# GUIDELINE
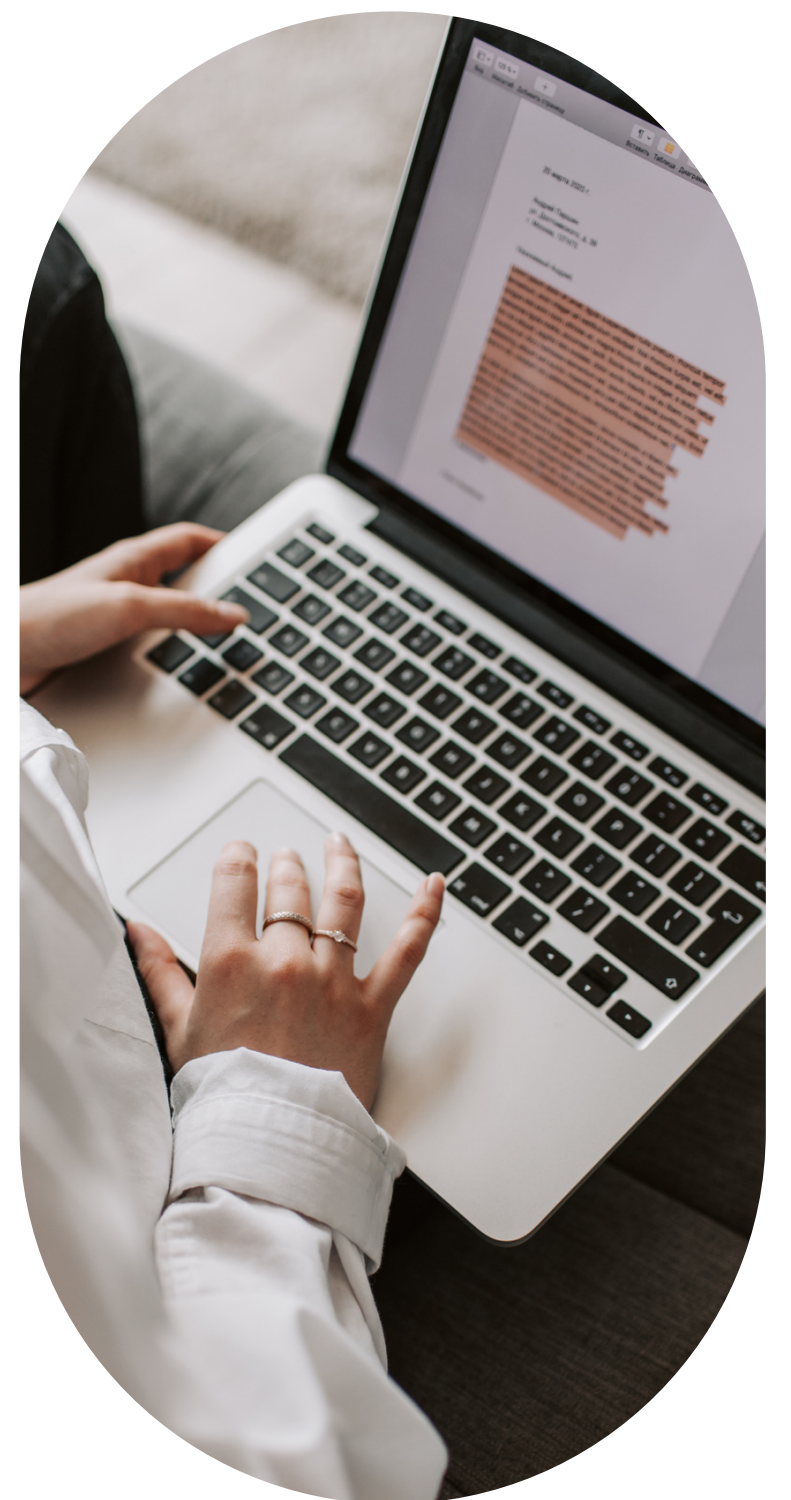# FINAL YEAR PROJECT (FYP)
# DOCUMENTATION

## Related to
## COMPUTER SCIENCE & INFORMATION TECHNOLOGY

**LIYANA ROSELY**
**SITI SARAH MAIDIN**
**2024**

## About this book

In the dynamic realm of Computing and Information Technology, the final year project serves as a crucial milestone for undergraduate students pursuing a bachelor's degree. It represents the conclusion of their academic endeavors and serves as a gateway to achieving professional achievement. This book, created with meticulous care to detail, serves as an inspiration for final-year students, providing them with a step-by-step direction to navigating the complexities of their project. The book provided in this context aims to educate students with the necessary abilities to express their findings effectively and convincingly through writing and documentation, which are essential components of a successful project. If you are starting a project in software development, data analysis, cybersecurity, or any other field within computing and information technology, this guide will be an essential resource for you. It will help you navigate the path to success in your academic and professional endeavors. In the ever-changing digital world, this book serves as evidence of the influence of education and the limitless opportunities that lie ahead for individuals who are willing to be innovative. Get ready to go on a voyage of exploration, difficulty, and achievement with "Final year project (FYP) Documentation Guideline".

# ACKNOWLEDGEMENT

I'd like to express my gratitude to everyone who contributed to the creation of this guideline. I would like to thank Emma for the invaluable feedback. Your insights have greatly enriched the content of this guideline.

Special thanks go to AP Dr Siti Sarah for the exceptional guidance throughout the guideline development process. Your vision has been crucial in shaping the direction and focus of this document.

Lastly, I also express my gratitude to all who provided feedback and input during the process. Your perspectives and suggestions have been integral to ensuring that this guideline is comprehensive and reflective of diverse viewpoints.

**Thank you to everyone who contributed to this guideline.**

# Contents

# LIST OF FIGURES

# LIST OF TABLES

# PROPOSAL

## 1.1  Introduction

A final year proposal typically refers to a formal document or presentation that a student in their final year of a degree program prepares to outline a research project or a capstone project they plan to undertake. This proposal is a crucial step in the academic process and serves several purposes:

**Project Overview**
- It provides an overview of the proposed project, including its title, objectives, and significance.

**Background and Literature Review**
- It outlines the background of the project, including relevant research or existing work in the field. A literature review is often included to demonstrate the student's understanding of the existing knowledge on the chosen topic.

**Research Questions or Hypotheses**
- The proposal clearly states the research questions or hypotheses that the student aims to address through their project.

**Methodology**
- It describes the methods and techniques the student plans to use to conduct the research. This section outlines the research design, data collection methods, and data analysis techniques.

**Timeline**
- A proposed timeline for the completion of different stages of the project is often included, showing when the student plans to accomplish specific tasks.

**Resources and Budget**
- If applicable, the proposal may include information on the resources required for the project, including materials, equipment, and budget estimates.

**Expected Outcomes**
- The student outlines the expected outcomes of the project and discusses how these outcomes will contribute to the existing body of knowledge in the field.

**Significance of the Study**
- The proposal explains the importance and relevance of the study, highlighting the potential impact of the research on the academic or practical aspects of the chosen field.

**Ethical Considerations**
- If the project involves human subjects or raises ethical concerns, the proposal may include a section discussing the ethical considerations and the steps the student plans to take to ensure the research is conducted ethically.

**Conclusion**
- The proposal typically concludes with a summary of the key points and a reiteration of the importance of the proposed project.
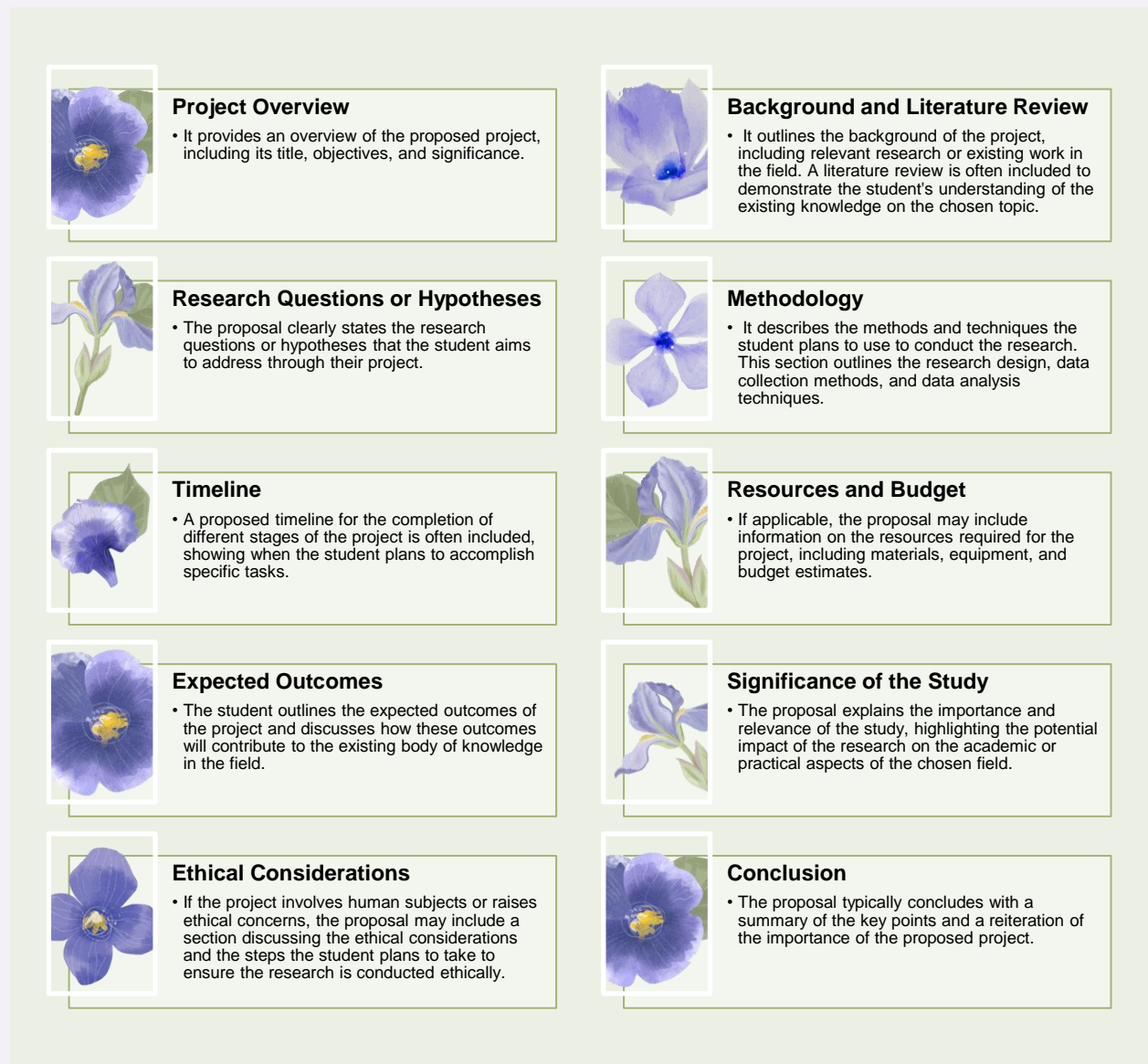
**Figure 1:** Proposal Elements

The final year proposal is often a precursor to the actual execution of the project, and its approval is usually required before the student can proceed with their research. It provides a roadmap for the student's work and helps ensure that the project is well-planned and meets academic standards.

## 1.2 Computer Science (CS) Proposal

In the context of CS, a final year proposal typically refers to a document or presentation outlining a research project or a significant software development project that a student plans to undertake during their final year of a computer science degree program. The specific details of the proposal may vary based on the nature of the project and the requirements of the educational institution; however certain elements are commonly included in computer science final year proposals.
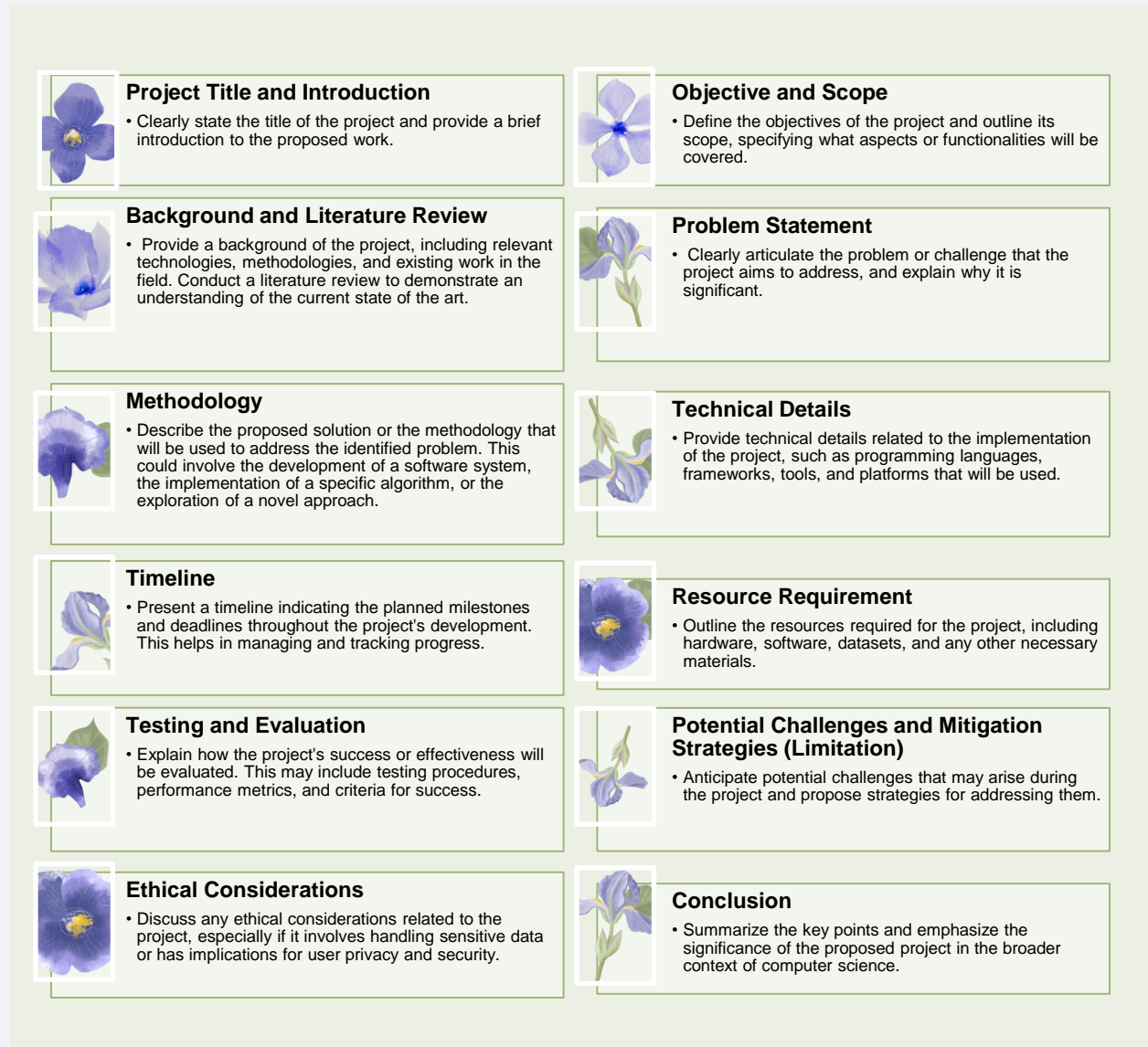
**Project Title and Introduction**
- Clearly state the title of the project and provide a brief introduction to the proposed work.

**Objective and Scope**
- Define the objectives of the project and outline its scope, specifying what aspects or functionalities will be covered.

**Background and Literature Review**
- Provide a background of the project, including relevant technologies, methodologies, and existing work in the field. Conduct a literature review to demonstrate an understanding of the current state of the art.

**Problem Statement**
- Clearly articulate the problem or challenge that the project aims to address, and explain why it is significant.

**Methodology**
- Describe the proposed solution or the methodology that will be used to address the identified problem. This could involve the development of a software system, the implementation of a specific algorithm, or the exploration of a novel approach.

**Technical Details**
- Provide technical details related to the implementation of the project, such as programming languages, frameworks, tools, and platforms that will be used.

**Timeline**
- Present a timeline indicating the planned milestones and deadlines throughout the project's development. This helps in managing and tracking progress.

**Resource Requirement**
- Outline the resources required for the project, including hardware, software, datasets, and any other necessary materials.

**Testing and Evaluation**
- Explain how the project's success or effectiveness will be evaluated. This may include testing procedures, performance metrics, and criteria for success.

**Potential Challenges and Mitigation Strategies (Limitation)**
- Anticipate potential challenges that may arise during the project and propose strategies for addressing them.

**Ethical Considerations**
- Discuss any ethical considerations related to the project, especially if it involves handling sensitive data or has implications for user privacy and security.

**Conclusion**
- Summarize the key points and emphasize the significance of the proposed project in the broader context of computer science.

**Figure 2:** Proposal Elements (Computer Science)

The final year proposal in CS serves as a blueprint for the student's research or development efforts, and its approval is typically required before the student can proceed with the actual implementation of the project.

## 1.3 Information Technology (IT) Proposal

In the context of IT, a final year proposal is like what is described for computer science. Students pursuing a degree in information technology often undertake a final year project or thesis as a culminating experience. The final year proposal in information technology would include elements specific to IT projects. Here is an overview of what should be included:
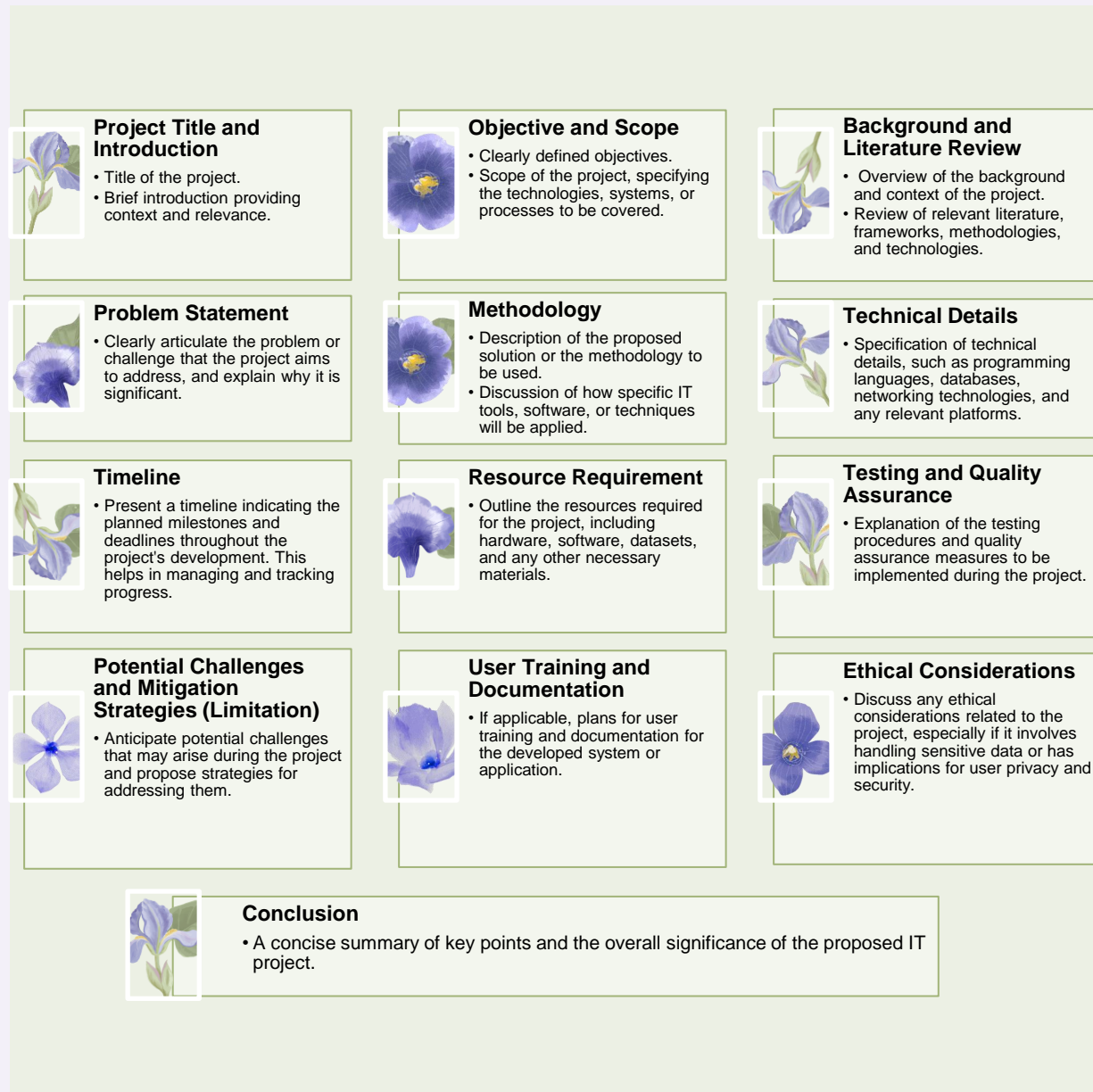
**Project Title and Introduction**
• Title of the project.
• Brief introduction providing context and relevance.

**Objective and Scope**
• Clearly defined objectives.
• Scope of the project, specifying the technologies, systems, or processes to be covered.

**Background and Literature Review**
• Overview of the background and context of the project.
• Review of relevant literature, frameworks, methodologies, and technologies.

**Problem Statement**
• Clearly articulate the problem or challenge that the project aims to address, and explain why it is significant.

**Methodology**
• Description of the proposed solution or the methodology to be used.
• Discussion of how specific IT tools, software, or techniques will be applied.

**Technical Details**
• Specification of technical details, such as programming languages, databases, networking technologies, and any relevant platforms.

**Timeline**
• Present a timeline indicating the planned milestones and deadlines throughout the project's development. This helps in managing and tracking progress.

**Resource Requirement**
• Outline the resources required for the project, including hardware, software, datasets, and any other necessary materials.

**Testing and Quality Assurance**
• Explanation of the testing procedures and quality assurance measures to be implemented during the project.

**Potential Challenges and Mitigation Strategies (Limitation)**
• Anticipate potential challenges that may arise during the project and propose strategies for addressing them.

**User Training and Documentation**
• If applicable, plans for user training and documentation for the developed system or application.

**Ethical Considerations**
• Discuss any ethical considerations related to the project, especially if it involves handling sensitive data or has implications for user privacy and security.

**Conclusion**
• A concise summary of key points and the overall significance of the proposed IT project.

**Figure 3:** Proposal Elements (Information Technology)

Approval of the final year proposal is typically a prerequisite for commencing the actual implementation of the project. It helps ensure that students have a well-thought-out plan and have considered all necessary aspects before embarking on their final year project in IT.

**1.4 Computer Science Final Year Project VS Information Technology Final Year Project**

The terms "Computer Science (CS)" and "Information Technology (IT)" are sometimes used interchangeably, they represent distinct but related fields. As such, final year projects in these disciplines may have some differences based on the emphasis and focus of each field. Here are some general distinctions.

**Table 1:** Highlights Between Computer Science (CS) Final Year Project and Information Technology (IT) Final Year Project

| Computer Science Final Year Project | Information Technology Final Year Project |
|---|---|
| • **Emphasis on Algorithms and Theory**<br>   • Computer science final year projects often focus on algorithm design, computational theory, and the development of theoretical models.<br>   • Projects might involve the creation of new algorithms, optimization techniques, or contributions to theoretical computer science.<br><br>• **Software Development and Systems Design**<br>   • Projects may involve the creation of software applications, systems, or tools with a strong emphasis on software engineering principles.<br>   • System-level design and architecture are often crucial components of computer science projects.<br><br>• **Artificial Intelligence and Machine Learning**<br>   • Computer science projects may delve into artificial intelligence, machine learning, and data science, exploring advanced algorithms for pattern recognition, data analysis, and decision-making.<br><br>• **Advanced Programming Languages**<br>   • Students might work with a variety of programming languages, including low-level languages, and engage in complex coding and debugging tasks.<br><br>• **Computational Complexity**<br>   • Projects may involve addressing problems related to computational complexity, scalability, and efficiency. | • **Practical Applications of Technology**<br>   • Information technology projects often focus on the practical application of technology to solve real-world problems.<br>   • Emphasis is on using existing tools, technologies, and frameworks to create solutions.<br><br>• **Systems Integration and Networking**<br>   • Projects might involve the integration of various information systems, network design, and implementation of IT infrastructure solutions.<br><br>• **Database Management and Information Systems**<br>   • Database design, management, and the development of information systems are common components of information technology projects.<br><br>• **Cybersecurity and IT Security**<br>   • Information technology projects may incorporate aspects of cybersecurity, including securing networks, systems, and data.<br><br>• **IT Project Management**<br>   • There might be a focus on project management principles and practices, ensuring that the project is delivered on time and within budget.<br><br>• **Business and Organizational Context**<br>   • IT projects often consider the broader business or organizational context, addressing the practical needs and requirements of stakeholders.<br><br>• **User Training and Support**<br>   • Information technology projects may include plans for user training and support, recognizing the importance of end-user satisfaction and adoption. |

It is important to note that these distinctions are generalizations, and there can be significant overlap between CS and IT projects. The specific nature of a final year project will also depend on the curriculum and requirements of the educational institution offering the degree program. In practice, both CS and IT professionals may collaborate on projects that require a combination of theoretical and practical expertise.

## 1.5 Contents Guideline

This section will focus and suggest the elements that should be highlighted for proposal contents. Before further explanation, Figure 4 is the recommendation structure for table of content structure.

**Figure 4:** Proposal Table of Contents (Recommendation)

### 1.5.1 Title

The title of a project is very crucial because it reflects your project and gives a sight about the project. Creating a good title is crucial as it serves as the first impression for your audience, conveying the essence of your work and attracting interest. However too many words in the title might give confusion and lead to the least engagement interest from reader.

Here the basic example you might follow (Refer Figure 5):

**The idea of study:**

This research delves into the realm of financial market trend prediction, focusing on the specific application of machine learning methods—Support Vector Machines (SVM) and Random Forests. By leveraging historical market data, the study aims to compare the efficacy of these two prominent machine learning algorithms in forecasting financial market trends. The investigation involves the development and fine-tuning of SVM and Random Forest models, considering factors such as market volatility, economic indicators, and past price trends. Through a comprehensive comparative analysis, the study seeks to discern the strengths and weaknesses of each approach, providing valuable insights into the optimal choice for predictive analytics in the financial domain. The outcomes of this research could offer practical guidance to investors, analysts, and financial institutions, informing their decision-making processes and contributing to the ongoing discourse on the application of specific machine learning methods in financial forecasting.

Therefore, from the above idea, we able to trace following:
- Purpose of the study
- Solution/method
- Highlight the unique aspect of solution.

Based on these THREE KEYWORDS, the title can be constructed. Following are TWO ways to construct a title.

| |
|---|
| **(Purpose of the study)** using **(your solution/method: Highlight the unique aspect of solution)** |
| Predict Financial Market Trends Analytics Using A Machine Learning Approach<br><br>**OR** |
| **(Your solution/method)** for **(purpose of study)** to **(the unique aspect of solution)** |
| **Example:**<br>Predicting Financial Market Trends: A Comparative Analysis of Support Vector Machines and Random Forests |

**Figure 5:** Basic Trick to Construct a Title (Recommendation)

A good title should be able to give insight into the project. A good title is not only informative but also enticing. It should encourage readers to delve into your work and discover more about what you have to offer. Therefore, it is important to ensure the title is direct, compact and eye catchy. Here some tips in designing a good title:

(a) **Be Clear and Concise:** Ensure that your title clearly conveys the main idea or focus of your work. Avoid unnecessary words and jargon that may confuse your audience. Make sure your title is not vague or ambiguous. It should clearly represent the content. Readers should not have to guess what your work is about. Keep your title concise and within a reasonable length. Long titles can be overwhelming. Aim for clarity in a few words. Suggest not longer than 15 words.

(b) **Use Keywords:** Include relevant keywords that reflect the central theme of your work. Keywords help your work get discovered in searches and databases.

(c) **Capture the Essence:** Summarize the main purpose, findings, or contribution of your work in the title. The title should give readers a good idea of what to expect.

(d) **Consider the Audience:** Think about who your target audience is and tailor the title to their level of expertise and interests. Use language that is accessible to your intended readers. It could be formal, informal, academic, or creative, depending on the context.

(e) **Highlight Unique Aspects**: If your work has a unique angle or contribution, try to incorporate that into the title. Showcase what sets your work apart from others in the same field.

(f) **Create Intrigue:** Spark curiosity without giving away everything. A good title makes the reader want to know more.

(g) **Test for Clarity:** Ask for feedback from peers or colleagues to ensure that the title is clear and easily understandable. Check if someone unfamiliar with your work can grasp the main idea from the title alone.

(h) **Check for Accuracy:** Ensure that your title accurately reflects the content of your work. Misleading titles can lead to confusion.

### 1.5.2 Abstract

An abstract is a concise summary or overview of the project. located at the beginning of the document, its primary purpose is to give readers a quick understanding of the content without having to read the entire document. It provides readers with a brief glimpse into the main objectives, methodology, results, and conclusions of the work and allows them to decide whether the document is interesting or not.

Provide here the guideline to write a good abstract (refer Table 2). After you identified and designed all the elements' contents, combine all become one paragraph. A good structure of abstract depends on the link between one element to another elements. Recommend here check the continuity between the elements. Since abstract is a short summary of your project, highly advise to write abstract as the final writing after all chapters of your documentation.

**Table 2:** Template to Write an Abstract.

| Element | Contents |
|---|---|
| Summary of situation that led to project / Problem background | |
| Summary of existing solutions | |
| The gap of your study / research | |
| The proposed solution<br>OR<br>The proposed solution with brief methodology | |
| The uniqueness of the proposed solution<br>(Method / Approach used / Selling Point(s)) | |
| The advantages of the proposed solution. | |

Key characteristics of an abstract include:

(a) **Content:** An abstract typically short paragraph of 150 to 250 words, it includes key elements such as the research question or problem, the methodology used, major findings or results, and the conclusion or implication of the work.

(b) **Structure:** While the structure can vary, a basic abstracts format includes, Introduction, Methodology, Result and Conclusion

(c) **Accuracy:** The abstract should accurately reflect the content of the full document. It should not mislead or misrepresent the research.

Here's a simple example of an abstract:

**Title: Predicting Financial Market Trends: A Comparative Analysis of Support Vector Machines and Random Forests**

*Abstract:*

| Element | Contents |
|---|---|
| Summary of situation that led to project / Problem background | • Financial markets, characterized by their inherent dynamism, necessitate precise trend prediction for effective decision-making. Traditional analytics methods often prove inadequate in capturing the intricacies of market movements, prompting a shift towards advanced machine learning approaches. |
| Summary of existing solutions | • Shown promise, a more nuanced understanding of the comparative effectiveness of specific machine learning methods is needed to enhance predictive capabilities. |
| The gap of your study / research | • Compare the efficacy of these two prominent machine learning algorithms in forecasting financial market trends. |
| The proposed solution OR The proposed solution with brief methodology | • Support Vector Machines (SVM) and Random Forests |
| The uniqueness of the proposed solution (Method / Approach used / Selling Point(s)) | • The investigation involves the development and fine-tuning of SVM and Random Forest models, considering factors such as market volatility, economic indicators, and past price trends. |
| The advantages of the proposed solution. | • Valuable insights into the optimal choice for predictive analytics in the financial domain |

**Therefore,**

Financial markets, characterized by their inherent dynamism, necessitate precise trend prediction for effective decision-making. Traditional analytics methods often prove inadequate in capturing the intricacies of market movements, prompting a shift towards advanced machine learning approaches. This research addresses the challenge of reliable financial market trend prediction by specifically investigating two widely used machine learning methods: Support Vector Machines (SVM) and Random Forests. By leveraging historical market data, the study aims to compare the efficacy of these two prominent machine learning algorithms in forecasting financial market trends. While existing solutions have shown promise, a more nuanced understanding of the comparative effectiveness of specific machine learning methods is needed to enhance predictive capabilities. The investigation involves the development and fine-tuning of SVM and Random Forest models, considering factors such as market volatility, economic indicators, and past price trends. Through a comprehensive comparative analysis, the study seeks to discern the strengths and weaknesses of each approach, providing valuable insights into the optimal choice for predictive analytics in the financial domain. The outcomes of this research could offer practical guidance to investors, analysts, and financial institutions, informing their decision-making processes and contributing to the ongoing discourse on the application of specific machine learning methods in financial forecasting.

**(203 Words)**

### 1.5.3 Project Description

Project description acts as the first impression for your project. Respond from reader will depend on how well they engage in your contents. Therefore, the main objective is to let the reader understand and get your idea in a satisfactory manner. The satisfactory manner is achievable in sense of your contents served smooth and balance continuity start from problem background followed by limitation of the exiting solutions and end with your proposed solution. Through these contents, it will help reader to relate better with your objectives, scope, limitation, and your target audience.

Like abstract, here is the project description template (Refer Table 3) that you might use as overview before further explanation about your project. After the identification and designed all the elements' contents, recommend to double check the continuity between the paragraphs. A smooth transition from one paragraph to another will reflect your problem-solving skill from identifying the problem, recognizing the gap and fill the gap by providing the solution. Also important, to include citations to support your justification and clarification.

**Table 3:** Template to Write Project Description.

| Element | Contents |
|---|---|
| **Paragraph 1: Problem Background**<br>this paragraph addresses the situation(s) that led to proposed project.<br><br>You may start with current situation/process OR introduce the related field. The description should direction to the limitation(s) / struggle(s) / improvement part(s). | |
| **Paragraph 2: Limitation of the exiting solutions**<br>This paragraph should be the continuity from the first paragraph and highlights the limitations.<br><br>If the limitations are numbers, clearly addressed which limitation(s) is/are your priority to solve.<br><br>Also, it is important to identify the major and minor limitations. Major limitation is the main or root cause that contributes to minor. Meanwhile minor is either the effect from major OR the effect does not bring major significant to the situation. | |
| **Paragraph 3: Proposed Solution**<br>This is considered as wrap paragraph. From the addressed of previous paragraph, a solution is proposed.<br><br>In this part, it is necessary to provide a brief view on how it will work, architecture/method/approach will be applied and justification for the proposed solution. | |

### 1.5.3.1 Problem Statement

A problem statement is a concise description of an issue or a challenge that needs to be addressed. It serves as a clear and well-defined statement that outlines the scope and context of a problem, providing a foundation for developing solutions or conducting further research.

In academic and research contexts, a problem statement is a crucial component of a project proposal, thesis, or research paper. It helps readers understand the significance of the problem being addressed and the motivation for conducting the study.

Key elements of a problem statement include:

(a) **Clear Description of the Problem:** Clearly articulate the issue or challenge that needs attention. Avoid vague language and provide specific details about the problem.

(b) **Context and Scope:** Define the context in which the problem exists. Specify the scope of the problem to set boundaries for the study.

(c) **Relevance and Significance:** Explain why the problem is important and relevant. Highlight the significance of addressing the problem, considering its potential impact on individuals, organizations, or the broader community.

(d) **Evidence or Data:** Provide evidence or data that supports the existence of the problem. Use facts, statistics, or examples to demonstrate the severity or prevalence of the issue.

(e) **Stakeholders and Perspectives:** Identify the key stakeholders (users) affected by the problem. Consider different perspectives or viewpoints related to the problem.

(f) **Negative Consequences:** Discuss the negative consequences or implications of the problem. Explain why leaving the problem unaddressed may lead to undesirable outcomes.

(g) **Gap in Current Knowledge or Solutions:** If applicable, highlight any gaps in existing knowledge or solutions related to the problem. Emphasize the need for further investigation or innovation.

Here's a simplified example of a problem statement:

**Title: Predicting Financial Market Trends: A Comparative Analysis of Support Vector Machines and Random Forests**

**Problem statement:**

"The financial markets represent a complex and dynamic environment where various factors influence asset prices, leading to challenges in accurately predicting market trends. Traditional methods often struggle to capture the intricate patterns and non-linear relationships present in financial data. To address this issue, the application of machine learning algorithms has gained prominence. However, the choice of the most suitable algorithm remains a critical aspect of successful trend prediction. This research aims to address this challenge by conducting a comparative analysis of two widely used machine learning techniques, Support Vector Machines (SVM) and Random Forests (RF), with the goal of enhancing the accuracy of financial market trend predictions."

In this example, the problem statement clearly identifies the issue, provides context, explains its significance, and suggests the need for innovative solutions. Researchers or project teams can use this problem statement as a starting point for developing strategies to address the identified problem.

### 1.5.3.2 Objectives

This section highlights the target outcomes or final product of project in a sentence. Objectives are specific, measurable, and achievable goals that provide a clear direction for a project. They outline what aims to be accomplished within a defined timeframe. Good practice in constructing the objective should be aligned with the broader goals or purpose of the endeavor. Key characteristics of objectives include:

    (a) **Specificity:** Objectives should be clear and specific, leaving no room for ambiguity. They define precisely what needs to be achieved.
    (b) **Measurable:** Objectives should be measurable, allowing for the assessment of progress and success. This often involves using quantifiable indicators or criteria.
    (c) **Achievable:** Objectives should be realistic and attainable within the given resources, constraints, and timeframe.
    (d) **Relevance:** Objectives should directly contribute to the overall goals of the project or initiative. They should be meaningful and aligned with the broader purpose.
    (e) **Time-Bound:** Objectives should have a defined timeframe for completion. This helps in planning and monitoring progress.

Here some tips in constructing the objectives:

(a) Start with 'To', follow by 'verb' and end with purpose.

<div style="background-color:#9caf6a; padding:20px; text-align:center;">

**To  +  Verb  +  Purpose**

</div>

Example:
- To investigate the predictive capabilities of Support Vector Machines in financial market trend analysis.
- To identify key features and parameters that significantly impact the predictive accuracy of each model.
- To conduct a comparative analysis of Support Vector Machines and Random Forests in terms of accuracy, precision, recall, and F1 score.
- To evaluate the robustness and generalization capabilities of the selected models across different market conditions.

(b) Ensure the application of verb is different from one objective to another. The tip is the verb of next objective has one level higher complexity than the previous verb's objective.

Example of each objective has different level of complexity:
- To study / investigate / research
- To develop / build / improve
- To test and evaluate / examine

Example of objective that not displayed level of complexity.

- To study
- To investigate
- To examine
- To enhance

### 1.5.4 Research Methodology

Research methodology refers to the systematic and structured process followed by researchers to design, conduct, and analyze a research study. It outlines the overall approach and techniques used to gather, interpret, and draw conclusions from data. A well-defined research methodology is crucial for ensuring the reliability and validity of research findings. The specific methodology employed can vary based on the nature of the research, the discipline, and the research questions being addressed.

Providing the suitable SDLC with justification helps your system to be executed in the right path. Here are some tips for selection of SDLC.

| Parameter | Process Model→ | Waterfall Model | Incremental Model | Prototype Model | Rad Model | Spiral Model | Agile Model | Xp programming |
|---|---|---|---|---|---|---|---|---|
| Clear Requirement Specifications | | Initial level | Initial level | At medium level | Initial level | Initial level | Change incrementally | Initial level |
| Feedback from user | | No | No | Yes | No | No | No | Yes |
| Speed to change | | Low | High | Medium | No | High | High | High |
| Predictability | | Low | Low | High | Low | Medium | High | High |
| Risk identification | | At initial level | No | No | No | Yes | Yes | Yes |
| Practically implementation | | No | Low | Medium | No | Medium | High | High |
| Loom | | Systematic sequence | Iterative sequence | Priority on customer feedback | Use readymade component | Identification of risk at each stage | Highly customer satisfaction and incremental development[09] | Customer satisfaction and incremental development |
| Any variation done | | Yes-v model | No | No | No | Yes-win win spiral[6] | No | No |
| Understandability | | Simple | Intermediate | Intermediate | Intermediate | Hard | Much complex | Intermediate |
| Precondition | | Requirement clearly defined | Core product should clearly define | Clear idea of Quick Design | Clean idea of Reuse component | No | No | No |
| Usability | | Basic | Medium | High | Medium | Medium | Most use now a days | medium |
| Customer priority | | Nil | Nil | Intermediate | Nil | Intermediate | High | Intermediate |
| Industry approach | | Basic | Basic | Medium | Medium | Medium | High | Medium |
| Cost | | Low | Low | High | very high | Expensive | Much Expensive | High |
| Resource organization | | Yes | Yes | Yes | Yes | No | No | Yes |
| Elasticity | | No | No | Yes | Yes | No | Very high | Medium |

**Figure 6:** Tips for SDLC Selection

### 1.5.5 Project Scope
Scope defines the parameters and boundaries of the research or project, specifying what is included and covered.

- (a) **Inclusions and Exclusions:** Describes what aspects, elements, or subjects will be included in the study. Outlines criteria for excluding certain elements or subjects.
- (b) **Extent of Coverage:** Specifies the geographical area, time frame, and depth of investigation. Sets the limits on the range and focus of the study.
- (c) **Research Objectives:** Outlines the goals and objectives of the study. Provides a roadmap for what the researcher intends to achieve.
- (d) Key Concepts and Variables: Identifies the main concepts, variables, or factors that will be investigated. Defines the elements that fall within the study's domain.
- (e) **Deliverables:** Describes the expected outcomes, results, or products that will be produced because of the research.

Example scopes for Online Ordering System:

**Scope of an Online Ordering System:**
The scope of an online ordering system defines the boundaries and features that the system will encompass. Here's an example:

- **User Registration and Authentication:** The system will allow users to register accounts, log in securely, and manage their profiles.
- **Payment Integration:** The system will integrate with secure payment gateways to enable online transactions. Users will have various payment options, including credit cards, digital wallets, and other secure methods.
- **Order Confirmation and Notifications:** Users will receive confirmation emails or messages upon successful order placement. The system will send notifications for order status updates, including preparation, dispatch, and delivery.
- **Feedback and Rating System:** Users can provide feedback and ratings for ordered items and the overall service. The system will aggregate feedback to improve menu offerings and service quality.
- **Mobile Responsiveness:** The system will be accessible and user-friendly across various devices, including desktops, tablets, and mobile phones.

**OR**
**scope can be the details about the platform, programming language,and architecture:**

- **Platform:** The online ordering system will be developed as a web-based platform accessible through standard web browsers. A responsive design will ensure usability on desktops, tablets, and mobile devices.
- **Programming Language and Framework:** The system will be developed using the following technologies:
  - Front-end: HTML5, CSS3, JavaScript (React.js or Angular)
  - Back-end: Node.js with Express or Django (Python)
  - Database: MySQL or MongoDB
- **System Architecture:** The system will adopt a microservices architecture to enhance scalability and maintainability. Components will include:
  - User interface (UI)
  - Order processing engine
  - Payment gateway integration
  - User authentication and authorization
  - Database management

- **User Authentication and Authorization:**
  - Users will register accounts with a unique username and password. Secure authentication protocols, such as OAuth, will be implemented.
  - Different user roles (customer, administrator) will have specific authorization levels.
- **Payment Integration:**
  - Integration with secure payment gateways (e.g., Stripe, PayPal) will enable seamless and secure online transactions.
  - Support for various payment methods, including credit cards and digital wallets.
- **Real-time Updates and Notifications:**
  - Customers will receive real-time updates on their order status through email or SMS notifications.
  - Notifications will cover order confirmation, preparation, dispatch, and delivery.

These examples illustrate how the scope sets the boundaries and features of the online ordering system.

### 1.5.6 Project Limitation
Limitations refer to factors or constraints that may affect the validity, generalizability, or completeness of the research.

(a) **Factors Beyond Control:** Acknowledges external factors or circumstances that the researcher cannot manipulate or control.

(b) **Potential Biases:** Acknowledges biases inherent in the research design, data collection methods, or sample selection. Addresses the potential impact of biases on the findings.

(c) **Resource Constraints:** Discusses limitations related to time, budget, personnel, or other resources. Recognizes any restrictions imposed by resource constraints on the study.

(d) **Generalizability:** Recognizes any restrictions on the extent to which the findings can be generalized to broader populations or contexts. Considers the applicability of the results beyond the studied sample.

(e) **Unforeseen Challenges:** Addresses unexpected issues or challenges that may arise during the research. Acknowledges the possibility of unforeseen events affecting the study.

The difference/relationship between the scope and project limitation are:

(a) **Complementary:** Scope and limitations are complementary aspects of a research plan. While scope outlines what will be covered, limitations address potential challenges or constraints.
(b) **Transparency:** Both scope and limitations contribute to the transparency and integrity of the research process. They guide the reader in understanding the study's boundaries and potential sources of error or bias.
(c) **Planning and Reflection:** Scope is more about planning and defining the research focus. Limitations involve reflection on potential challenges and constraints that may affect the study's outcomes.

Example limitations for Online Ordering System:

**Limitations of an Online Ordering System:**

The limitations of an online ordering system identify potential constraints or challenges that might affect the system's functionality or user experience. Here's an example:

- **Internet Connectivity:** The system's effectiveness relies on users having a stable internet connection. Poor connectivity may hinder order placement or updates.
- **Geographical Constraints:** Delivery services may be limited to specific geographical areas, and users outside these zones may be unable to place orders.
- **Data Security Concerns:** Despite secure payment gateways, there's always a risk of data breaches. The system should employ robust security measures to protect user data.
- **Inventory Management Challenges:** Real-time inventory updates are crucial. Delays or inaccuracies in inventory management may result in unavailable items.
- **User Adoption and Technical Literacy:** The success of the system depends on users' willingness to adopt online ordering. Some users may face challenges due to limited technical literacy.
- **Dependency on Third-Party Services:** Integration with external services (payment gateways, delivery services) makes the system reliant on the reliability of these third-party providers.
- **System Downtime:** Maintenance activities or unexpected technical issues may cause temporary system downtime, affecting users' ability to place orders.

These examples illustrate how the limitations identify potential challenges and constraints that should be considered during development and use.

### 1.5.7 Target Audience

The target audience refers to a specific group of individuals or entities at which a product, service, or message is aimed. This group is identified based on certain characteristics, demographics, behaviors, or interests that make them more likely to be interested in or benefit from what is being offered. The concept of a target audience is fundamental in marketing, advertising, and communication strategies to tailor messages and offerings effectively. Key aspects of a target audience include:

(a) **Demographics**: Characteristics such as age, gender, income level, education, occupation, and geographic location help define the target audience.
(b) **Psychographics:** This includes lifestyle, interests, hobbies, values, attitudes, and personality traits that shape the preferences and behaviors of the target audience.
(c) **Behavioral Factors:** Purchasing behavior, product usage, brand loyalty, and other behavioral aspects play a role in identifying a target audience.
(d) **Needs and Pain Points:** Understanding the specific needs, challenges, or problems that the target audience faces helps in offering solutions that are relevant to them.
(e) **Communication Channels:** Knowing where the target audience spends their time and how they consume information helps in choosing appropriate communication channels for marketing and advertising.

For example, in the context of an online ordering system, the target audience might include individuals who prefer the convenience of ordering food online, restaurant owners or managers looking to expand their customer reach, and delivery drivers interested in delivery opportunities.

Identifying and understanding the target audience is essential for businesses and organizations to create products, services, or messages that resonate with the right people, leading to more effective marketing campaigns and improved overall success.

### 1.5.8 References

Citation styles can vary depending on the academic discipline or the type of publication. Here are some general guidelines for common citation styles:

(a) **APA (American Psychological Association) Style:**
**Books:**
Author, A. A. (Year). Title of work: Capital letter also for subtitle. Publisher. Journal
**Articles:**
Author, A. A. (Year). Title of article. Title of Journal, volume number(issue number), page range.
**Websites:**
Author, A. A. (Year, Month Day of publication). Title of webpage. Website Name. URL

(b) **MLA (Modern Language Association) Style:**
**Books:**
Author's Last Name, First Name. Title of Book. Publisher, Publication Year.

**Journal Articles:**
Author's Last Name, First Name. "Title of Article." Title of Journal, vol. number, no. number, Year, pages.
**Websites:**
Author's Last Name, First Name. "Title of Webpage." Title of Website, Publication Date, URL.

**(c) Harvard style:**
- **Books:**
  **Print Book:**
  Author's Last Name, First Initial(s). (Year). Title of Book. Place of publication: Publisher.
  **E-book:**
  Author's Last Name, First Initial(s). (Year). Title of Book. [Online] Place of publication: Publisher. Available at: URL (Accessed: Day Month Year).

- **Journal Articles:**
  **Print Journal Article:**
  Author's Last Name, First Initial(s). (Year). 'Title of Article'. Title of Journal, Volume number (Issue number), Page range.
  **Online Journal Article:**
  Author's Last Name, First Initial(s). (Year). 'Title of Article'. Title of Journal, Volume number (Issue number), Page range. Available at: URL (Accessed: Day Month Year).

- **Websites:**
  **Author(s) or Organization:**
  Author's Last Name, First Initial(s) or Organization Name. (Year). 'Title of Webpage'. [Online] Available at: URL (Accessed: Day Month Year).
  **In-Text Citations:**
  For in-text citations, include the author's last name and the publication year within parentheses. For example: (Author's Last Name, Year).

## 1.6 Conclusion

Writing a conclusion for a proposal is an essential part of summarizing key points, reinforcing the proposal's objectives, and leaving a lasting impression on the reader. Here are some tips on how to write a conclusion for a proposal and basic structure of conclusion:

How to Write the Conclusion:

(a) **Conciseness:** Keep the conclusion concise. Summarize without introducing new information.
(b) **Relevance:** Ensure that the conclusion directly relates to the content of the proposal. Avoid introducing unrelated details.
(c) **Language Tone:** Maintain a professional and positive tone. Use language that inspires confidence and enthusiasm.
(d) **Avoid Repetition:** While summarizing key points is essential, avoid unnecessary repetition of details already discussed in the proposal body.
(e) **Emphasis on Significance:** Emphasize the significance of the proposal. Why is it important, and what impact can it have?

Here's a basic structure you can follow:

(a) **Introduction to Conclusion**: Transition from the last section of the proposal to the conclusion by briefly summarizing the proposal's content.
(b) **Summary of Key Points:** Recap the main points, findings, or recommendations presented in the proposal.
(c) **Restatement of Objectives:** Clearly restate the objectives and goals that the proposal aims to achieve.
(d) **Highlighting Benefits:** Emphasize the positive outcomes and benefits that the proposal offers.
(e) **Expression of Confidence:** Express confidence in the success of the proposed project or initiative.

Example Conclusion:

*"In conclusion, this proposal outlines a comprehensive strategy for [project/initiative]. By focusing on [key points], we believe that the proposed approach will [highlighted benefits]. With your support, we are confident in our ability to [achieve objectives]. We look forward to the opportunity to discuss this proposal further and move forward with the implementation of this impactful project."*

Remember to tailor the conclusion to the specific content and objectives of your proposal.

# CHAPTER 1: INTRODUCTION

The "Introduction" section of a research project or thesis serves as the opening chapter that sets the stage for the entire document. It provides an overview of the research, establishes the context, outlines the scope, and introduces the key elements of the study. The introduction is crucial for grabbing the attention of the reader and presenting the rationale behind the research. Figure 7 is the chapter structure recommendation.

**Table of Contents**

**Figure 7:** Introduction Table of Contents (Recommendation)

Here is a breakdown of the key components typically found in the Introduction:

(a) **Opening Statement:** Hook the Reader: Begin with a compelling statement, anecdote, relevant quote, or a thought-provoking question to capture the reader's interest.

(b) **Background: Contextualize the Study:** Provide a broader context for the research by discussing the relevant field, industry, or area of study. This helps the reader understand the significance of the research problem.

**Example:**

"The field of [your project domain] has witnessed significant advancements in recent years, with [mention key developments]. Despite these strides, there remains a notable gap in [specific aspect or problem], which forms the basis of this research."

**\*\*\*\*Details refer to Proposal's Chapter.**

(c) **Problem Statement: Identify the Problem:** Clearly articulate the specific problem or issue your research aims to address. Explain why it's important and how it fits into the broader context.

**Example:**

"The primary challenge addressed in this project is [describe the problem]. This problem is critical in the context of [explain the broader implications]. Addressing this issue is essential for [mention potential benefits]."

****Details refer to Proposal's Chapter.**

(d) **Objectives: State the Objectives:** Clearly list the goals or objectives of your research. These should be specific, measurable, and aligned with the problem statement.

**Example:**

"The main objectives of this project are:

To [objective 1].
To [objective 2].
To [objective 3].
These objectives guide the scope and direction of the study, ensuring a focused and systematic approach."

****Details refer to Proposal's Chapter.**

(e) **Research Questions or Hypotheses:** Present Research Questions or Hypotheses: Formulate the key questions or hypotheses that guide your investigation. These should directly correspond to the objectives.

**Example:**

"The research questions guiding this study are:

What is the impact of [variable] on [outcome]?
How does [factor] influence [process]?
These questions serve as a framework for the investigation, providing a clear focus for the research."

Here is a template to help design research questions corresponding to objectives.

**Table 4:** Template to Write Research Question

| Research Objective | Research Question(s) |
|---|---|
| Objective 1 | |
| | |
| | |
| Objective 2 | |
| | |
| | |
| Objective 3 | |
| | |
| | |

**Remark:** An objective might have more than one question. The number of questions depends on how many required processes to execute / accomplish the objectives. You may apply 5W 1H in designing the research question.

(f) **Justification and Significance:** Explain Why It Matters: Discuss why your research is important. Highlight any potential contributions to the field, advancements, or practical implications.

**Example:**

"This study holds significance as it [highlight the potential impact]. By addressing [the problem], this project contributes to [mention broader goals or advancements], potentially leading to [expected outcomes or benefits]."

(g) **Scope of the Study: Define the Scope:** Clearly delineate what your research includes and what it excludes. This helps manage expectations and establishes the boundaries of your study.

**Example:**

"While this project aims to provide insights into [specific area], it does not encompass [mention excluded aspects]. The scope is limited to [define the specific parameters], ensuring a thorough investigation within the defined boundaries."

**\*\*\*\*Details refer to Proposal's Chapter.**

(h) **Methodology: Brief Overview:** Provide a concise overview of the research methods or approaches you will employ. Detailed methodology is usually presented in a later chapter. Suggest to include figure of methodology.

> **Example:**
>
> "To achieve the objectives outlined, a mixed-methods approach will be employed. [Describe the research methods, tools, and data sources]. This methodology ensures a comprehensive and robust investigation into [the problem or topic]."
>
> **\*\*\*\*Details refer to Proposal's Chapter.**

(i) **Structure of the Thesis/Project (Optional):** Outline the Chapters: Briefly describe how the document is organized. Provide a roadmap for the reader, indicating what each chapter will cover.

> **Example:**
>
> "The remainder of this thesis is organized as follows:
>
> Chapter 2 provides a comprehensive review of the literature related to [your topic].
> Chapter 3 outlines the research methodology adopted in this study.
> Chapter 4 presents the findings and analysis of [specific aspects].
> Chapter 5 discusses the implications of the findings and proposes recommendations.
> Finally, Chapter 6 concludes the thesis and suggests avenues for future research."

(j) **Definition of Terms: Clarify Terminology:** Define any technical terms, acronyms, or concepts that may be unfamiliar to the reader.

> **Example:**
>
> "In this thesis, the following terms are used:
>
> These definitions are provided to enhance the reader's comprehension of the content."

(k) **Summary:** Conclude the Introduction: Summarize the key points discussed, reinforcing the importance of the research problem and setting the stage for the subsequent chapters.

> **Example:**
>
> "In conclusion, Chapter 1 has provided a thorough introduction to the background, problem statement, objectives, and methodology of this study. The subsequent chapters will delve into a detailed exploration of each aspect, contributing valuable insights to the field of [your domain]."

Tips for Writing a Strong Introduction:

(a) **Clarity:** Ensure that your language is clear, concise, and easily understandable.
(b) **Relevance:** Keep the content focused on the main topic and avoid unnecessary details.
(c) **Engagement:** Engage the reader by making your introduction interesting and relevant to a broader audience.
(d) **Accuracy:** Provide accurate information and avoid making statements that cannot be supported by evidence.
(e) **Transition:** Use smooth transitions to guide the reader from one point to another.

Preparing Chapter 1 will be easier if you already completed the research/project proposal because almost 70% of the contents of Chapter 1 are from the proposal. The balance of 30% comes from improvement comment(s), structuring research questions and deeper explanation/ justification/ clarification of certain section(s).

# CHAPTER 2: LITERATURE REVIEW

Literature review is a critical evaluation and synthesis of existing research, studies, and literature on a specific topic. It aims to provide an overview of the current state of knowledge, identify gaps or areas requiring further investigation, and establish the context for your own research or project. Remember that the structure can be adapted based on the specific requirements of your project or the guidelines provided by your institution. The goal is to present a well-organized and coherent narrative that guides the reader through the existing literature on your chosen topic. However, provide the recommendation structure for Chapter Literature Review.

**Figure 8:** Literature Review Table of Contents (Recommendation)

The structure of a literature review typically follows a specific format to ensure clarity and coherence. Here is a guide on how to structure a literature review:

  **(a)  Introduction/Overview:**
- **Contextualize the Topic:** Begin by introducing the general topic of your literature review and explaining its significance within the broader field.
- **Scope and Objectives:** Clearly outline the scope and objectives of your literature review. Define the specific themes, concepts, or research questions you will address.
- **Organization:** Briefly mention how the literature review is organized, highlighting the main themes or categories you will cover.

**(b) Theoretical Framework**
- **Introduction to Theories and Concepts:** Introduce the key theories, concepts, and models relevant to your topic.
- **Explanation and Application:** Explain each theory or concept in detail and discuss how they have been applied in previous research.

**(c) Historical Background**
- **Development and Milestones:** Provide a historical overview of the development of the topic. Highlight key milestones and influential studies.

**(d) Current State of the Art**
- **Overview of Current Trends:** Survey the current state of the art in your field. Discuss the latest technologies, methodologies, or approaches.

**(e) Key Concepts and Definitions**
- **Define Key Terms:** Clearly define and explain key terms and concepts that are crucial for understanding your topic.

**(f) Related Work**
- **Review of Relevant Studies:** Summarize and analyze studies, projects, or research that are directly related to your topic. Provide details on methodologies, findings, and contributions.

**(g) Critical Analysis**
- **Strengths and Weaknesses:** Critically evaluate the strengths and weaknesses of existing approaches. Identify any limitations or gaps in the literature.

**(h) Emerging Trends and Technologies**
- **Highlight Emerging Trends:** Discuss any emerging trends, technologies, or methodologies in your field that have the potential to impact your topic.

**(i) Synthesis and Integration**
- **Synthesize Findings:** Integrate the information from different sources to identify patterns, trends, or conflicts in the literature.

**(j) Research Questions and Objectives**
- **Define Research Questions:** Clearly outline the research questions or objectives that your project aims to address based on the gaps identified in the literature.

**(k) Conclusion**
- **Summary:** Summarize the key findings and insights obtained from the literature review.

- **Contributions to Knowledge:** Highlight how your literature review contributes to the existing body of knowledge and sets the stage for your own research or project.

Here are some templates to present related studies, methods, and the existing system. A number of related studies, methods and the existing systems are suggested to consult with supervisor.

**Table 5:** Template to Present Related Studies

| Author (Year) | Title | Purposed Study | Outcome | Remark (Limitation/ Future Work Suggestion |
|---|---|---|---|---|
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Table 6:** Template to Present Related Methods (Method Finding)

| Criteria | Method 1 | Method 2 | Method 3 | Method n |
|---|---|---|---|---|
| Strength(s) |  |  |  |  |
| Drawback(s) |  |  |  |  |
| Limitation(s) |  |  |  |  |
| **Remark:** <ul><li>Strength is the highlight or advantages of the method in a particular field/area.</li><li>Drawback is the limitation of the method in a particular field/area.</li><li>Limitation is an open gate for the idea of improvement.</li></ul> | | | | |

**Table 7:** Template to Present and Compare Existing Systems and Proposed System

| Features / requirements | System 1 | System 2 | System n | Proposed System |
|---|---|---|---|---|
| Feature 1 | / or X |  |  |  |
| Feature 2 |  |  |  |  |
| Feature 3 |  |  |  |  |
| Feature n |  |  |  |  |
| **Remark:** <ul><li>/ is available.</li><li>X is not available.</li></ul> | | | | |

# CHAPTER 3: RESEARCH METHODOLOGY

This chapter presents the systematic and theoretical analysis of the methods or techniques applied in a particular field of study. In the context of a computer science and IT project, methodology refers to the systematic approach and set of procedures used to conduct research, design, develop, and implement a system or solution. As methodology as core of a project, a brief introduction should be done in Chapter 1 or proposal. Therefore, this chapter is continuity of that brief introduction. The result of fact-finding and early design should be comprehensively presented in this chapter. Apart from that, System Requirement analysis should be presented in detail (Functional and Non-Functional).

Provided here are a few guidelines to prepare Chapter 3. Start with Figure 9 and followed by a few related templates.

---

**Table of Contents**

**Page**

**Figure 9:** Methodology Table of Contents (Recommendation)

**Table 9:** Template to Present Questionnaire: Questions and Details

| Section A, B …. N Example Section A – Demographic Information | | |
|---|---|---|
| 1 | Question | What is your age range? |
| | Purpose | To categorize respondents into specific age groups |
| | Option | |
| | Question type | Multiple-Choice question |
| | | |
| 2 | Question | What is your gender? |
| | Purpose | |
| | Option | |
| | Question type | |
| | | |
| n | Question | |
| | Purpose | |
| | Option | |
| | Question type | |

**Table 10:** Template to Present Questionnaire: Finding and Analysis

| Section A, B …. N Example Section A – Demographic Information | | |
|---|---|---|
| 1 | Question | What is your age range? |
| | Result | (Please include suitable graph to represent the result) |
| | Analysis | |
| | | |
| 2 | Question | |
| | Result | |
| | Analysis | |
| | | |
| n | Question | |
| | Result | |
| | Analysis | |

**\*\*\* Remark:** This can also be presented in paragraph style.

**Table 11:** Template to Present Interview: Questions and Details

| | | |
|---|---|---|
| **Interview Questions** | | |
| 1 | Question | |
| | Objective | |
| | Question type | Open-ended question / Closed-ended question |
| | | |
| 2 | Question | |
| | Objective | |
| | Question type | |
| | | |
| n | Question | |
| | Objective | |
| | Question type | |
| | | |

**Table 12:** Template to Present Interview: Finding and Analysis

| Interview 1 | |
|---|---|
| **Name:** | |
| **Position:** | |
| **Experience:** | |
| **No** **Question** | **Answer** |

| No | Question | Answer |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |

Based on the provided answer, do the analysis by presenting the importance, outcome, and next action (if applicable). The presentation can be in the form of a table or paragraph.

**Table 13:** Template to Present List of Use Case Actors

| Actor | | Use Case | Use Case Description |
|---|---|---|---|
| Actor A | *initiates* | | |
| | | | |
| | | | |
| | | | |
| Actor B | | | |
| | | | |
| | | | |
| | | | |

**Table 14:** Template to Present Use Case Description – Use Case 1

| Use case | | |
|---|---|---|
| **Precondition** | | |
| **Typical Course of Events:** | **Actor Action** | **System Response** |
| | | |
| | | |
| | | |
| | | |

****Remark:** For use case description, the number of tables is based on number of use case designed in Use Case Diagram.

System Requirement Analysis is a crucial phase in the software development life cycle that involves gathering, documenting, and analyzing the requirements of a system. These requirements are categorized into functional and non-functional requirements. Here is a general guide on how to perform System Requirement Analysis:

(a) **Identify Stakeholders:** Identify and involve all stakeholders including end-users, clients, managers, and developers. Understand their perspectives and expectations from the system.

(b) Gather Requirements:

- **Functional Requirements:**
  i.  Identify and document what the system should do. Use techniques like interviews, surveys, and workshops to gather information from stakeholders.
  ii. Define use cases and scenarios to understand the system's functionality. Create user stories or use case diagrams to capture functional requirements.

- **Non-Functional Requirements:**
    i. Gather information on performance, security, usability, reliability, and other quality attributes. Discuss constraints such as budget, time, and technology limitations.
    ii. Consider regulatory and compliance requirements.
(c) **Document Requirements:** Create a Requirements Document that includes both functional and non-functional requirements. Use clear and concise language, and make sure requirements are well-documented and unambiguous. Provide details such as priority, dependencies, and acceptance criteria.
(d) **Prioritize Requirements:** Assign priorities to each requirement to help in the development and testing phases. Distinguish between "must-have" and "nice-to-have" requirements.
(e) **Modeling:** Use modeling techniques such as UML diagrams (use case diagrams, class diagrams) to represent relationships between different components and actors in the system.

Effective communication and collaboration with stakeholders are crucial throughout the System Requirement Analysis process. Adjust these steps based on the specific needs and complexity of your project. The most crucial part here, to able determine and differentiate between functional and non-functional.

**Table 16:** Functional Vs Non-Functional Requirements

| | **Functional Requirement** | **Non-Functional Requirements** |
|---|---|---|
| **Definition** | Functional requirements describe what a system should do. They are specific features and capabilities that the system must provide to its users. | Non-functional requirements specify the quality attributes and constraints that the system must adhere to. They don't necessarily describe what the system does but how well it does it. |
| **Focus** | They focus on the behavior of the system - how it functions in response to specific inputs or stimuli. | They focus on characteristics such as performance, usability, reliability, and security. |
| **Examples** | User authentication<br>Data input and processing<br>Report generation<br>Search functionality<br>Calculations and algorithms | Response time<br>Scalability<br>Availability<br>Security measures<br>User interface design principles |

| | | |
|---|---|---|
| **Measurability** | Functional requirements are generally measurable and can be tested objectively. | Non-functional requirements are often more subjective and challenging to measure precisely. They may be specified in terms of ranges or acceptable limits. |
| **Documentation** | They are often documented in use cases, user stories, and functional specifications. | They are typically documented in supplementary documents like the System Requirements Specification or in specific sections within the main requirements document. |

Differences between functional and non-functional as the following:

(a) **What vs. How:**
- Functional requirements describe what the system must do, focusing on features and capabilities.
- Non-functional requirements describe how well the system must perform, focusing on quality attributes and constraints.

(b) **Measurability:**
- Functional requirements are generally more objective and measurable.
- Non-functional requirements can be subjective and may have a range of acceptable values.

(c) **User Experience vs. System Characteristics:**
- Functional requirements are more closely related to the user experience and the functionalities users interact with.
- Non-functional requirements are more concerned with the overall characteristics and performance of the system.

(d) **Testing:**
- Functional requirements are often tested using functional testing methods.
- Non-functional requirements may require different testing approaches, such as performance testing or security testing.

In a well-documented system, both functional and non-functional requirements are essential for ensuring that the final product meets the needs and expectations of its users and stakeholders. Both types of requirements work together to define a comprehensive set of criteria for the successful development and implementation of a system.

As an example, let consider an online ordering system for a restaurant:

**(a)Functional Requirements:**

    i. **User Registration:** Users can create accounts with unique usernames and passwords.

    ii. **Menu Display:** The system displays a categorized menu with items, prices, and descriptions.

    iii. **Item Selection:** Users can add items to their virtual cart from the menu.

    iv. Cart Management: Users can view and modify the contents of their cart before proceeding to checkout.

    v. **Payment Processing:** The system supports various payment methods (credit card, cash on delivery, etc.) for order payment.

    vi. **Order Confirmation:** Users receive a confirmation email or notification after successfully placing an order.

    vii. **Order History:** Registered users can view their order history.

**(b)Non-Functional Requirements:**

    i. **Performance:** The system must load the menu within 3 seconds to provide a responsive user experience.

    ii. **Scalability:** The system must handle a minimum of 100 concurrent orders during peak hours without performance degradation.

    iii. **Reliability:** The system should have a 99.9% uptime, ensuring it is available to users almost all the time.

    iv. **Security:** User passwords must be encrypted, and the payment process should comply with industry-standard security protocols.

    v. **Usability:** The user interface should be intuitive, and the ordering process should be easy to understand for users of all technical levels.

    vi. **Compatibility:** The system should be compatible with major web browsers (Chrome, Firefox, Safari) and mobile devices.

    vii. **Data Backup:** User and order data should be regularly backed up to prevent data loss.

These examples illustrate how functional requirements describe the specific features and capabilities of the ordering system, while non-functional requirements focus on the qualities and constraints that define how well the system should perform and behave. Both types of requirements are crucial for designing, developing, and testing a robust and user-friendly ordering system.

# CHAPTER 4: SYSTEM DESIGN

In this chapter the design of the proposed project should be emphasized with the final design of the system. The previous designs from Chapter 3, Rich Picture Diagram, Use Case Diagram, Sequence Diagram, Activity Diagram and UML Class Diagram should be mapped and synchronized to each other. These designs should be visualized correctly in system user interface. Therefore, highly recommend the structure of this chapter to be arranged by the user interface corresponding to the system requirements.

Number of use cases can be reflected to number of requirements. For example, if your system has four use cases *(Login, Register, Forget Password and Manage Account)*, therefore the minimum number of the user interface will be four. In some cases, a use case is shared by multiple users with different access. Hence suggest explaining the general followed by specification of user. Refer Figure 10 for contents structure.

<div style="background-color:#d7e0bf; padding:20px;">

**Page**

**Table of Contents**

**4.1 Overview** …………………………………………………………..…………
**4.2 Use Interface 1 : (Interface's Name)**……………………………….....................
    4.2.1 Interface Description ………………………………………………………..
    4.2.2 Available Features and Services…………………………………………………
    4.2.3 Strength and Uniqueness……………………………………………………….
**4.3 Use Interface 2 : (Interface's Name)**……………………………….....................
    4.3.1 Interface Description ………………………………………………………..
    4.3.2 Available Features and Services…………………………………………………
    4.3.3 Strength and Uniqueness……………………………………………………….
**4.4 Use Interface 3 : (Interface's Name)**……………………………….....................
    4.4.1 Interface Description ………………………………………………………..
    4.4.2 Available Features and Services…………………………………………………
    4.4.3 Strength and Uniqueness……………………………………………………….
 ……………...
 ……………...
**4.n**
 **4.n+1 Summary**……………………………………………………………………..

</div>

**Figure 10:** Design Table of Contents (Recommendation)

Following is the suggestions content of the Chapter 4's section:

**(a) Interface Description**

This section briefs and exposure reader the purpose of the interface includes the significant to the system requirements.

**(b) Available Features and Services**

This section provides insight into the available features and services with details include the requirement for the features and services, type of users (if involve more than one user) and the importance of the features and services.

**(c) Strength and Uniqueness**

This section will highlight the advantages OR strength OR uniqueness of the interface compared to the related existing system. Also, it emphasizes non-functionality of the system.

# CHAPTER 5: SYSTEM DEVELOPMENT

This chapter is the continuity of the previous chapters, especially Chapter 4. This chapter is crucial because it is pre-validation from readers after they read the title, Chapter 1, Chapter 2, and Chapter 3. Through this chapter the friendliness and usability of requirements able to be examined. Therefore, it is important to highlight the development process that shows the uniqueness of the system *(Should be reflected from the title).* Apart from that the involved process of mentioned requirements in the previous chapter also needs to be highlighted. Refer Figure 11 for suggestions of content structure.

**Figure 11:** Development Table of Contents (Recommendation)

Based on Figure 11, here the highlights:

(a) **System Development Tools and Configuration:** This section will highlight related configuration(s) and installation(s) for your system. IF you have more than one configuration and installation, treat each of them as sub-section for this section.

(b) **Uniqueness of System:** This section is a section to highlight your proposed technique or method. For example, if you are using machine learning, artificial intelligence, device, or special algorithm(s), this should be part of section because it reflects uniqueness of your system.

(c) **Development Approach:** This is a sub-section to show/present the functionality of a requirements/ uniqueness or any special development that you wish to highlight and bring significant to your system. In this sub-section, the details of how the approach is working should be highlighted and will be supported by the following sub-section which is code development.

(d) **Code Development:**  This sub-section is the heart of development where it provides the code to realize the functionality of the purposed system that has been elaborated in (a) and (b). Hence, the related code(s) should be presented with explanation(s) in this sub-section.

(e) **Advantages of the (Approach):** This sub-section only applied for uniqueness section to support and show the benefit(s) / advantage(s) of implementing the approach. This will be useful especially for those applied machine learning, artificial intelligence, device, or special algorithm(s).

(f) **Summary:** This section concludes the chapter. The content is flexible as long as reflecting the chapter. For example:

**Nut of shell, Chapter 5 has highlighted** *(number of code)* **of the system. The highlighted codes are** *(list of codes / requirements)* **represent the uniqueness of the system and the main requirements of the system. Detailed explanations are presented with the code of development to support the corresponding requirements.**

# CHAPTER 6: TESTING AND EVALUATION

The main objective of this chapter is to prove validity of system functionality and present quality of the proposed system.

**Figure 12:** Testing and Evaluation Table of Contents (Recommendation)

Based on Figure 12, here the highlights:

**(a) Testing and Evaluation of (Method):** This section emphasizes two main results of the proposed method; testing and evaluation. For the testing part, the result of the method will be tested by accuracy and other measurement to provide efficiency proof. Therefore, it will have more advantage by testing the proposed method with a few numbers of dataset. Table 17 is an example of testing result presentation.

**Table 17:** (Method Name)'s Accuracy Result

| Dataset | Accuracy (%) |
|---------|--------------|
|         |              |
|         |              |
|         |              |
|         |              |
|         |              |

Meanwhile, for evaluation the obtain results from the test result will be compared with other related methods. The main objective of the evaluation is to provide significant evidence that the proposed method is not only able to present good efficiency yet able shown good performance among other related methods. For this purpose, at undergraduate level two or

three related methods will be sufficient. Table 18 is an example of result evaluation presentation.

**Table 18:** Accuracy Result based on Different Methods

| Dataset | Method A | Method B | Method C | Proposed Method |
|---------|----------|----------|----------|-----------------|
|         |          |          |          |                 |
|         |          |          |          |                 |
|         |          |          |          |                 |
|         |          |          |          |                 |
|         |          |          |          |                 |

Also highly recommended to present the test and evaluation results in form of graph(s). This will help for better elaboration and discussion of the results. Plus, the visualization of results will be easier to capture by reader.

**(b) Testing and Evaluation of System:** This section is designed to present test and evaluation for system development. Therefore, it will be focused on test process includes testing plan, testing design specification, and user acceptance testing.

**i. Testing Plan:** This is sub-section that highlight the testing plan for system. Test feature, testing approach, Pass/Fail criteria and test deliverables are determined and presented. Table 19 can be used to systematically present the test cases.

By refer allocating Test Case ID to available test cases, the presentation of test results will be more organize and easy to be refer for future reference. The number of test cases is reflecting to the number of functionality and non-functionality of the system that will be tested.

**Table 19:** (System's Name) Test Plan.

| Test Case ID | Test Case Description | Testing Technique | Pass/Fail Criteria |
|--------------|----------------------|-------------------|--------------------|
|              |                      |                   |                    |
|              |                      |                   |                    |
|              |                      |                   |                    |
|              |                      |                   |                    |
|              |                      |                   |                    |
|              |                      |                   |                    |
|              |                      |                   |                    |
|              |                      |                   |                    |
|              |                      |                   |                    |

**Remarks:**

- **Test Case ID:** Created ID to represent system use case or system requirement. It can be a combination of alphabet and numeric as long as the ID is unique. Highly suggest the numeric in ascending order.

- **Test Case Description:** To give description of Test Case ID. Here, the main functionality of the test case is highlighted. Highly recommend the description is direct, short, and clear.

- **Testing Technique:** There are two main techniques; static and dynamic. For this column the selection of technique depends on the test case. Normally to present the evidence with systematic recorded result, use case testing is highly suggested. Figure 13 summarizes the available testing techniques.



**Figure 13:** Testing Techniques

- **Pass Criteria:** Provide the benchmark to indicate the pass standard for each created test case. This important to test and evaluate the efficiency of the features. The details must be provided to make sure the assessment is done tartly.

## ii. Testing Design Specification:

This sub-section will present the report of test cases based on the assigned test techniques in the previous sub-section. Provide is an example of form or template that applied use case testing as the testing technique (Refer Table 20).

| Test Case ID | | Test Case Description | | | |
|---|---|---|---|---|---|
| Created By | | Reviewed By | | Version | |

| QA Tester's Log | |
|---|---|

| Tester's Name | | Date Tested | | Test Case (Pass/Fail/Not Executed) | |
|---|---|---|---|---|---|

| | Prerequisites: | | | Test Data | |
|---|---|---|---|---|---|
| 1 | | | 1 | | |
| 2 | | | 2 | | |
| 3 | | | 3 | | |
| 4 | | | 4 | | |

| Test Scenario | |
|---|---|
| | |

| Step # | Step Details / Test Procedure | Expected Results | Actual Results | Pass / Fail / Not executed / Suspended |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**Table 20:** Use case Testing: (Feature's Name)

Based on Table 20, the test case ID and description must be tally with test plan. Meanwhile, Test Case (Pass/Fail/Not Executed) depends on the matching result between 'Actual Result' with 'Expected result'. Also, must be tally with pass criteria describe in pass criteria (in the test plan).

### iii. User Acceptance Testing:

This sub-section acts as validation phase where the completed system is tested by every single type of available users. For that purpose, a form should be prepared to direct the user to how the system should work. Table 21 is an example of the form.

| System Name | | | | | | |
|---|---|---|---|---|---|---|
| Testing Start Date | | Testing Start Time | | | | |
| Testing End Date | | Testing End Time | | | | |
| Name of Tester | | Type of User (for tester) | | | | |
| | | | | | | |
| Test No. | Description of Tasks | Steps to Execute | Expected Results | Pass | Fail | Defect / Comments / Additions |
| APPLICATION 1: | | | | | | |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| APPLICATION N: | | | | | | |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| GENERAL QUESTIONS / COMMENTS | | | | | | |
| | | | | | | |
| | | | | | | |

**Table 21:** Use Acceptance Testing

**Remarks:**

- Application refers to related features or requirements. For example, login, registration, make order and etc.
- Steps to execute are the provided steps to the tester how they can experience the tested features or requirements.
- Expected results are presented to ensure the tester (user) able to recognize the expectation output from each step.
- Meanwhile, *'Pass', 'Fail' and 'Defect / Comments / Additions'* are the provided columns to be filled by the user.
- Any further feedback should be included in 'GENERAL QUESTIONS / COMMENTS'.

**(c) Summary:** This section concludes the chapter. The content is flexible as long as reflecting the chapter.

44

# CHAPTER 7: CONCLUSION

The last chapter and should portray the final system outcomes that cover from Chapter 1 until Chapter 6. This chapter emphasized the significance, constraint, and suggestion for future enhancements. Also provided a user manual (if any) for user reference. Figure 14 is an example of conclusion structure.

**Figure 14:** Conclusion Table of Contents (Recommendation)

Based on the Figure 14, here the highlight:

**(a) User Manuals:**
This section will present the implementation phase where guidelines or user manuals are provided. You may highlight the list of available user manuals here and attach the user manuals as part of appendices. However, another alternative is to separate user manuals and make it as one chapter.

**(b) Significances:**
This section highlights the significances of the developed system, and it can be in multiple perspectives.

**(c) Constraints:**
The difficulties and challenges of completing this project can be highlighted here.

**(d) Future Enhancements:**
This section emphasizes suggestions for future enhancement with justification.

**(e) Summary:**
This is the last section and Table 21 can be used as part of content to present the summary of final documentation.

**Table 21:** Summary of (Project Title)

| Research Objective | Research Question | Outcome | Remark / Future Enhancements |
|---|---|---|---|
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

# COMPACT WITH SIMPLICITY

This guideline is specially designed for Final Year Project's documentation related to Computer Science and Information Technology. The guideline starts from proposal till complete chapters for Final Year Project's Report. Its served the relevant section ideas to be presented in the proposal and final report with some tricks. Besides that, includes step-by-step guidance and practical advice to help students successfully navigate every stage of their FYP.

## Dr. Liyana Rosely

Nur Fatin Liyana Mohd Rosely was born in Malaysia in 1991. She received the BSc., Master's degree and Doctor of Philosophy in computer science from Universiti Teknologi Malaysia (UTM), Malaysia in 2020. Since 2014 she has been involved in research with School of Computing, Faculty of Engineering, UTM. Her research interests include computer vision, swarm intelligence and exploring new technologies using artificial intelligence approach. Currently, she is a senior lecturer in INTI International University (IIU), Malaysia. She is a dedicated academician and a passionate researcher with diversified research interests. She is also an editorial board member of the Journal of Data Science (JoDS). Apart from that, she is certified International Software Testing Qualifications Board (ISTQB) Tester.

She can be contacted via email: yanarosely@gmail.com

## Associate Professor Dr. Siti Sarah Binti Maidin
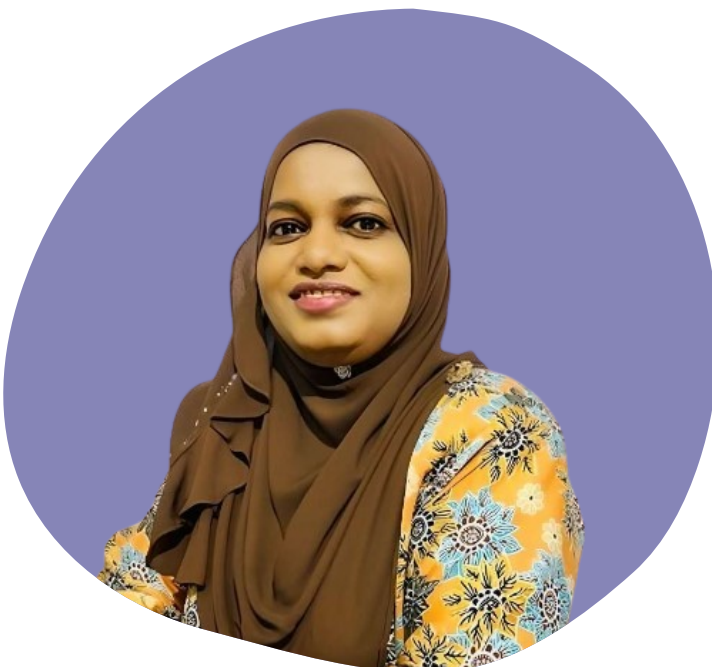
Siti Sarah Maidin received B.Sc. degree in Computer Science from the University Teknikal Malaysia Melaka, Malaysia, M.Sc. degree in Information Technology from the University Teknologi MARA, Malaysia and the Ph.D. degree in Information and Communication Technology from Universiti Tenaga Nasional, Malaysia. She is currently an Associate Professor with the Department of Data Science and Information Technology, INTI International University, Malaysia holding post as Head of Programme. She has supervised numerous undergraduate and postgraduates' students. She serves as editorial board member for Editorial Board member, The Journal of Management Theory and Practice (ISSN: 2716-7089) and The Journal of Management Theory and Practice. She also has been appointed as the evaluator for the university level research grant and Malaysian government research grant. In addition, she is also involved in organizing local and international conferences. Her research interests include software engineering, educational technology, and information systems.

She can be contacted via email: sitisarah.maidin@newinti.edu.my.