the organization and services that are deliver to them, the capacity of the sole internet service provider in the country and budget of the organization. The following bandwidth requirement is enough to properly meet the needs the hospital community:

Every student and instructors (staffs) require 0.1 mbps and 0.5mbps of WAN data transmission rate respectively to access an internet service in the hospital to access all services in well-suited manner. This network estimation is done by considering staffs are exist in a highest priority level to access all the above-mentioned services. Therefore, the total bandwidth requirement to the hospital will be the multiply of individual requirement with the total number of students and staffs in the hospital (i.e. $1000*0.1\text{mbps} + 300*0.5\text{mbps} = 350 \text{ mbp}$).

2.5. Load Variation Estimates

Load forecasting (estimation) plays a key role in helping the company to advance a network service and to make important decisions on network users and its priority, load switching, network re-configuration, infrastructure development, purchasing and installing new hardware and software to enhance a network services to its clients. In order to determine the network load it is better to study for long period (i.e. to know the network access history), accesses the organization ICT policy to know the current stand and to propose the future network (bandwidth) requirement of the organization.

Therefore, the team can define the network load (usage) variation in the organization in different day and time interval. In order to determine the users' characteristics (network access) the team can conduct a series of studies (i.e. collect necessary data to reach some conclusion about load variation) in the organization. The team may also conduct interviews, uses networking tools in order to know users access history and observing the LAN of the organization at different days and time intervals.

For Example: Let consider network infrastructure in the Hawassa City Municipality. The following cases can be considered:

- ❖ The data indicate that the highest average traffic volume will occur from 8:30 a.m. to 5:00 p.m., Monday to Friday (since it is the normal working hours of the Municipality offices in the city).
- ❖ The network traffic reaches a peak volume at two times during the working days of the organization: 9:00 a.m. to 12:00 p.m. and 2:30 p.m. to 5:00 p.m.
- ❖ At nighttime and weekends, the network traffic is minimal except for the daily backups of the PCs to the LAN servers in the districts and several batch data transfers anticipated from the State Office.

The data indicate the following network design parameters:

- ❖ The average required throughput on any LAN during working hours (8:00 a.m. to 6:00 p.m.) will be only about 10 mbps.
- ❖ The average required throughput on the WAN during working hours (8:00 a.m. to 6:00 p.m.) will be only 0.5 mbps.
- ❖ The peak expected traffic load on any LAN would be about 100 mbps.
- ❖ The peak expected traffic load on the WAN would be about 2.5 mbps.

Of course, to avoid user complaints, the network will be designed for the average of peak traffic loads and the average throughput requirements of the organization.

2.5. Storage Requirements

Storage requirement is all about knowing and determining the requirements, or making your best educated guess when you cannot know for sure. Factors to consider include potential data

storage requirements of future projects and tier(s) of storage. Tiered storage allows less frequently accessed items to be moved to a lower (and less costly) tier, freeing faster (and more expensive) tiers for those applications that need it. Techniques like data de duplication and file compression can help reduce the amount of storage capacity needed by eliminating extra copies of the same file and reducing the amount of space needed to store files and images [13]. The following issues could also be taking into consideration in predicting organization storage requirement [14]:

- ❖ Business Continuity Planning Process (BCP) /Disaster Recovery (DR): so that technical recovery strategies are tightly coupled to the business continuity objectives, and hence enterprise risk management.
- ❖ Record keeping and archival management: so that storage solutions are optimized in parallel with a long-term view of information management in the organization.
- ❖ Operations management: storage solutions can consider the memory requirements to run day-to-day business transaction in the organization.

Consequently, the team can estimate storage requirements to the proposed network infrastructure to meet the organizational objectives and users' requirements by considering the above-mentioned issues in storage requirement prediction for the companies. In addition, the team also defines the memory technologies (i.e. level of tiers, storage types and technologies) and individual storage device sizes that can be configured in the network to meet the objectives.

Example: consider the network infrastructure in the university, the storage requirements need to be large enough to store all students, instructors, and other required data (note: student data are data about students, not data generated by students). By considering, the current trends in the storage requirements for holding students and teachers' data indicate that teachers and students will need an average of 500 MB and 100MB of server space respectively. In addition, the university storage requirement can also consider for Departments, Faculties, college and Institutes, registrar and other offices in the university. The maximum estimated server-side storage requirement for any user cannot exceed 1 GB.

Additionally, the network operating system will occupy about 50GB on each LAN server. Considering price-performance issues, each PC will have a minimum storage capacity of 500GB;

each LAN server will have a minimum storage capacity of 12TB. A main data server in the registrar Office will have a 36 TB capacity. It is easy to calculate the total memory requirements for the entire network (i.e. multiplying total number of students and instructors with their storage assignment in the network). Nevertheless, the memory requirement cannot only dependent on the current students; but it also considers the future expansion of the university and university alumni records too.

2.6. Reliability Requirements

Reliability is an attribute of any computer-related component (software, or hardware, or a network, for example) that consistently performs according to its specifications. It has to be considering one of three related attributes (i.e. reliability, availability, and serviceability) that must be taken into consideration when making, buying, or using a computer product or component.

Since, network reliability plays a major role in developing network functionality. The network monitoring systems and network devices are necessary for making the network reliable in the organization. The network monitoring systems detects and identifies the network problems (i.e. there are a number of tools and hardware devices used for this purpose). The network devices ensure that the data reaches the appropriate destination with a predefined reliability set by the organization IT experts.

The reliability of the network is measured by following factors:

- ❖ Frequency of failure - determines how frequently the network fails. This issue mainly focuses on the repetition of network/service failures in the organization network infrastructure due to many reasons.
- ❖ Recovery time - it is the time taken by a device or network to recover from the failure. It also includes the human capital of the organization that maintains the network facilities in the company.
- ❖ Catastrophe - network must be protected from the disasters such as fire, earthquake and other natural/manmade disasters.

Therefore, the team is could clearly specifies the minimum network reliability requirements for both LAN and WAN based on the above criteria's and consider other national and international

network reliability standards. This activity requires a deep understanding of the company ICT policy (if exist), its business requirements and their future expansion.

Example: To kuma Broadcasting Organization wants to upgrade the existing network facility in the organization. The Bid document specifies that, the organization wants to broadcast its Radio Programs in live streaming to its audiences throughout the globe. The following minimum network requirement is needed to meet the organization objectives:

- ❖ The LANs are expected to operate at 99 % and the WAN is expected to operate at 95% uptime and an undiscovered error rate of 1% and 2% for LAN and WAN respectively.
- ❖ Both LAN and WAN networks could works properly in the organization broadcasting hours (i.e. the broadcasting organization may have at least two modes of data accesses to the Internet Service Provider).
- ❖ The network could have a replica servers in other places to keep the company data save and reliance to any kind of catastrophes.

2.7. Security Requirements

Network security consists of the policies and practices adopted to prevent and monitor unauthorized access, misuse, modification, or denial of a computer network and network-accessible resources. Network security involves the authorization of access to data in a network, which is controlled by the network administrator. Network security covers a variety of computer networks, both public and private, that are used in everyday jobs; conducting transactions and communications among businesses, government agencies and individuals. Network security is involved in organizations, enterprises, and other types of institutions. The most common and simple way of protecting a network resource is by assigning it a unique name and a corresponding password.

Therefore, the team first studies the existing network security standards, policies and guidelines in the organization. Then, the team can briefly specifies what kind of network security measures to be implemented in the newly network infrastructure by considering current security trends and organizational business objectives. Some of the security measures that can be used in the company are:

- ❖ A firewall will be used to control threats from the outside world; therefore, the internal network is entirely secure from some unauthorized users (i.e. hackers and crackers).
- ❖ Part of the security will be Users accounts and passwords that will give limited access. There will be different access capabilities for network managers and users.
- ❖ Implement physical security (like biometric identification systems, installing alarm and fire controlling systems, CCTV system to manage activities in the centers etc.) strategies for data centers and server rooms in order to secure the core services from any kind of physical security challenges.

CISCO, a prominent network appliance manufacture, proposes a general security checklist that can be taken into consideration in order to design and implement secure network infrastructure in the organization. For detail, please refer the appendix five.

General Security Planning Tips [15]

The following tips can help you develop and win support for an effective network security plan:

- Focus on return on value rather than return on investment. Consider the harm a network security breach could do to your business, such as lost revenue or customer litigation (legal actions).
- Never assume that network attacks will come only from outsiders.
- Do not be tempted to confront security concerns with a gradually approach rather than a single, unified strategy that protects your whole network.
- Work with others in your company to develop and roll out security strategies, focusing on technology, training, and physical site security with tools like surveillance cameras.
- Find the right balance between security and usability.

2.8. Existing Network

The team can study the status of computer network infrastructure in the organization. When the organization has a network infrastructure, the team is expected to specify why the new network design is required regarding different parameters that need change in the company network infrastructure. Like:

- Changes in services in the organization: the company could provide new services to its customers to meet the interest.
- Changes in computer networking and infrastructure technologies (i.e. advancements in wireless and mobile phone needs changes the access ways and interfacing facilities to the existing system)
- Service year of the entire network: the network facility may require an upgrade due to it is the planned service is over.
- Clients (users) satisfaction: the measures of user's satisfaction changes dramatically time to time. Therefore, it is necessary make changes on the company network infrastructure to meet user's need from the system.
- Number of users' increases: companies design the network infrastructure by considering its users and its budget. Therefore, the company could upgrade the network infrastructure in order to provide acceptable services to clients based on national and international standards.
- Advancements in network security: since security is one of a critical issue in network services. Therefore, companies can adapt changes in security to secure their day-to-day business transaction and secure their clients information.
- Policy changes: either national or organizational level ICT policy changes due to different reasons have a great impact to upgrade the existing network infrastructure in the company.

CHAPTER THREE

3. Logical Network Design

This chapter is focus on activities required in order to perform a logical network design. Designing a network topology is the first step in the logical design phase of the top-down network design methodology. To meet a customer's goals for scalability and adaptability, it is important to architect a logical topology before selecting physical products or technologies. During the topology design phase, you identify networks and interconnection points, the size and scope of networks, and the types of internetworking devices that will be required, but not the actual devices.

The chapter also provides guidelines for assigning addresses and names to internetwork components, including networks, subnets, routers, servers, and end systems. The section mainly focuses on Internet Protocol (IP) addressing and naming devices in the organization network.

The third section of this chapter is to help you select the right switching and routing protocols for your network design customer. The selections you make will depend on your customer's business and technical goals. In order to select appropriate switching and routing protocols you could consider the following attributes: network traffic characteristics, bandwidth, memory, and CPU usage, the approximate number of peer routers or switches supported, the capability to adapt changes in an internetwork and the capability to authenticate route updates for security reasons.

Developing security strategies that can protect all parts of a complicated network while having a limited effect on ease of use and performance is one of the most important and difficult tasks related to network design. To help you handle the difficulties inherent in designing network security for complex networks, this fourth section of this chapter teaches a systematic, top-down approach that focuses on planning and policy development before the selection of security products.

The last section of the chapter concludes the discussion of logical network design. Network management is one of the most important aspects of logical network design. Management is often overlooked during the design of a network because it is considered an operational issue

rather than a design issue. If you consider management from the beginning, however, you can avoid scalability and performance problems that occur when management is added to a design after the design is complete.

3.1. Designing a Network Topology

CISCO advises network engineers to use a hierarchical model in order to design a network topology. Campus network design topologies should meet a customer's goals for availability and performance by featuring small bandwidth domains, small broadcast domains, redundancy, mirrored servers, and multiple ways for a workstation to reach a router for off-net communications. The networks should be designed using a hierarchical, modular approach so that the network offers good performance, maintainability, and scalability.

The network can consist of access, distribution, and core layers; these layers are critical in order to meet organizational objectives and it has specific role in the network.

Guidelines to design a network topology:

- Split the entire network into different virtual LANs groups
- Identify areas that are suitable for wireless LAN
- Positioning a wireless access point for maximum coverage
- Check areas that require redundant wireless access points and/or wired LANs
- Check server redundancies for company critical services to guarantee the availability of the services to the clients
- Planning for physical security
- Meeting security goals with firewall topologies

If necessary, implement Virtual private networks (VPN), it uses advanced encryption and tunneling to permit organizations to establish secure, end-to-end, private network connections over a third-party network.

- Redundant WAN Segments: since WAN links can be critical pieces of an enterprise internetwork, redundant (backup) WAN links are often included in an enterprise edge network topology.

By applying the above guidelines, the team designs a network topology for the company by considering the company's business objectives (i.e. stated in the first chapter of this documentation) and budget.

3.2. Designing Models for Addressing and Numbering

It is critical issue to use structured model for network layer addressing and naming. Without structure, it is easy to run out of addresses, waste addresses, introduce duplicate addresses and names, and use addresses and names that are hard to manage. To meet a customer's goals for scalability, performance, and manageability, you should assign addresses and names systematically. Therefore, as network designers, the group could develop policies and procedures for addressing and naming for the proposed network infrastructure. The policies and procedure could consider the guidelines given below for network layer addresses and naming devices in the network.

Guidelines for Assigning Network Layer Addresses:

Network layer addresses should be planned, managed, and documented. Although an end system can learn its address dynamically, no mechanisms exist for assigning network or subnet numbers dynamically. The following list provides some simple rules for network layer addressing that can help you architect scalability and manageability into a network design.

- Design a structured model for addressing before assigning any addresses.
- Leave room for growth in the addressing model.
- Assign blocks of addresses in a hierarchical fashion to foster good scalability and availability.
- Assign blocks of addresses based on the physical network, not on group membership, to avoid problems when groups or individuals move.
- If the level of network management expertise in regional and branch offices is high, you can delegate authority for addressing regional and branch-office networks, subnets, servers, and end systems.
- To maximize flexibility and minimize configuration, use dynamic addressing for end systems.

- To maximize security and adaptability, use private addresses with Network Address Translation (NAT) in IP environments.

Guidelines for Assigning Names:

- To maximize usability, names should be short, meaningful, unambiguous, and distinct.
- A good practice is to include in a name some sort of indication of the device's type. For example, you can prefix or suffix router names with the characters *rtr*, switches with *sw*, servers with *svr*, and so on.
- Using meaningful prefixes or suffixes decreases ambiguity for end users and helps managers, more easily extract device names from network management tools.
- Names can also include a location code.
- Try to avoid names that have unusual characters, such as underscores, ampersands, asterisks, and so on, even if the naming protocol allows these characters.
- It is also best if names are not case-sensitive because people usually cannot remember which case to use.
- You should also avoid spaces in names.
- If a device has more than one interface and more than one address, you should map all the addresses to one common name.

3.3. Selecting Switching and Routing Protocols

This section describe the characteristics to be considered in order to select an appropriate switching and routing protocols for the proposed network. The selections you make will depend on your customer's business and technical goals. To match options with goals, you can make a decision table, a decision table that matches routing protocols to a fictional customer's business and technical goals.

For example: let see the following decision table for routing algorithms and organization objectives.

Critical Goals	Other Goals
----------------	-------------

Protocols	Adaptability ²	Must scale to a large size	Industry standard ³	Not create a lot of traffic	Run on inexpensive routers	Easy to configure and manage
BGP	X	X	X	8	7	7
OSPF	X	X	X	8	8	8
IS-IS	X	X	X	8	6	6
IGRP	X	X				
EIGRP	X	X				
RIP			X			

After a decision has been made, you should troubleshoot the decision. Ask yourself the following:

- If this option is chosen, what could go wrong?
- Has this option been tried before (in other customers)? If so, what problems occurred?
- How will the customer react to this decision?
- What are the contingency plans if the customer does not approve of the decision?

This decision-making process can be used during both the logical and physical network design phases. You can use the process to help you select protocols, technologies, and devices that will meet a customer's requirements. Therefore, the team develops a company specific decision table (i.e. company business objectives with routing algorithms) for selecting an appropriate switching and routing protocols for the proposed infrastructure. For the detail information about routing algorithms, please see appendix six that shows the comparison of different routing algorithms mostly used by routers.

3.4. Developing Network Security Strategies

Following a structured set of steps when developing and implementing network, security will help you address the varied concerns that play a part in security design. Many security strategies have been developed in a haphazard way and have failed to actually secure assets and to meet a

² Adaptability must adapt to changes in a large internetwork within seconds

³ Must be an industry standard and compatible with existing equipment

customer's primary goals for security. Breaking down the process of security design into the following steps will help you effectively plan and execute a security strategy:

- Identify network assets.
- Analyze security risks.
- Analyze security requirements and tradeoffs.
- Develop a security plan.
- Define a security policy.
- Develop procedures for applying security policies.
- Develop a technical implementation strategy.
- Achieve buy-in from users, managers, and technical staff.
- Train users, managers, and technical staff.
- Implement the technical strategy and security procedures.
- Test the security and update it if any problems are found.
- Maintain security.

Performing required tasks in every step by considering organizational objectives and security tradeoff (i.e. each security methods have its own tradeoffs) with respected to the current business transaction of the organization. The successful completion each steps in security design, starting from identifying network assets, becomes an input for the proceeding steps in the processes, so as a team, careful design and operation of tasks is necessary. Some of the activities have an output documents that supports how the system to be successfully accomplished in the ongoing tasks done by the organization.

Before designing a security policy document to the organization, tasks like identify network assets, analyze security risks, analyze security requirements, tradeoffs, and developing a security plan designed could be accomplished successfully. Because the activities that are done in those steps are used as inputs for the proper security policy designs. In addition, security design document is also including the following security parameters:

- An access policy that defines access rights and privileges of users in the network. The access policy should provide guidelines for connecting external networks, connecting devices to a network, and adding new software to systems. An access policy might

also address how data is categorized (for example, confidential, internal, and top secret).

- An accountability policy that defines the responsibilities of users, operations staff, and management. The accountability policy should specify an audit capability and provide incident-handling guidelines that specify what to do and whom to contact if a possible intrusion is detected.
- An authentication policy that establishes trust through an effective password policy and sets up guidelines for remote-location authentication.
- A privacy policy that defines reasonable expectations of privacy regarding the monitoring of electronic mail, logging of keystrokes, and access to users' files.
- Computer-technology purchasing guidelines that specify the requirements for acquiring, configuring, and auditing computer systems and networks for compliance with the policy.

This security policy document will be a benchmark to perform a security related tasks in the organization to meet the company objectives. This document also considers the possible security mechanisms to be used in order to achieve security goals of the client in the proposed network infrastructure to the organization.

Security experts promote the security defense in depth principle. This principle states that network security should be multilayered, with many different techniques used to protect the network. Because there is, a security mechanism can be guaranteed to withstand every attack. Therefore, each mechanism should have a backup mechanism⁴.

As part of implementing security defense in depth, security design should be modular just like the network design. Multiple security methods should be designed and applied to different parts of the network, whether it is the internet connection, the wireless infrastructure, server farms, user services or the remote-access component.

⁴ The backup security mechanisms are critical issues in the design of a secure systems, because the attacker and attacking mechanism in the network is changing dynamically.

3.5. Developing Network Management Strategies

Network management is one of the most important aspects of logical network design. A good network management design can help an organization achieve availability, performance, and security goals. Effective network management processes can help an organization measure how well design goals are being met in working environment and adjust network parameters if these goals are not being met.

Network management also facilitates meeting scalability goals because it can help an organization analyze current network behavior, apply upgrades appropriately, and troubleshoot any problems with upgrades. The goal of this section is to help the team to design network management strategies and to help the team to select the right tools and products to implement the strategies.

Most clients have a need to develop network management processes (it also true for the team network project) that can help them manage the implementation and operation of the network, diagnose and fix problems, optimize performance, and plan enhancements. The International Organization for Standardization (ISO) defines five types of network management processes, which are often referred to with the FCAPS acronym:

- **Fault management:** refers to detecting, isolating, diagnosing, and correcting problems. It also includes processes for reporting problems to end users and managers, and tracking trends related to problems. In some cases, fault management means developing workarounds until a problem can be fixed. Monitoring tools are often based on the Simple Network Management Protocol (SNMP) and Remote Monitoring (RMON) standards.
- **Configuration management:** helps a network manager keep track of network devices and maintain information on how devices are configured. With configuration management, a network manager can define and save a default configuration for similar devices, modify the default configuration for specific devices, and load the configuration

on devices. It also lets a manager maintain an inventory of network assets and do version-logging⁵.

- **Accounting management:** facilitates usage-based billing, whereby individual departments or projects are charged for network services. Even in cases in which there is no money exchange, accounting of network usage can be useful to catch departments or individuals who “abuse” the network. The abuse could be intentional or unintentional.
- **Performance management:** allows the measurement of network behavior and effectiveness. It includes examining network application and protocol behavior, analyzing reachability, measuring response time, and recording network route changes. It facilitates optimizing a network, meeting service-level agreements (SLA), and planning for expansion.
- **Security management:** lets a network manager maintain and distribute passwords and other authentication and authorization information. It includes processes for generating, distributing, and storing encryption keys. It can also include tools and reports to analyze a group of router and switch configurations for compliance with site security standards. It is a process for collecting, storing, and examining security audit logs.

After you have discussed high-level network management processes with your customer, and developed network management architecture, you can make some decisions on which network management tools and protocols to recommend to your customer.

When selecting management tools, consider the flexibility of the tools and the varied audiences that may interface with them. Network management tools⁶ should provide an intuitive user interface that can react quickly to user input. In many cases, having both a browser interface and command-line interface (CLI) is beneficial.

If the tools allow dynamic configuration of devices, configuration changes should take effect without requiring a reboot of the device. Management software should also check the validity of any configuration changes and automatically restore operation to the last known configuration or

⁵ Version-logging refers to keeping track of the version of operating systems or applications running on network devices.

⁶ Popular network management tools are Simple Network Management Protocol (SNMP), Remote Monitoring (RMON), Cisco Discovery Protocol (CDP), and Cisco Netflow Accounting.

software image in case of error. Management software that supports the dynamic configuration of devices should require authentication to avoid an unauthorized user making changes.

After you have determined which management protocols will be used, you can estimate the amount of traffic caused by network management. When the management protocol is selected, you should determine which network and device characteristics will be managed.

CHAPTER FOUR

4. Physical Network Design

Physical network design involves the selection of LAN and WAN technologies for campus (organization) network design. During this phase of the network design process, choices are made regarding cabling, physical and data link layer protocols, and internetworking devices (such as switches, routers, and wireless access points). A logical design, which Chapter III, “Logical Network Design,” covered, forms the foundation for a physical design. In addition, business goals, technical requirements, network traffic characteristics, and traffic flows influence a physical design.

A network designer/team has many options for LAN and WAN implementations. No single technology or device is the right answer for all circumstances (i.e. an appropriate device and configuration selection is always dependent on the organization business objectives). The goal of this chapter is to give you (team) information about the scalability, performance, affordability, and manageability characteristics of typical options, to help you make the right selections for your particular client.

An effective design process is to develop organization network solutions first, followed by remote access and WAN solutions. After you have designed a client’s network, you can more effectively select WAN and remote-access technologies based on the bandwidth and performance requirements of traffic that flows from one junction in the network to the other junctions.

This chapter begins with a discussion of LAN cabling-plant design, including cabling options for building and organization networks. The chapter then provides information about LAN technologies. The next section provides some selection criteria you can use when selecting switches, routers, and wireless access points for a network design.

4.1. LAN Cabling Plant Design

It is important to design and implement the cabling infrastructure carefully, keeping in mind availability and scalability goals, and the expected lifetime of the design. In many cases, your

network design must adapt to existing cabling. Documenting cabling specification could include the following issues:

- Campus- and building-cabling topologies
- Types and lengths of cables between buildings
- Types and lengths of cables for vertical cabling between floors
- Types and lengths of cables for horizontal cabling within floors
- Types and lengths of cables for work-area cabling going from telecommunications closets to workstations

Cabling Topologies

- A centralized cabling scheme terminates most or all of the cable runs in one area of the design environment. A star topology is an example of a centralized system. This cabling topology is suitable for small networks.
- A distributed cabling scheme terminates cable runs throughout the design environment. Ring, bus, and mesh topologies are examples of distributed systems. These cabling topologies are suitable for medium and large network.

Company's network implementations use three major types of cables; these are shielded copper (including shielded twisted-pair (STP), coaxial (coax), and twin axial (twinax) cables), unshielded copper (typically UTP) cable and fiber-optic cables. The cable selection could consider properties of network cables, budget of the organization, and geographic span of the network and future expansion of the organization.

4.2. LAN Technologies

After analyzing the business constraints and objectives of the client organization you could know the issues that could be considered in order to select an appropriate networking (LAN) topology (topologies) that meets the needs of the organization. The following issues could affect LAN topology selection:

- Biases (technology religion)
- Policies about approved technologies or vendors
- The customer's tolerance to risk

- Technical expertise of the staff and plans for staff education
- Budgeting and scheduling

In addition, to the above mentioned issues in LAN topology selection the team also consider technical goals of the organization. Technical goals have a direct impact on how the proposed LAN can meet scalability, availability, manageability, adaptability, affordability, and other technical issues.

The team should consider clients strict requirements about throughput, delay, and delay variation for any network applications. The team should also consider the types of applications the customer plans to run on the network. Applications that allow users to share videos, collaborate with desktop sharing, watch high-definition television, and so on are more bandwidth hungry and delay sensitive than text-based applications.

4.3. Ethernet Technology Choices

Ethernet is a scalable technology that has adapted to increasing capacity requirements. The following options for implementing Ethernet networks are available:

- Half- and full-duplex Ethernet
- 100-Mbps Ethernet
- 1000-Mbps (1-Gbps or Gigabit) Ethernet
- 10-Gbps Ethernet
- Metro Ethernet
- Long-Reach Ethernet (LRE)
- Cisco EtherChannel

Each of these technologies is a possibility for the access, distribution, or core layers of a campus topology, although usually the higher speeds, such as Gigabit Ethernet, are reserved for the core layer.

The choice of an Ethernet technology for the access layer depends on the location and size of user communities, bandwidth and Quality of Service (QoS) requirements for applications, broadcast and other protocol behavior, and traffic flow. The choice of an Ethernet technology for

the distribution and core layers depends on the network topology, the location of data stores, and traffic flow.

4.4. Selecting Internetworking Devices for a Organization Network Design

After team has designed a network topology and made some decisions about the placement and scope of shared, switched, and routed network segments, you should then recommend actual switches, bridges, and routers from various vendors. Please refer a review of the major differences between internetworking devices that can be used to connect network segments in appendix eight.

General Criteria for Selecting Internetworking Devices: selecting internetworking devices general criteria include the following:

- Number of ports
- Processing speed
- Amount of memory
- Amount of latency introduced when the device relays data
- Throughput in packets per second
- Ingress/egress queuing and buffering techniques
- LAN and WAN technologies supported
- Autosensing of speed (for example, 10 or 100 Mbps)
- Auto-detection of half- versus full-duplex operation
- Media (cabling) supported
- Ease of configuration
- Cost
- Manageability (for example, support for Simple Network Management Protocol [SNMP] and Remote Monitoring [RMON], status indicators)
- Mean time between failure (MTBF) and mean time to repair (MTTR)
- Support for packet filters and other security measures
- Support for hot-swappable components
- Support for in-service software upgrades
- Support for redundant power supplies
- Support for optimization features

- Support for QoS features
- Availability and quality of technical support
- Availability and quality of documentation
- Availability and quality of training (for complex switches and routers)
- Reputation and viability of the vendor
- Availability of independent test results that confirm the performance of the device

These criteria are applicable for any kind of interconnecting devices (i.e. router, switch, hub or bridge). However, each interconnecting devices have their own specific specification that can be taking in to consideration to select an appropriate device to meet the objective of the organization.

Therefore, the team could analyze the advantages and disadvantages of internetworking devices with respected to the organizational objectives and budget before deciding which devices can be purchased and installed in the proposed network.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

Summarize the major contributions, evaluating the current position, and pointing out flaws in methodology, gaps in the research, contradictions, and areas for further study.

Recommendation

Sometimes recommendations are included with a report's conclusion, although they serve different purposes. Whereas a conclusion offers you the opportunity to summarize or review your report's main ideas, recommendations suggest actions to be taken in response to the findings of a report. You can regard recommendations as a prompt to action for your readers. As you have seen from your planning, your report structure should lead up to the recommendations and provide justification for them.

What makes a good recommendation? Effective recommendations:

- Describe a suggested course of action to be taken to solve a particular problem that can't addressed yet in the project;
- Are written as action statements without justification;
- Are stated in clear, and specific language;
- Should be expressed in order of importance (i.e. it is better to start from the most important recommendation and proceeded to others based on their significance to the clients or users of the system);
- Are based on the case built up in the body of the report; are written in parallel structure to the developed system.

A word of caution about writing recommendations: you should always consider your relationship with the reader first. If you have no authority to make recommendations, the reader may be hostile to their presence.

ARTIFICIAL INTELLIGENCE OUTLINE

PART I: EXPERT SYSTEM

An expert system is a software system that attempts to reproduce the performance of one or more human experts, most commonly in a specific problem domain, and is a traditional application and/or subfield of artificial intelligence. A wide variety of methods can be used to simulate the performance of the expert however common to most or all are

- The creation of a so-called "knowledgebase" which uses some knowledge representation formalism to capture the subject matter experts (SME) knowledge and
- A process of gathering that knowledge from the SME and codifying it according to the formalism, which is called knowledge engineering. Expert systems may or may not have learning components but a third common element is that once the system is developed it is proven by being placed in the same real world problem solving situation as the human SME, typically as an aid to human workers or a supplement to some information system.

CHAPTER ONE

1. INTRODUCTION

(Similar to Software Development outline)

2. LITERATURE REVIEW

The majority of literature used should be from peer-reviewed, international journals and should be from recent years. However, in such cases where scarce literature exists, using old (past 5-10 years) literature may be appropriate. Also if there is a ‘classical’ reference, you should mention it. Try to use primary sources of literature, which originally proposed the main idea. Do not use internet-sources, which are not reliable.

2.1. Subheading 1

TextTextTextTextTextTextTextTextTextTextTextTextTextTextTextTextTextText
TextTextTextTextTextTextTextTextTextTextTextTextText(Ranzijn et al., 2009)

2.2. Sub heading 2

If you use abbreviations extensively in your thesis, you must include a list of abbreviations and their corresponding definitions. For example, if the following abbreviations have been used: AIDS, RAM, ROM, DOS, FTP, HTML, BDU, and BIT. Make sure they are listed under lists of abbreviations.

[illegible]

If the Table and figures are reviewed and adopted in the literature review, forexample, include the following table as:

Table 0:1Migration Summary - State and Territory 2013-2014

	Net Overseas Migration (NOM)	Net Interstate Migration (NIM)	Net migration
State or territory	no.	no.	no.
NSW	73 300	-6 857	66 443
Vic.	59 358	8 783	68 141
Qld	30 270	5 753	36 023
SA	11 166	-2 968	8 198
WA	32 270	1 045	33 315
Tas.	1 322	-1 168	154
NT	2 983	-3 344	-361
ACT	2 017	-1 244	773
Australia	212 695	-	212 695

Note: Adapted from "Migration, Australia, 2013-14 (No 3412.0)," by the Australian Bureau of Statistics, 2015. Copyright 2015 by the Australian Bureau of Statistics.

2.3. Sub heading..... n

CHAPTER THREE

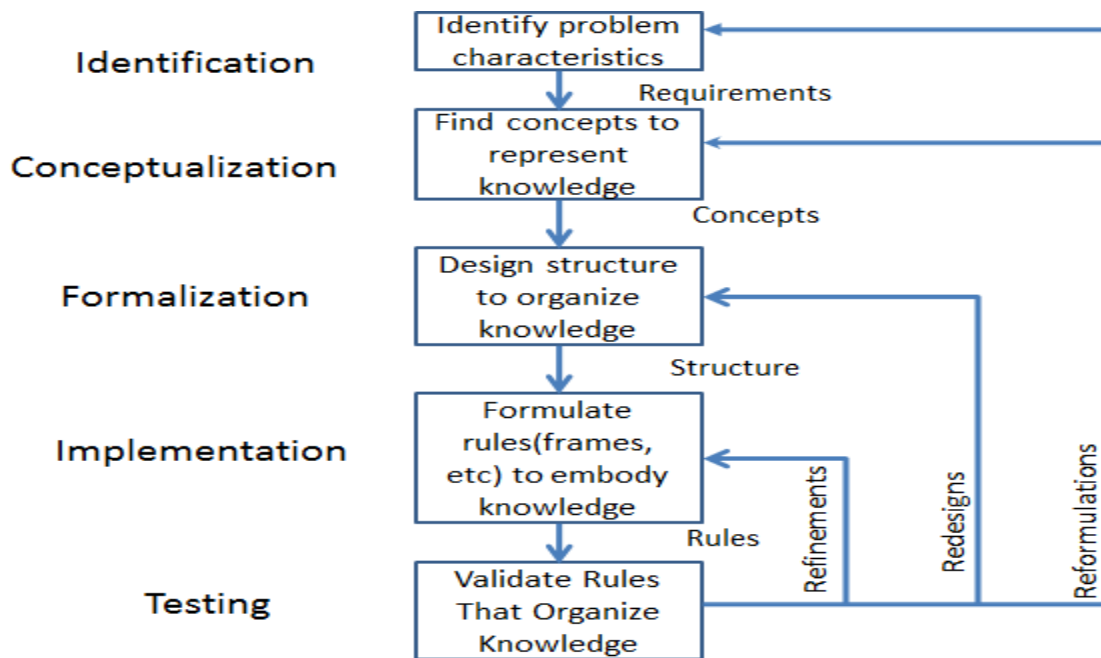
3. KNOWLEDGE ACQUISITION

3.1. Introduction

In this section students are expected to give an overview of what has been said, what are the prevailing theories and hypotheses, what questions are being asked, and what methods and methodologies are appropriate and useful. As such, it is not in itself primary research, but rather it reports on other findings.

3.2. Steps in Knowledge Acquisition

Knowledge acquisition is not an easy task. It includes identifying the knowledge, representing the knowledge in a proper format, structuring the knowledge, and transferring the knowledge to a machine. In this section students are expected to discuss more detail about knowledge engineering process, source of knowledge acquisition both primary and secondary sources.



3.3. Conceptual Modeling

A conceptual model is a representation of a system, made of the composition of concepts which are used to help people know, understand, or simulate a subject the **model** represents. It is also a set of concepts.

3.4. Concepts in the choice of (for example drugs to THYPHOID AND MALARIA patients)

3.4.1. Pregnancy

3.4.2. Tuberculosis

3.4.3. Renal Failure (kidney)

3.4.4. Hepatic Failure (liver)

CHAPTER FOUR

4. KNOWLEDGE REPRESENTATIONS

4.1. Introduction

In this section you are expected to introduce about the chapter like explanation facility, system control structure and assignment of certainty factors.

4.2. The Knowledge Base

In this section you should discussed about a technology used to store complex structured and unstructured information used by a computer system.

4.3. The Explanation Facility

4.4. System's Control Structure

4.5. Assignment of Certainty Factors

CHAPTER FIVE

5. KNOWLEDGE APPLICATION PHASE

5.1. User Interface

A good user interface provides a "user-friendly" experience, allowing the user to interact with the software or hardware in a natural and intuitive way.

5.2. Testing and Evaluation

In this section students are expected the possible testing and evaluation criteria in detail.

5.3. Issue of Integration into other ES and Conventional system

5.4. Knowledge Base Maintenance

5.5. Design Requirements

CHAPTER SIX

6 CONCLUSION AND RECOMMENDATION

9.3. Conclusion

Summarize the major contributions, evaluating the current position, and pointing out flaws in methodology, gaps in the research, contradictions, and areas for further study.

9.4. Recommendation

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PART II: RESEARCH PROJECT

In this section students are expected to write research project like machine learning, Artificial intelligence and Natural Language processing related project should follow the following outlines.

CHAPTER ONE

1. INTRODUCTION

(Similar to Software Development Module)

CHAPTER TWO

2. LITERATURE REVIEW

The literature review is chapter two. It should be a critical analysis of relevant existing knowledge on the research topic. It includes the strengths, the limitations and gaps of previous studies. The literature review should be relevant with recent citations on the topic. Citations within the past five years are ideal and generally considered current. Citations ten years and older should be used carefully and only when necessary. Unpublished documents and lay sources like encyclopedias are strictly discouraged. This is done by the student carefully tracking and referencing each and every document used.

The majority of literature used should be from peer-reviewed, international journals and should be from recent years. However, in such cases where scarce literature exists, using old (past 5-10 years) literature may be appropriate. Also if there is a ‘classical’ reference, you should mention it. Try to use primary sources of literature, which originally proposed the main idea. Do not use internet-sources, which are not reliable.

The literature review might have number of sub divisions as:

a. Subheading 1

[illegible]

TextTextTextTextTextTextTextTextTextTextTextTextTextTextTextTextTextText
TextTextTextTextTextTextTextTextTextTextTextTextText(Ranzijn et al., 2009)

b. Sub heading 2

If you use abbreviations extensively in your thesis, you must include a list of abbreviations and their corresponding definitions. For example, if the following abbreviations have been used:

AIDS, RAM, ROM, DOS, FTP, HTML, BDU, and BIT. Make sure they are listed under lists of abbreviations.

If the Table and figures are reviewed and adopted in the literature review, forexample, include the following table as:

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Tas.	1 322	-1 168	154
NT	2 983	-3 344	-361
ACT	2 017	-1 244	773
Australia	212 695	-	212 695

c. Sub heading..... n

CHAPTER THREE

3. METHODOLOGY

It describes precisely what will be done and how it will be done, what data will be recorded, the proposed tools or instruments to be used in data collection and the methods of analyzing the data.

In this chapter, the student should give clear, specific, appropriate and credible procedures that will be followed to attain the proposed objectives of the study. The research design planned for use should be clearly stated. The research methods should be appropriate to the problem area, i.e., the statement of the problem, the objectives and the hypotheses. The student should also address the methods of data collection, data quality control and methods of data analysis.

This chapter of the work should cover the materials that were used required for the experiments and the different procedures and protocols followed. Experimental designs and methods of statistical analyses should be mentioned.

Clearly state the controls, treatments and design of the experiment. Someone should be able to repeat your experiments based on what you write here, so you'll need to include things like the number of times each subject was tested, how results were scored, etc. Be sure to report your procedures as past events, not as a set of directions.

The designed questionnaire or other documents that is going to be used for data collection should be placed at **appendix VI**.

In the methodology part you may also show the research procedure by using Figure

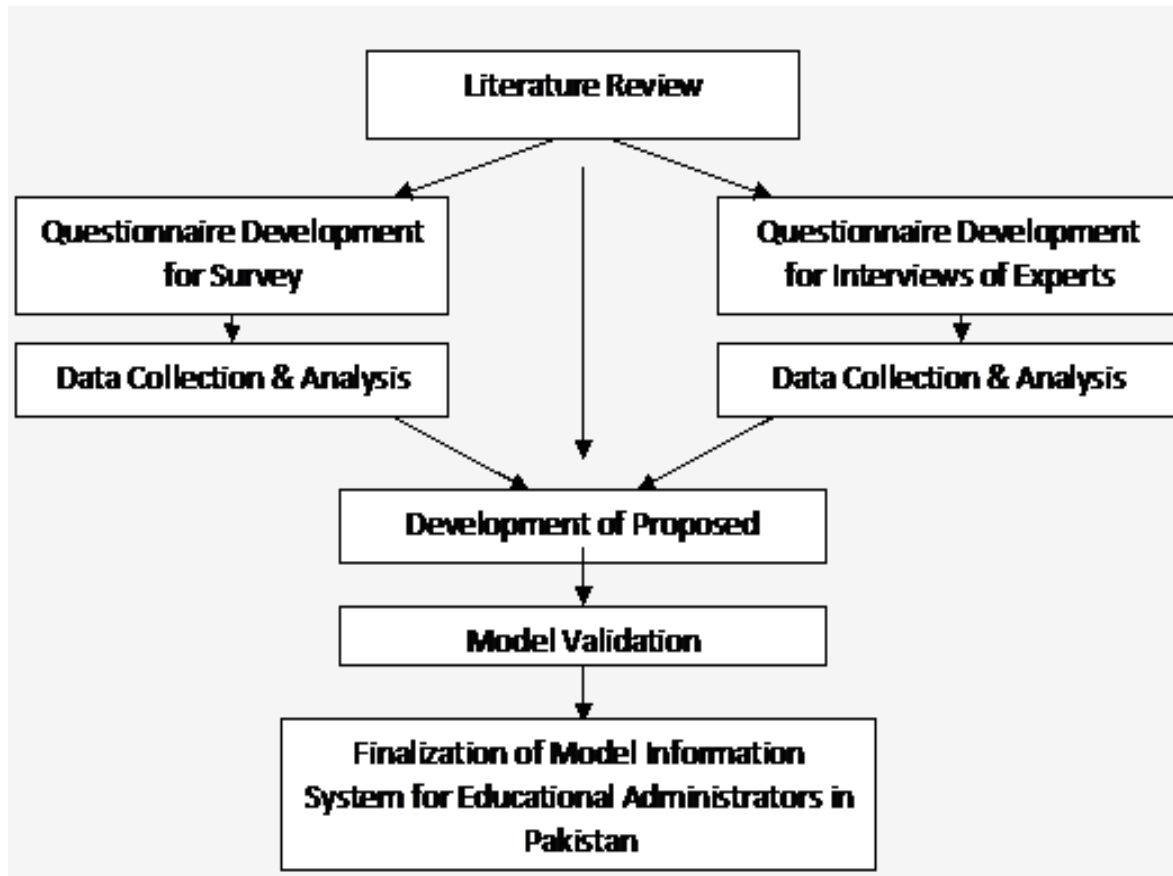


Figure 3:1 Flow Chart of the Research Methodology

CHAPTER FOUR

4. RESULTS AND DISCUSSION

The findings of the research work should be presented in this chapter. Tables and figures should be given and important points should be explained textually. Statistical analyses should be presented in both tables and figures with appropriate significance levels. Multiple comparisons might reveal more information, but don't mess-up all results. Key results may be highlighted in bold. This section may be broken into several sub-sections. The headings/sub-headings should be short, informative and represent the actual message.

The discussion should not contain repetition of the results. Rather it should explore the implications of the results by considering the relevant published research, which may be in agreement/disagreement with your hypothesis. It should be as concise as possible, but be provided in a logical manner. Collectively, this section should have coordination between your results and previous literature. It is not necessary all the time that your results should support previous reports, however, while interpreting the results should be done in an acceptable manner.

If your results have new findings that are not yet published anywhere, don't hesitate to discuss those findings, but provide closely related literature to support that hypothesis. Key findings may be kept in bold and avoid common words like good, bad, positive, negative etc. because they are misunderstandable. For clarity and ease of tracing your finding, result and discussion should be done in parallel

a. Sub heading 1

The table and figure used should be extensively and should be cross referenced in the paragraph residing.

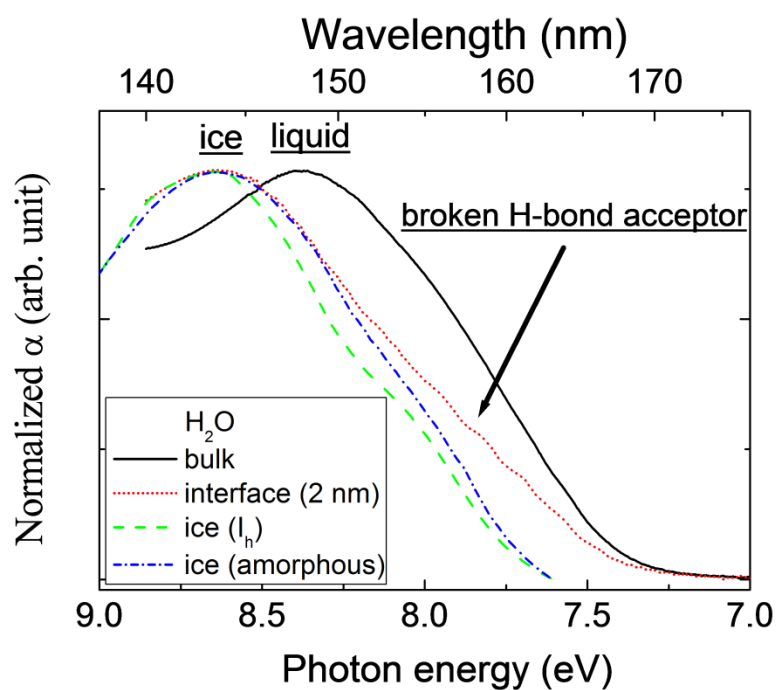
[illegible]

Table 4:1 Descriptive name of the table

Name of Raw	Issue 1	Issue 2	Issue 3	Issue 4
Raw 1	X11	X12	X13	X14
Raw 2	X21	X22	X23	X24
Raw 3	X31	X32	X33	X34
Raw 4	X41	X42	X43	X44

b. Sub heading 2

Error! Reference source not found.



c. Sub heading n

When using symbols in the research project, do not start a sentence with a symbol; write out the word or expression, or rephrase the sentence. For example, “ t was found to be 0.99” should be rephrased as: “The value of t was found to be 0.99”.

Symbols should not be used in running text in the same way as abbreviations. Avoid writing: “... and K was 71.8 ...” but say instead: “... the value of K was 71.8 ...” or “... the value of the constant was 71.8...”

Compound symbols such as eV and ΔH_F are written close up, with a space between the number and the symbol: 12.5 eV, $25\Delta H_F$.

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

Summarize the major contributions, evaluating the current position, and pointing out flaws in methodology, gaps in the research, contradictions, and areas for further study.

5.2. Recommendations

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Appendix II: Sample Cover page



WOLKITE UNIVERSITY
COLLEGE OF COMPUTING AND INFORMATICS
DEPARTMENT OF << Your department name >>
<<Times New Roman, 18>>

<**TITLE OF THE PROJECT**>
<<Times New Roman, 16 [**Bold**]>>
COMP XXXX: INDUSTRIAL PROJECT
BY

NAME OF THE STUDENTS ID NO
<<Times New Roman, 14>>

PROJECT ADVISOR: <ADVISOR'S NAME>
<<Times New Roman, 14>>

MONTH, YEAR
<<Times New Roman, 12>>

Appendix II: Sample Title page

WOLKITE UNIVERSITY
COLLEGE OF COMPUTING AND INFORMATICS
DEPARTMENT OF <<YOUR DEPARTMENT NAME >>

<<Times New Roman, 18>>

<Title of the Project>

<<Times New Roman, 16 [**Bold**]>>

SUBMITTED TO DEPARTMENT OF (YOUR DEPARTMENT NAME)
IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR
THE DEGREE OF BACHLER OF SCIENCE IN (YOUR DEPARTMENT
NAME)

<<Times New Roman, 14>>

BY

NAME OF THE STUDENTS IDNO

<<Times New Roman, 12>>

PROJECT ADVISOR: <ADVISOR'S NAME>

<<Times New Roman, 12>>

Wolkite University, Wolkite, Ethiopia

Month Date, Year

<<Times New Roman, 12>

Appendix III: Sample Declaration page

DECLARATION

This is to declare that this project work which is done under the supervision of <<Your Advisor Here>> and having the title <<Your Title Here>> is the sole contribution of:

<<Group Members Name Here>>

No part of the project work has been reproduced illegally (copy and paste) which can be considered as Plagiarism. All referenced parts have been used to argue the idea and have been cited properly. We will be responsible and liable for any consequence if violation of this declaration is proven.

Date: _____

Group Members:

Full Name

Signature

Appendix V: Sample Declaration page

Approval Form

This is to confirm that the project report entitled <<**Your Project title here**>>submitted to **Wolkite University, College of Computing and Informatics Department of (Your Department Name)** by: <<list group members name here>> is approved for submission.

-----	-----	-----
Advisor Name	Signature	Date
-----	-----	-----
Department Head Name	Signature	Date
-----	-----	-----
Examiner 1 Name	Signature	Date
-----	-----	-----
Examiner 2 Name	Signature	Date
-----	-----	-----
Examiner 3 Name	Signature	Date

Appendix VI: Sample Questioner

Questionnaire: Survey for BSc. Project on the Assessment of Extent, Causes and Effects of Construction Materials Wastage on Selected Building Construction Projects in Wolkite

Part One: Profile of the Company

1. Type of Organization:

- Contractor _____,
- Consultant _____,
- Owner _____

2. Name of the construction company _____

3. Year of establishment: _____

4. Classification:

- BC _____
- GC _____
- Grade _____

5. Address town: _____

6. Position of the Respondent:

- Project manager _____,
- Site engineer _____,
- Contractor _____,
- Consultant _____,
- Owner _____

Part two: Idea of the Company towards Waste Management

1. Is there construction material waste in your company construction sites:

- Yes _____.
- No _____

2. Is there a plan to manage material waste in your company:

- Yes _____
- No _____