# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belagavi, Karnataka - 590018

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**


A Project Report on

## Presentation Hub

Submitted in partial fulfilment of the requirements for the conferment of degree of

**BACHELOR OF ENGINEERING**

in

**COMPUTER SCIENCE AND ENGINEERING**

by

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# CERTIFICATE

This is to certify that the project entitled Presentation Hub is a Bonafide work carried out by **K Amrutha Kamath-1BY22CS095, Himanshu Lodha-1BY22CS083, Aditya Raj-1BY22CS210** in partial fulfilment for the award of "BACHELOR OF ENGINEERING" in "Computer Science and Engineering" of the Visvesvaraya Technological University, Belagavi, during the year 2025-26. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report. The project report has been approved as it satisfies the academic requirements in respect of working for the BE degree.

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# ABSTRACT

In today's fast-paced digital environment, creating high-quality presentations quickly has become essential for students, professionals, educators, and businesses. Traditional presentation tools require manual effort, designing slides, organizing content, choosing visuals, and formatting layouts, which can be time-consuming and difficult for users who aren't familiar with design principles. As AI continues to transform productivity, there is a growing demand for intelligent tools that can automate these repetitive tasks and help users focus on ideas instead of formatting.

Presentation Hub is built to solve this problem. It is an AI-powered presentation generator that converts a simple text prompt into a fully structured PowerPoint file within seconds. Using the OpenAI API, the system automatically generates slide content, summaries, titles, and image suggestions. With a modern tech stack, Next.js, React, and serverless APIs, the platform delivers fast performance, smooth user experience, and reliable generation workflows. Clerk provides secure authentication, ensuring safe user access, while Lemon Squeezy enables seamless payment integration for premium features.

By combining AI with modern web technologies, Presentation Hub aims to simplify the presentation-creation process, helping users produce professional, visually appealing slides effortlessly. The project showcases how generative AI can enhance creativity, reduce workload, and improve productivity across multiple domains.

# ACKNOWLEDGEMENT

We are happy to present this project after completing it successfully. This project would not have been possible without the guidance, assistance and suggestions of many individuals. We would like to express our deep sense of gratitude and indebtedness to each and every one who has helped us make this project a success.

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We heartily thank **Dr Shobha M** Cluster Head, BMS Institute of Technology & Management for his constant encouragement and inspiration in taking up this project.

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# DECLARATION

We, hereby declare that the project titled "**Presentation Hub"** is a record of original project work under the guidance of **Dr Sanjay H A**, Department of Computer Science and Engineering, BMS Institute of Technology & Management, Autonomous Institute under Visvesvaraya Technological University, Belagavi during the Academic Year 2025-2026. We, hereby declare that the project titled "**Presentation Hub"** is a record of original project work under the guidance of **Dr Sanjay H A**, Department of Computer Science and Engineering, BMS Institute of Technology & Management, Autonomous Institute under Visvesvaraya Technological University, Belagavi during the Academic Year 2025-2026.

I also declare that this project report has not been submitted for the award of any degree, diploma, associate ship, fellowship or other title anywhere else

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# Chapter-1

# 1. Introduction

## 1.1 Background

Creating visually appealing and well-structured presentations has always been a time-consuming task, especially for students, educators, and professionals who need to present information quickly. Traditional presentation tools require users to manually design layouts, add content, choose images, and maintain consistent formatting across slides. As workload increases and deadlines become tighter, people often struggle to prepare high-quality presentations within a limited time. With the rise of AI-driven solutions, there is a growing need for tools that can automate this process and reduce the effort required to convert ideas into professional slides.

Presentation Hub addresses this need by leveraging advanced generative AI to create complete presentations from just a text prompt. Built using modern technologies like Next.js, React, OpenAI API, Clerk authentication, and Lemon Squeezy payments, the platform delivers a seamless and secure user experience. The system intelligently generates slide content, titles, summaries, and visuals, allowing users to produce ready-to-use PPT files within seconds. By integrating AI with a powerful web stack, Presentation Hub simplifies the entire presentation-creation workflow and demonstrates how automation can significantly enhance productivity and creativity.

## 1.2 Problem Statement

Preparing a complete and visually consistent presentation is often a tedious and time-consuming task for students, professionals, and educators. Users must manually gather information, structure the content into meaningful slides, decide on design layouts, and select visuals that match the topic. This process demands both creativity and technical presentation skills, which many users may lack. As a result, individuals often end up with poorly structured slides, mismatched designs, or rushed presentations created under tight deadlines.

Despite the availability of modern presentation tools, there is still no fast and automated solution that can convert a simple prompt or idea into a fully generated PPT. Users need a system that can instantly produce accurate content, organized slide structures, and relevant visuals without requiring extensive editing. The absence of such an AI-powered presentation

generator makes it difficult for people to create high-quality presentations efficiently. Therefore, there is a need for a platform like Presentation Hub that automates the entire slide creation process and significantly reduces the effort and time required to prepare professional presentations.

## 1.3 Problem Description

Creating a well-structured and visually appealing presentation requires a combination of content knowledge, design skills, and a significant amount of time. Users often struggle with organizing information into meaningful slides, maintaining consistent formatting, selecting appropriate visuals, and ensuring the presentation flows smoothly. For many students, teachers, and working professionals, these tasks become overwhelming—especially when deadlines are short or when they lack strong design experience. As a result, presentations often end up rushed, inconsistent, or lacking clarity.

Although several presentation tools exist, most of them still rely heavily on manual effort. They do not offer an automated way to transform a simple text prompt into a complete, ready-to-use PowerPoint file. Users must start from scratch, design templates themselves, and manually populate content. This gap creates a strong need for an AI-powered solution that can instantly generate structured slides, relevant text, and visuals. Presentation Hub aims to fill this gap by providing an intelligent system that automates the entire presentation-creation process and significantly reduces the user's workload.

## 1.4 Objectives

Presentation Hub is an AI-powered platform that automatically generates complete, professional presentations from a simple text prompt. It simplifies the entire slide-creation process by producing structured content, clean layouts, and relevant visuals within seconds. The system combines OpenAI, Next.js, React, Clerk, and Lemon Squeezy to deliver a fast, secure, and seamless presentation-building experience. The objectives of this project include:

1. To automate the creation of presentations using AI, reducing manual effort and saving user time.
2. To generate structured slide content (titles, points, summaries) based on a simple text prompt.
3. To produce professional PPT files with consistent formatting and layout.

4. To integrate OpenAI's API for high-quality content generation and topic understanding.
5. To offer a smooth user experience through a modern Next.js and React-based interface.
6. To provide secure user authentication using Clerk for safe login and access control.

## 1.5 WPs and SDG Addressed

Solving Complex Engineering Problems Incorporating Sustainability Goals

Mapping of Complex Engineering Problems with Washington Accord WPs( WP1-WP7)

| WP Code | Description | Competencies | Applicable (✓) |
|---|---|---|---|
| WP1 | In-Depth Engineering Knowledge | Uses advanced algorithms | ✓ |
| | | Works with complex data structures | |
| | | Applies specialized domain knowledge | ✓ |
| | | Uses professional-grade tools and platforms | ✓ |
| | | Combines knowledge from multiple CSE fields | ✓ |
| | | Performs algorithm optimization | |
| | | Refers to research papers or standards | ✓ |
| WP2 | Wide-Ranging or Conflicting Technical & Non-Technical Issues | Balances security with performance | ✓ |
| | | Evaluates resource limitations | |
| | | Considers user experience needs | |
| | | Follows privacy and security rules | ✓ |
| | | Chooses solutions that scale and are easy to maintain | ✓ |
| | | Identifies and manages risks | ✓ |
| | | Considers ethical impacts | ✓ |
| WP3 | Abstract Thinking & Originality | Designs new algorithms or models | |
| | | Creates original system designs | ✓ |
| | | Introduces innovations in machine learning models | |
| | | Uses strong abstract thinking | |
| | | Develops improved optimization methods | |
| | | Experiments with new ways of representing data | ✓ |
| | | Adds original ideas not taken from standard tutorials | ✓ |
| WP4 | Design and development of solutions | Solves real-world problems that don't have ready-made code | ✓ |
| | | Modifies existing tools or frameworks in advanced ways | ✓ |
| | | Uses cutting-edge or emerging technologies | ✓ |
| | | Implements algorithms or protocols from scratch | ✓ |

| | | | |
|---|---|---|---|
| | | Handles messy or incomplete data effectively | |
| | | Designs custom workflows for networking, security, or ML | |
| | | Builds non-default configurations in cloud, IoT, or distributed systems | ✔ |
| WP5 | Use of modern tools | Builds custom security mechanisms | |
| | | Creates new database techniques | |
| | | Proposes original design or coding standards | ✔ |
| | | Improves standard algorithms | ✔ |
| | | Defines new performance benchmarks | ✔ |
| | | Explains why standard workflows need changes | |
| | | Builds custom testing or validation tools | |
| WP6 | Nature of problem: uncertainty, ambiguity | Collects requirements from different types of users | ✔ |
| | | Designs role-based access and permissions | |
| | | Manages conflicting requirements | |
| | | Builds interfaces tailored to each stakeholder | |
| | | Uses proper modeling techniques | ✔ |
| | | Ensures secure data handling for all roles | ✔ |
| | | Validates the system with user testing | ✔ |
| WP7 | Interdependence and multidisciplinary factors | Breaks the system into clear layers | ✔ |
| | | Designs and connects multiple interacting modules | ✔ |
| | | Integrates hardware and software components | ✔ |
| | | Handles advanced system constraints | ✔ |
| | | Uses DevOps tools and automation | |
| | | Tests for performance and reliability | |
| | | **Ensures different technologies work together** | ✔ |

| **WP Code** | **No. of Competencies Mapping** | **Low/Moderate/High** |
|---|---|---|
| WP1 | 5 | HIGH |
| WP2 | 6 | HIGH |
| WP3 | 3 | MODERATE |
| WP4 | 5 | HIGH |
| WP5 | 4 | MODERATE |
| WP6 | 4 | MODERATE |

| | | |
|---|---|---|
| WP7 | 5 | HIGH |

| | |
|---|---|
| **Note: Scale for mapping:**<br>• Low: 1–2 competencies matched<br>• Moderate: 3–4 competencies<br>• High: 5 or more | **Complex Engineering Project**<br>A project is considered complex if:<br>Condition A:<br>At least 3 out of WP1–WP7 are High<br>AND<br>Condition B:<br>At least 5 out of WP1–WP7 are Moderate or High<br>If both conditions are met → Complex Project. |

**Conclusion:** Based on the above key indicators, the Project is considered a **Complex Project.**

## 2. Mapping of Project with SDG Goals, Targets, and Indicators

| SDG Goal Addressed | Target Description | Justification / Mapping Explanation | Expected Impact / Outcome | Level |
|---|---|---|---|---|
| SDG 4 – Quality Education | Increase digital skills and access to quality learning tools. | Presentation Hub helps students and teachers generate structured, high-quality learning materials quickly. | Improved learning experience, enhanced presentation quality, and better educational outcomes. | HIGH |
| SDG 9 – Industry, Innovation & Infrastructure | Enhance scientific research and upgrade technological capabilities. | Uses AI, automation, Next.js, and cloud infrastructure to promote digital innovation | Encourages adoption of modern tech tools and strengthens digital infrastructure. | HIGH |
| SDG 8 – Decent Work & Economic Growth | Improve productivity and technological innovation. | Automates manual presentation work, increasing efficiency for professionals and students. | Saves time, boosts productivity, and supports efficient workflow. | MODERATE |
| SDG 12 – Responsible Consumption & Production | Reduce waste through efficient resource use. | Encourages digital presentation creation instead of printed drafts, reducing paper waste. | Supports eco-friendly digital practices and lowers resource consumption. | HIGH |

# Chapter 2

# Literature Review

## 2.1 Analysis of the literature

With the rapid development in AI, NLP, and ML, digital content creation has undergone a significant transformation, especially regarding automated presentation generation. Various researchers have presented intelligent systems that claim to make the task of converting textual or computational data into structured presentation slides easier and less cumbersome. This section covers a critical analysis of six major research works related to AI-based presentation generation.

1. OutlineSpark (Fengjie Wang, 2024)

   This focuses directly on the generation of presentation slides from such computational notebooks as Jupyter through a well-structured outline approach. It includes the display of an overview of the notebook, an outline panel, and a slide panel. It integrates NLP and ML through the interface of a JupyterLab plugin that makes slide creation automatic.
   Strengths:
   - Reduces manual effort to convert notebooks into slides
   - Well-organized content extraction
   - Improves researcher productivity

   Limitations:
   - Only accepts notebook-based input
   - No advanced visual editing tools
   - Lacks collaboration and cloud storage
   - Limited UI experience

   As this research is highly specialized for computational users, it does not support general-purpose online PPT creation as the proposed system.

2. AI pptX (Vineeth Ravi, 2019)

It introduces a conversational AI-based document generation system in which users issue natural-language commands that are translated into actionable "skills." It makes use of a CRF-based parser and a Robust Knowledge Base, RKB, for continuous learning.

Strengths:

- Supports voice/text commands.
- Continuous learning from user behavior
- Reduces manual command effort

Limitations:

- Back-end driven with no interactive UI
- No drag-and-drop editor
- No project dashboard
- No authentication or payment system
- No real-time AI-assisted editing

Powerful as it is for command-based automation, this system lacks the frontend interactivity needed for modern online PPT platforms.

3. PPTAgent (Hao Zheng, 2025)

PPTAgent analyses existing presentations to learn structural patterns through a two-stage AI pipeline, thereby automatically generating new presentations. It is evaluated by using PPTEval, an advanced framework for benchmarking.

Strengths:

- High-quality slide structuring
- Generating content and layout automatically
- Strong evaluation framework

Limitations:

- No real-time editing
- No user customization
- No theming features

- No authentication and monetization
- Entirely backend-focused

This work is outstanding in AI evaluation but lacks practical usability for end-users, especially over cloud-based platforms.

4. Presentify (Atul Shreewastav, 2024)

Presentify automates the generation of presentation slides based on academic research using a fine-tuned T5 Transformer.

Strengths:

- Accurate academic summarization
- Structured slide generation
- Useful for educators and researchers

Limitations:

- Restricted to academic content
- No interactive editing
- No theming options
- No authentication system
- No project management

Presentify is domain-specific and cannot be used as a general solution for online PPT building.

5. D2S – Document to Slide (Edward Sun – IBM, 2021)

D2S uses a two-step summarization in which the model first uses slide titles to retrieve relevant text, and then long-form QA techniques to generate the bullet points. A new dataset called SciDuet is also introduced.

Strengths:

- High-quality Summarization
- Benchmark dataset contribution
- Performs better than traditional summarization

Limitations:

- Focused only on academic content

- No real-time editing
- No design customization
- No frontend interface

This research contributes strongly to the AI-based summarization but does not address the full presentation creation workflow.

6. AutoPresent (Jiaxin Ge, 2025)

AutoPresent creates presentation slides from natural language descriptions and introduces the SlidesBench dataset. It uses a LLaMA-based model with support for iterative self-refinement.

Strengths:

- Generates structured slides from prompts
- Self-improving design mechanism
- Large benchmark dataset

Limitations:

- No real-time editing
- No authentication or user management
- Limited design customization
- No monetization capabilities
- No full frontend interface

While AutoPresent is technologically advanced, its practical features are lacking for a commercial online PPT platform.

## 2.2 A Summary Table

| Research Work | Year | Core Technology | Main Focus | Key Limitations Compared to Proposed System |
|---|---|---|---|---|
| OutlineSpark | 2024 | NLP, ML, Jupyter | Notebook-to-slide | No UI editor, no themes, no sharing |
| AI pptX | 2019 | CRF, RKB, NLP | Command-based PPT | No frontend editor, no authentication |
| PPTAgent | 2025 | Two-stage AI, PPTEval | Pattern-based generation | No realtime editing, no themes |
| Presentify | 2024 | T5 Transformer, NLP | Research to PPT | Domain-specific, no UI |
| D2S | 2021 | Long-form QA, Summarization | Document to slides | No visual editor, no cloud |
| AutoPresent | 2025 | LLaMA, SlidesBench | Prompt to slides | No frontend, no monetization |

## SUMMARY OF LITERATURE SURVEY:

The literature survey reveals that AI-based presentation generation has evolved significantly with the integration of NLP, machine learning, and deep learning models. Systems such as OutlineSpark, AI pptX, PPTAgent, Presentify, D2S, and AutoPresent demonstrate strong capabilities in automating slide generation through notebook conversion, conversational

commands, pattern learning, academic summarization, and prompt-based generation. These studies successfully address core technical challenges such as content extraction, summarization, slide structuring, and layout prediction. Many of them also introduce benchmark datasets and evaluation frameworks, which strengthen the research foundation of automated presentation systems.

However, despite their strong backend intelligence, most existing systems suffer from significant practical limitations. The majority of these tools lack real-time interactive editing, visual drag-and-drop interfaces, theme customization, cloud storage, user authentication, and collaboration features. Several systems are also domain-specific, focusing only on academic or computational content. Moreover, most of the reviewed works exist purely as research prototypes without frontend integration, monetization models, project management, or real-world user accessibility.

These limitations clearly highlight a research and implementation gap between intelligent slide generation and fully usable commercial platforms. The proposed system, Presentation Hub, directly bridges this gap by combining prompt-based AI slide generation with a complete cloud-based, PowerPoint-like interactive editor. It supports themes, user authentication, project storage, real-time editing, and instant PPT sharing. Hence, the proposed platform is not merely an extension of existing research but a practical, scalable, and market-ready solution that transforms AI-based presentation generation into a complete end-user product.

## 2.3 Implications

The literature reviewed clearly shows that AI-based presentation generation is an emerging and highly impactful research area. Existing systems successfully automate:

- Slide content extraction
- Outlining generation
- Text summarization
- Structural pattern learning

However, nearly all of these systems lack many important real-world usability features including:

- Real-time editable slide interface
- PowerPoint-like drag-and-drop editing

- Multiple theme selection
- Cloud storage & anywhere access
- User authentication
- PPT sharing options
- Continuous AI assistance during editing

These gaps strongly justify the need for your Online AI PPT Maker Platform, which:

- Combines AI content generation + full interactive editing
- Works as a cloud-based platform
- Supports theme selection and instant PPT sharing
- Matches functionality of Microsoft PowerPoint
- Is accessible from any device, anywhere

Thus, our project is not just a repetition of existing research but is extended into an integrated commercial-grade solution.

## 2.3.1 CONCLUSION

The literature review clearly establishes that AI-based presentation generation is a rapidly growing and impactful research area. Existing systems have made significant progress in automating essential tasks such as slide content extraction, outline generation, text summarization, and structural pattern learning. These advancements have reduced the manual effort involved in creating presentations and improved the efficiency of content transformation from raw text to structured slides.

However, despite these technical achievements, most existing solutions lack critical real-world usability features. The absence of real-time editable interfaces, PowerPoint-like drag-and-drop functionality, multiple theme options, cloud-based storage, user authentication, and presentation sharing severely limits their adoption for everyday users. Additionally, the lack of continuous AI assistance during the editing process creates a gap between automated generation and practical presentation refinement.

The proposed Online AI PPT Maker Platform directly addresses these limitations by integrating intelligent content generation with a fully interactive, cloud-based editing environment. By offering theme selection, real-time editing, secure authentication, cloud access, and instant sharing features, the platform delivers functionality comparable to

Microsoft PowerPoint while leveraging the power of AI. Therefore, this project represents not just an improvement over existing systems, but a complete, commercial-grade solution designed for students, professionals, educators, and businesses.

## 2.4 Existing System

Most current AI-based presentation generation systems are backend tools or research prototypes rather than full-fledged applications. The key characteristics of existing systems include:

- Limited to document-to-slide or notebook-to-slide conversion
- No live UI-based editing
- No cloud-based project storage
- No authentication or user management
- No real-time AI content refinement
- No presentation sharing system
- No theme customization
- Targeted only for researchers or technical users

In contrast, the proposed system is a complete:

- Online AI-powered PPT platform
- Supports prompt-based slide creation
- Allows users to choose themes
- Provides full PowerPoint-like editing options
- Enables cloud access & project storage
- Includes PPT sharing feature
- Works for students, teachers, professionals, and businesses

Most existing AI-based presentation generation systems function primarily as backend research tools or experimental prototypes rather than complete, user-ready applications. These systems are generally limited to basic document-to-slide or notebook-to-slide conversion and do not

provide a live, interactive user interface for real-time editing. Features such as cloud-based project storage, user authentication, and user management are largely absent. Additionally, real-time AI refinement, presentation sharing options, and theme customization are missing, which restricts their usability for general users. As a result, these tools are mainly targeted at researchers, developers, or technical users rather than students, educators, and business professionals.

In contrast, the proposed system is designed as a complete and user-friendly Online AI-powered PPT platform that overcomes all the limitations of existing solutions. It supports prompt-based slide creation using advanced AI models, allowing users to generate complete presentations simply by entering a topic or description. The platform enables users to choose from multiple professionally designed themes and provides full PowerPoint-like editing capabilities, including drag-and-drop slide editing, text formatting, layout changes, and animations. This ensures that users have both automation and creative control over their presentations.

Moreover, the proposed system offers cloud access with secure project storage, ensuring that users can save, edit, and access their presentations from anywhere and on any device. It includes a built-in PPT sharing feature for collaborative and professional use, making it suitable for academic presentations, corporate meetings, and business proposals. By serving a wide range of users, including students, teachers, professionals, and businesses—the proposed platform transforms AI-based presentation generation into a practical, accessible, and commercial-grade solution.

# CHAPTER-4

# Architecture Design

## 4.1 Architecture Diagram

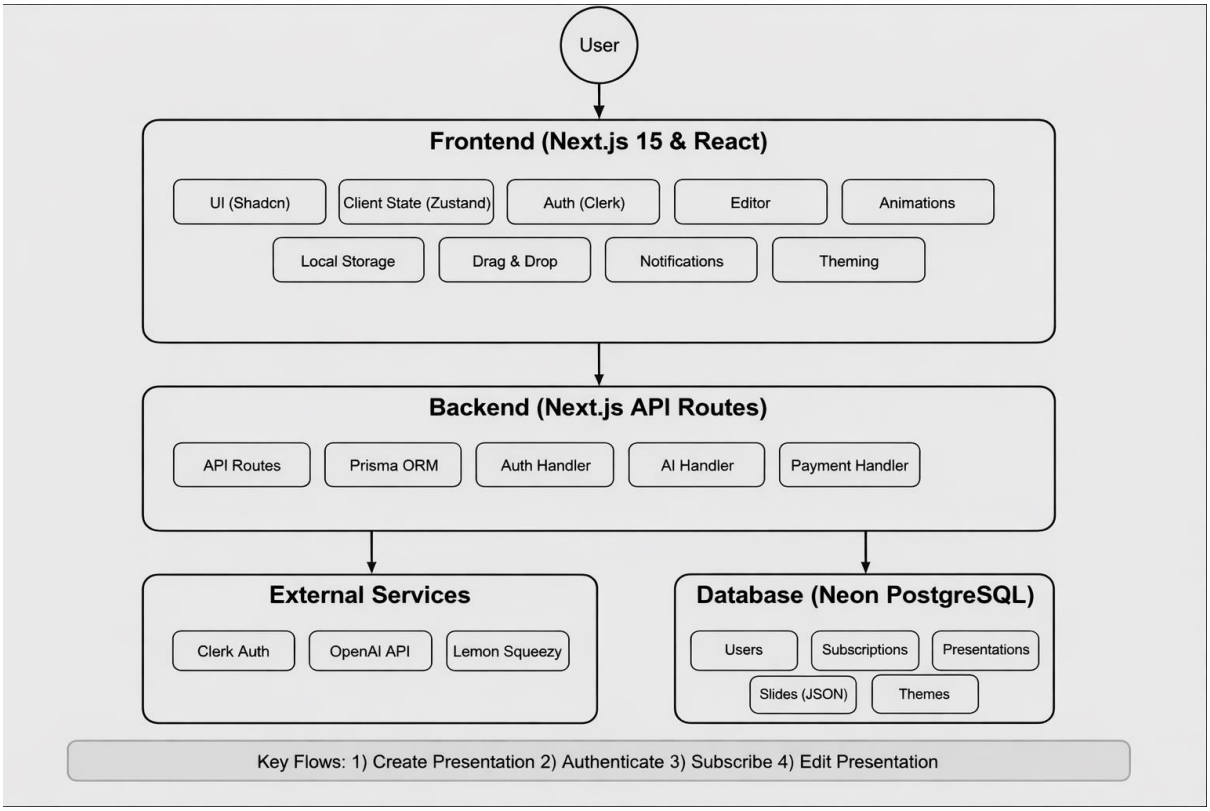


**FIGURE 4.1 ARCHITECTURE DIAGRAM**

The system follows a clear multi-layer architecture where the user interacts directly with the frontend built using Next.js 15 and React. This layer manages everything related to the user experience, including the UI components made with Shadcn, client-side state using Zustand,

authentication through Clerk, the slide editor, drag-and-drop functionality, local storage for temporary data, animations, notifications, and theming controls. All interactive features, visual elements, and editing tools are handled here to ensure a smooth and responsive workflow while creating or modifying presentations.

The backend runs through Next.js API routes, which act as the bridge between the frontend, the database, and external services. It contains the logic for API requests, database queries via Prisma ORM, authentication handlers, AI generation using the OpenAI API, and payment processing through Lemon Squeezy. These backend routes communicate with external services such as Clerk for user authentication, OpenAI for generating presentation content, and Lemon Squeezy for managing subscription plans. All persistent data—including user accounts, subscription status, presentations, themes, and slide content stored in JSON format—is saved in a Neon PostgreSQL database. Together, this setup supports the entire flow of creating presentations, authenticating users, handling payments, storing data, and allowing users to edit their work seamlessly.

The architecture of the proposed system is designed using a modern full-stack approach, where the user directly interacts with the **Frontend built using Next.js 15 and React**. This layer provides a rich and responsive user experience through components such as Shadcn UI for interface design, Zustand for client-side state management, Clerk for authentication, and advanced features like drag-and-drop editing, animations, theming, notifications, and local storage. These components together ensure that users can easily create, edit, and customize presentations in real time with smooth performance and an intuitive workflow.

The **Backend layer is implemented using Next.js API routes**, which acts as the core processing unit of the system. It handles all server-side logic through well-defined modules such as API route handlers, Prisma ORM for database communication, authentication handlers, AI processing handlers, and payment handlers. This layer securely manages requests from the frontend, processes AI-based slide generation, validates users, manages subscriptions, and ensures smooth communication with external services. The modular backend design improves scalability, maintainability, and performance.

The system integrates **external services and a cloud-hosted database** to complete the workflow. Clerk is used for secure user authentication, the OpenAI API powers intelligent content generation, and Lemon Squeezy manages subscription payments. All persistent data,

including users, subscriptions, presentations, slide content (JSON), and themes, are stored in **Neon PostgreSQL**. The key system flow includes creating a presentation, authenticating the user, subscribing when required, and editing the presentation. Together, these components form a fully scalable, secure, and cloud-based AI-powered presentation generation platform.

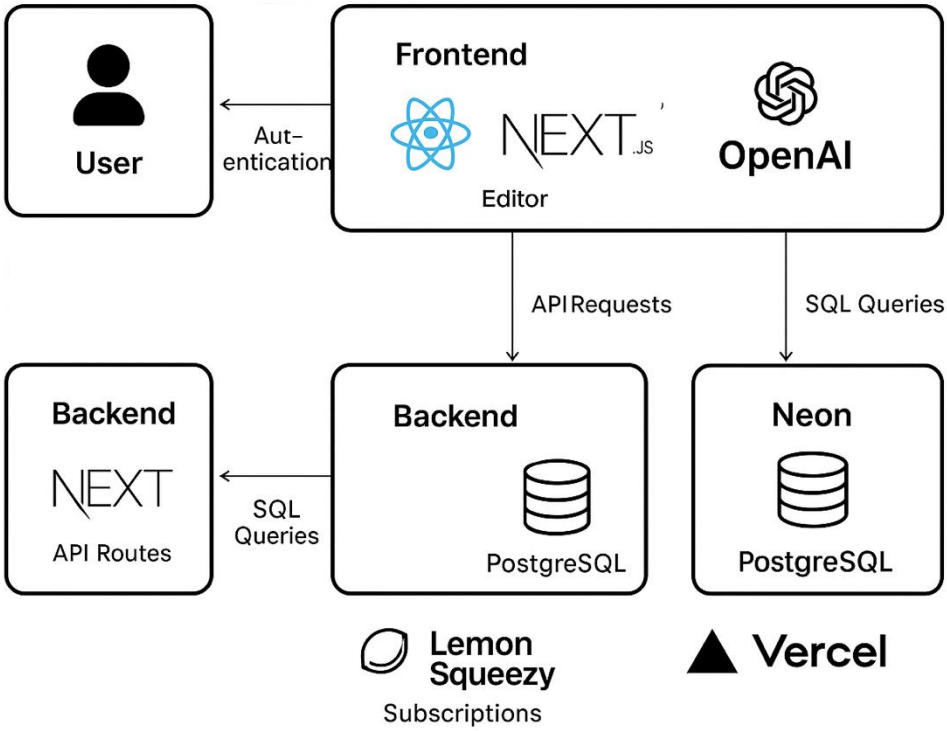


**FIGURE 4.2 ARCHITECTURE DIAGRAM 2**

Another important aspect of this architecture is the smooth integration between the backend and external services. The backend ensures secure communication with Clerk for user identity verification, uses the OpenAI API to generate slide content or improve presentation text, and connects with Lemon Squeezy to manage subscription tiers and payment operations. These interactions are abstracted behind API handlers, making the system modular and easy to extend. If you decide to add new AI models, analytics services, or different payment providers in the future, the backend can incorporate them without affecting the frontend or database layers.

The database layer, powered by Neon PostgreSQL, plays a central role in storing structured information like user profiles, subscriptions, saved presentations, themes, and slide data in

JSON format. This storage design ensures reliability, high performance, and support for real-time updates, especially when users edit or regenerate slides. By separating presentation content from user preferences and subscription details, the system becomes cleaner, safer, and easier to manage. Overall, this architecture supports scalability, modularity, and smooth user experience, making it suitable for a modern AI-powered presentation creation platform.

## 4.2 Data Flow Diagram

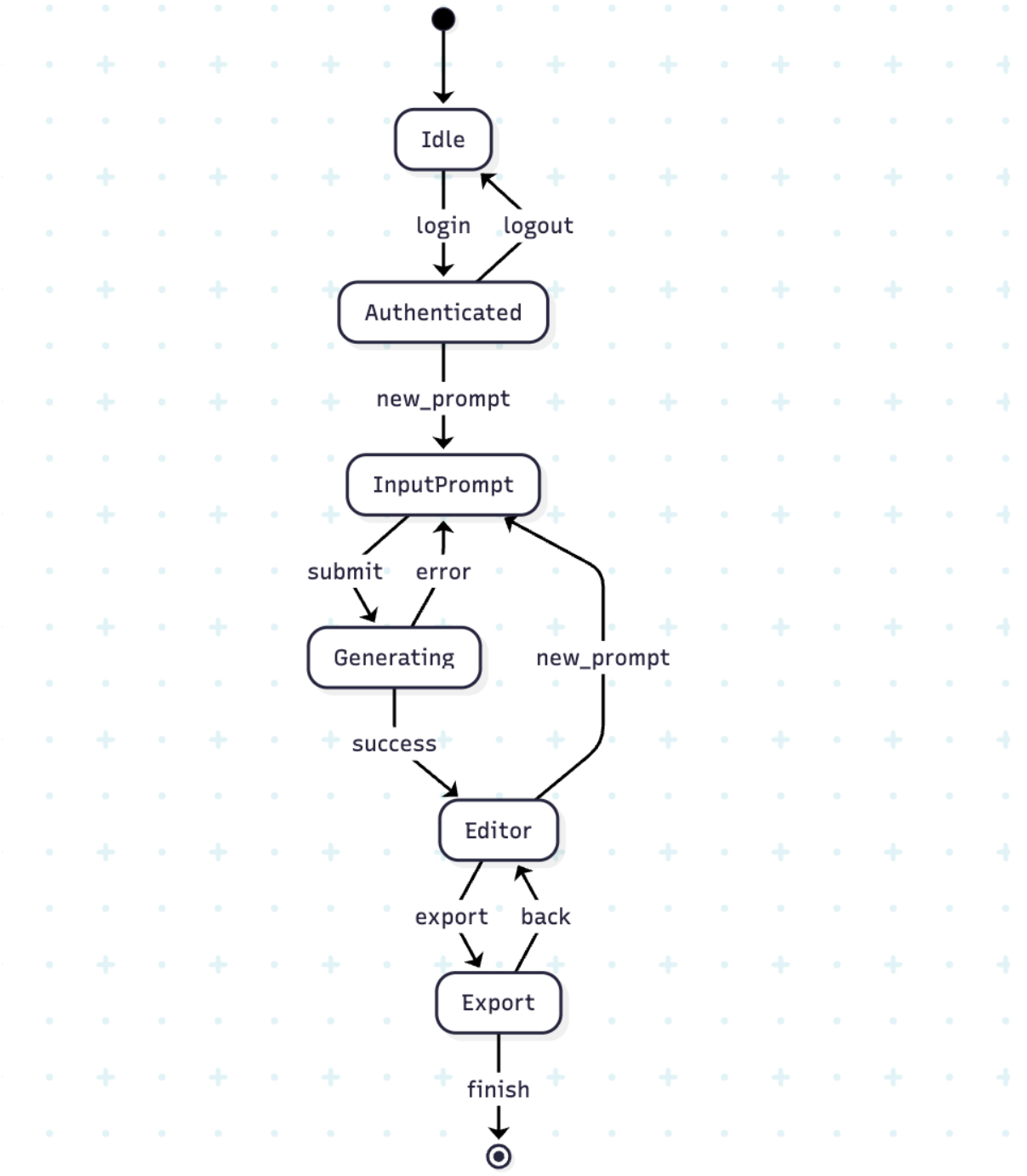


FIGURE 4.3 DATA FLOW DIAGRAM

The system begins in the Idle state where no user action has taken place yet, and the interface simply waits for the user to either sign in or start using the platform. Once the user logs in successfully, the system transitions to the Authenticated state, unlocking protected features such as saving presentations, accessing templates, and using the AI tools. From here, the user enters the Input state where they provide the topic, description, or details that will form the

basis of the AI-generated presentation. This data then moves to the Prompts Generate state, where the backend sends the user's input to the AI engine, processes the request, and returns structured slide content, titles, and themes.

After the AI returns the results, the system moves into the Editor state, where the user can customize the generated slides using drag-and-drop tools, animations, theming options, and layout adjustments. When the user is satisfied, they transition to the Export state, where the system converts the finished presentation into formats such as PDF, PPTX, or shareable links. The final state is Finish, where the export is completed, and the user can download, save, or continue editing. Each state represents a clear step in the user's journey, ensuring smooth flow, organized data processing, and a seamless workflow from login to final presentation output.

# 4.3 Algorithm Diagram

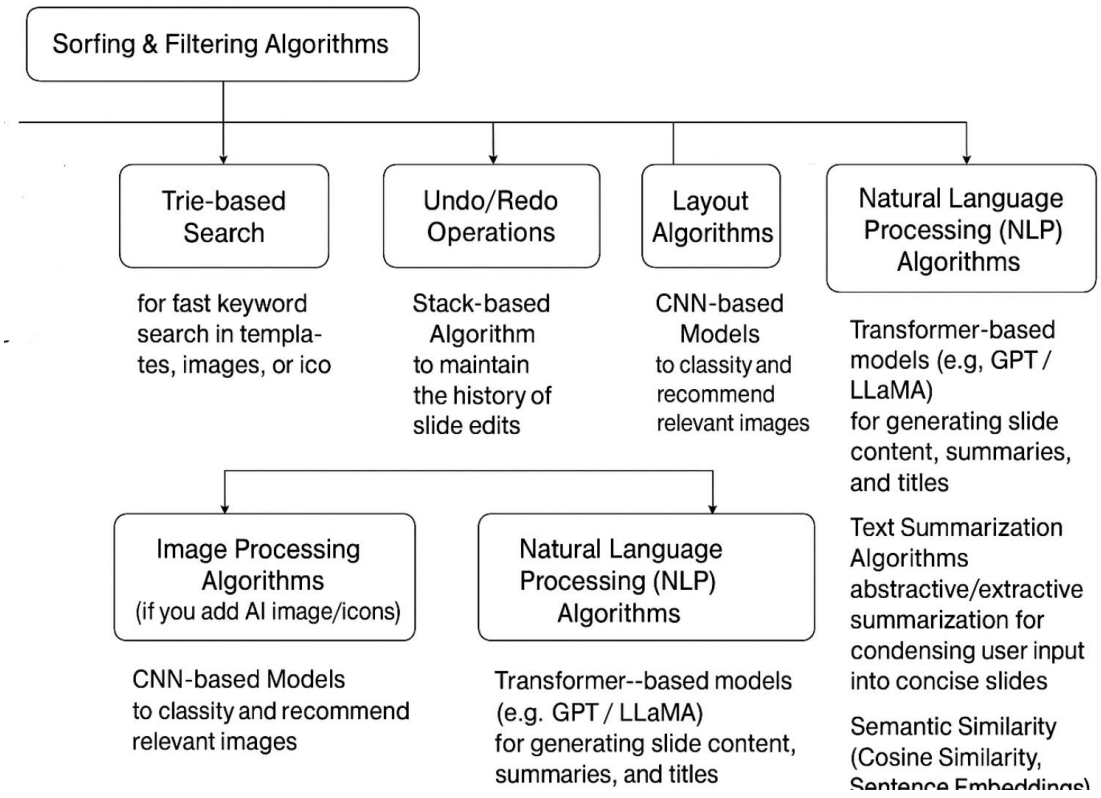


**FIGURE 4.4 ALGORITHM DIAGRAM**

The PPT Maker system uses several algorithmic components to manage content generation, slide arrangement, and user interactions efficiently. To organize templates or slide elements,

sorting and filtering algorithms such as merge sort and quick sort help arrange slides based on relevance, time, or priority. For fast template or asset lookup, a trie-based search algorithm enables quick keyword-based retrieval because it stores words in a prefix tree structure, making lookup times significantly faster. Additionally, the system supports undo and redo actions through a stack-based algorithm, where every user action is stored on a stack, allowing operations to be reversed or reapplied in the correct sequence.

For layout generation, the system relies on algorithms that decide where and how text, images, and icons should be placed on each slide. Greedy placement ensures elements are arranged quickly in the best available space, while constraint-satisfaction techniques maintain rules such as margins, spacing, and alignment. In more advanced diagramming features, graph-based layout algorithms, including force-directed layouts, automatically organize flowcharts or network diagrams by treating nodes as objects with attractive and repulsive forces. When image-based enhancement is included, machine learning methods such as convolutional neural networks can classify or recommend relevant images for the slide. K-means clustering further helps extract dominant colors from images to build matching color palettes.

The intelligence behind text and content generation comes from natural language processing algorithms. Transformer models process user prompts and generate titles, bullet points, and summaries. Text-summarization techniques, both extractive and abstractive, condense long user input into neat, readable slide content. To improve recommendation quality, semantic similarity methods using sentence embeddings and cosine similarity measure how close two text inputs are in meaning. This helps the system suggest related templates, icons, or images to match the user's topic. Together, all these algorithms create a smart, automated, and user-friendly PPT creation experience.

Along with these core methods, the system integrates lightweight optimization techniques to improve responsiveness. Caching mechanisms store frequently used templates and AI responses to reduce loading time, while basic heuristics guide the selection of slide layouts to keep the design consistent. These supporting algorithms ensure the overall user experience remains smooth, fast, and adaptive, even as the system handles complex content generation tasks.

# CHAPTER 4

# System Requirements Specifications

## 4.1 Functional Requirements

i. User Authentication & Authorization
   a. Allow users to sign up, log in, log out using Clerk.
   b. Secure route access based on authentication status.

ii. Presentation Creation
   a. Enable users to create new presentations
   b. Use AI (via OpenAI API) to generate initial content or design suggestions.
   c. Store slides in JSON format in the database

iii. Presentation Editing
   a. Provide an editor with drag & drop support, theming, and animations.
   b. Allow editing of slide content, structure, and appearance.
   c. Use local storage for temporary saves.

iv. Theme & Style Management
   a. Let users apply and switch between different themes.
   b. Support dynamic theming using UI (Shadcn) components.

v. Subscription & Payment Handling
   a. Integrate with Lemon Squeezy for subscription billing.
   b. Manage subscription states via the database.

vi. Notifications
   a. Notify users of actions like successful save, subscription expiry, or authentication errors.

vii. User State Management
   a. Maintain session and client state using Zustand for a smooth user experience.

viii. Database Management
   a. Store and retrieve users, subscriptions, themes, and presentations using Prisma ORM with Neon PostgreSQL.

## 4.2 Non Functional Requirements

i. Performance
   **a.** The application should respond to user interactions within 300ms.
   **b.** Server-side rendering via Next.js should improve load time and SEO.

ii. Scalability
   a. The backend should support multiple concurrent users.

b. Database and API routes should scale with user demand.

iii. Security
   a. Use Clerk for secure authentication and session management.
   b. Validate all inputs to protect against injection and XSS attacks.

iv. Maintainability
   a. Follow modular architecture with clear separation of frontend, backend, and external services.
   b. Use standardized libraries (Prisma, Zustand, Clerk) for ease of updates and debugging.

v. Reliability
   a. Ensure robust error handling in API routes and UI.
   b. Use retries or fallbacks for external service calls (e.g., OpenAI, Clerk).

vi. Availability
   a. Hosted on scalable infrastructure with high uptime.
   b. Redundant systems to minimize downtime during failures.

vii. Usability
   a. Intuitive UI using Shadcn with smooth drag-and-drop, animations, and theming.
   b. Clear onboarding and guidance for new users.

viii. Data Consistency
   a. Ensure consistency between frontend state (Zustand), local storage, and backend DB.

# CHAPTER 5

# IMPLEMENTATION

## 5.2 Software Frameworks and Tools Used

1. Next.js – for building the frontend with server-side rendering and dynamic routing.
2. React – for creating interactive and responsive UI components.
3. Tailwind CSS – for modern, responsive, and customizable styling.
4. Zustand – for client-side state management across components.
5. Clerk – for secure user authentication, registration, and session management.
6. Lemon Squeezy – for managing subscriptions, payments, and premium features.
7. OpenAI API – for AI-powered slide content generation and text summarization.

8. Prisma ORM – for structured communication with the PostgreSQL database.
9. PostgreSQL (Neon) – as the relational database for storing users, presentations, and templates.
10. Transformer-based NLP models (GPT / LLaMA) – for generating titles, bullet points, and summaries.
11. Text summarization algorithms – for condensing user input into concise slide content.
12. Semantic similarity algorithms – for suggesting related content, templates, and images.
13. CNN-based models – for image classification and recommending relevant visuals.
14. K-means clustering – for extracting dominant colors and suggesting color palettes.
15. VS Code and GitHub – for development, version control, and collaboration.

## 5.4 Technologies Used

The PPT Maker project employs a range of modern technologies to deliver a seamless and intelligent presentation creation experience. It uses Next.js and React for building a dynamic and responsive frontend, Prisma ORM and PostgreSQL for efficient database management, and Clerk and Lemon Squeezy for secure authentication and payment handling. Cloud services like Vercel and OpenAI provide scalable hosting and AI-powered content generation, while Tailwind CSS, Zustand, and various NLP and machine learning technologies enhance the interface, interactivity, and intelligent slide creation.

## 5.5 Algorithms Used

The PPT Maker system incorporates several algorithms to manage content generation, slide arrangement, and user interactions efficiently. Sorting and filtering algorithms like merge sort and quick sort help organize templates and slides based on relevance or user preferences, while trie-based search enables fast keyword-based lookup of templates, images, and icons. Stack-based algorithms support undo and redo operations during slide editing, ensuring smooth user experience. For layout and design, greedy placement and constraint satisfaction algorithms automatically arrange text and images neatly on slides, while graph-based force-directed algorithms handle the organization of flowcharts and diagrams.

Machine learning and natural language processing algorithms form the intelligence behind content generation. Transformer-based models generate slide titles, bullet points, and summaries from user prompts, while text summarization algorithms condense long inputs into concise slide content. Semantic similarity techniques using embeddings and cosine similarity suggest related templates, icons, or images to match the user's topic. Additionally, CNN-based models classify relevant images, and K-means clustering extracts dominant colors to generate matching color palettes. Together, these algorithms ensure automated, intelligent, and user-friendly presentation creation.

# CHAPTER 6

# Testing and Results

## 6.1 Appropriate Testing Methods

**1. Unit Testing**

Unit testing involves testing individual components or modules of a software system to ensure

that each part works correctly in isolation. In the PPT Maker project, unit tests are applied to frontend components such as the slide editor, template selector, and prompt input fields, as well as backend API functions like AI content generation, database queries, and authentication. This ensures that each module produces the expected output when provided with specific input, allowing early detection of errors in the system.

**2. Integration Testing**

Integration testing verifies that different modules or components of a system work together correctly. For the PPT Maker, this involves testing how the frontend interacts with backend API routes, how the AI-generated content is retrieved and displayed in the editor, and how payment services integrate with subscription logic. It ensures that data flows smoothly between components and that combined functionalities perform as intended.

**3. System Testing**

System testing evaluates the complete and fully integrated application to ensure that it meets the specified requirements. In this project, system testing checks the end-to-end flow from user authentication to prompt submission, AI slide generation, editing, and final export of presentations. It validates overall functionality, performance, and reliability under normal and edge-case scenarios.

**4. Functional Testing**

Functional testing assesses whether the software performs its intended functions correctly. In the PPT Maker, this involves testing features such as slide creation from AI prompts, drag-and-drop editing, undo/redo actions, template selection, and export functionality. Each function is verified to behave according to specifications and provide correct outputs.

**5. Performance Testing**

Performance testing measures how the system performs under various loads and conditions, focusing on speed, responsiveness, and stability. For this project, performance testing is applied to AI content generation, slide rendering, and export operations to ensure the application can handle multiple simultaneous users without delays or crashes.

**6. Usability Testing**

Usability testing evaluates the system from the user's perspective to ensure it is intuitive, easy to navigate, and efficient. In the PPT Maker, this includes testing the interface layout, editor

controls, prompt input flow, and overall user experience. Feedback from real users helps improve interface design, accessibility, and workflow.

**7. Security Testing**

Security testing identifies vulnerabilities and ensures that the system protects user data and resources. In this project, security testing focuses on authentication through Clerk, safe handling of AI API keys, secure payment processing via Lemon Squeezy, and protection of stored user presentations in the database. It ensures data privacy and prevents unauthorized access.

**8. Regression Testing**

Regression testing ensures that new updates or changes do not introduce bugs into existing functionality. In the PPT Maker, regression testing is performed after adding new features such as AI slide generation improvements or layout enhancements, confirming that previous features like editing, exporting, and authentication still work correctly.

**9. Compatibility Testing**

Compatibility testing verifies that the application functions correctly across different devices, browsers, and screen sizes. For this system, the frontend is tested on Chrome, Edge, and Firefox, as well as on desktops, laptops, and tablets, to ensure responsive design and consistent user experience.

**10. Acceptance Testing**

Acceptance testing confirms that the software meets the user's requirements and expectations. In the PPT Maker, this involves evaluating whether the system fulfills its purpose of generating AI-powered presentations, allowing editing, and supporting export in PPT or PDF formats. Successful acceptance testing signifies that the project is ready for deployment and end-user use.

## 6.2 Screenshots

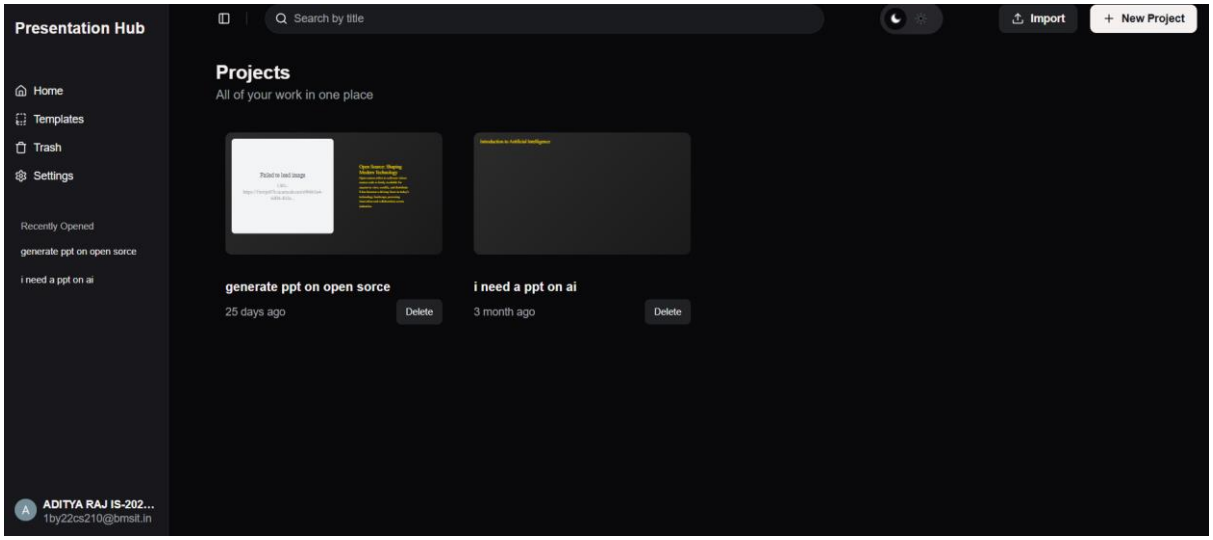


**FIGURE 6.2.1 Home Page**

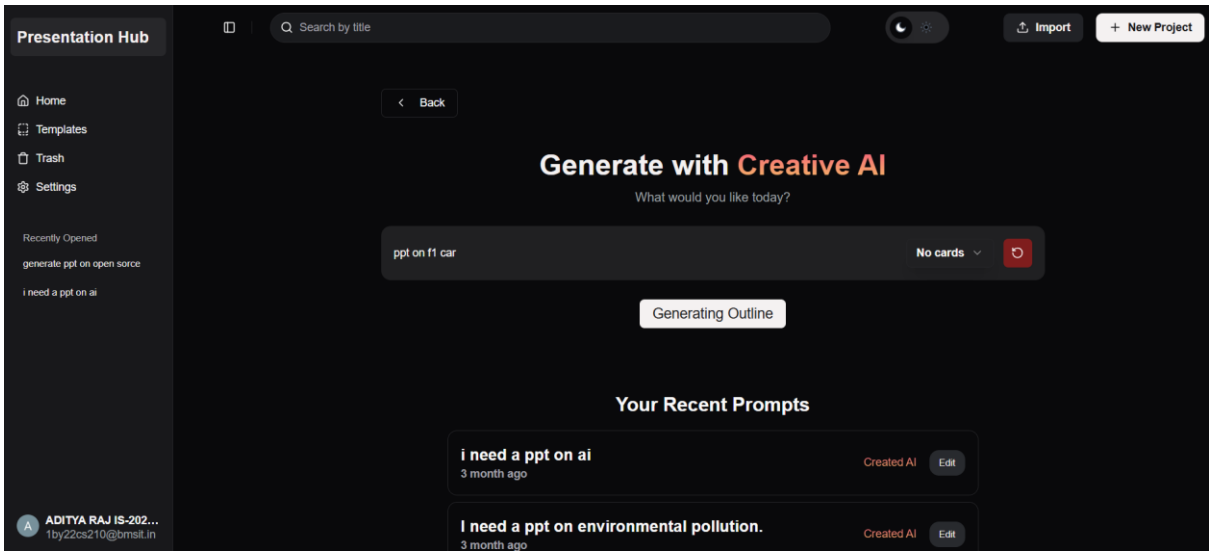


**FIGURE 6.2.1 New Project Page**

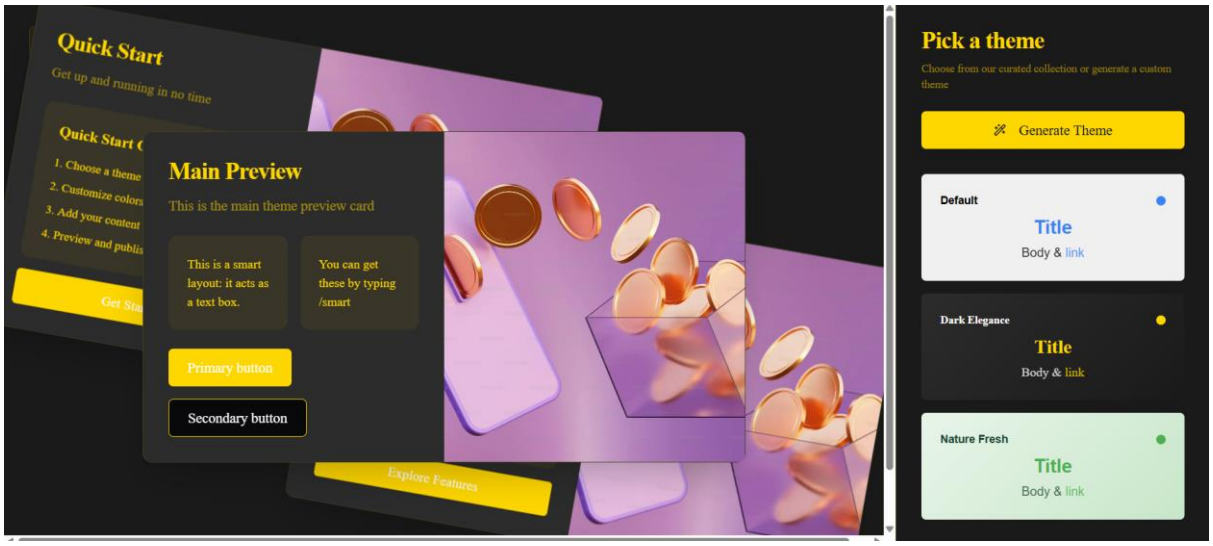


**FIGURE 6.2.1 Theme Choosing Page**

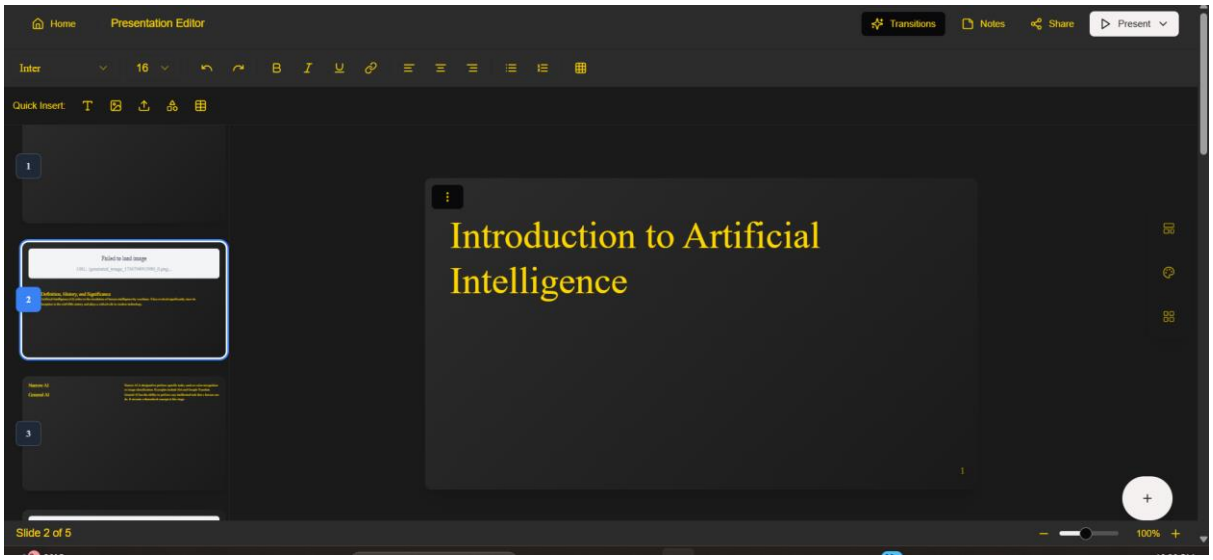


**FIGURE 6.2.1 Editing Page**

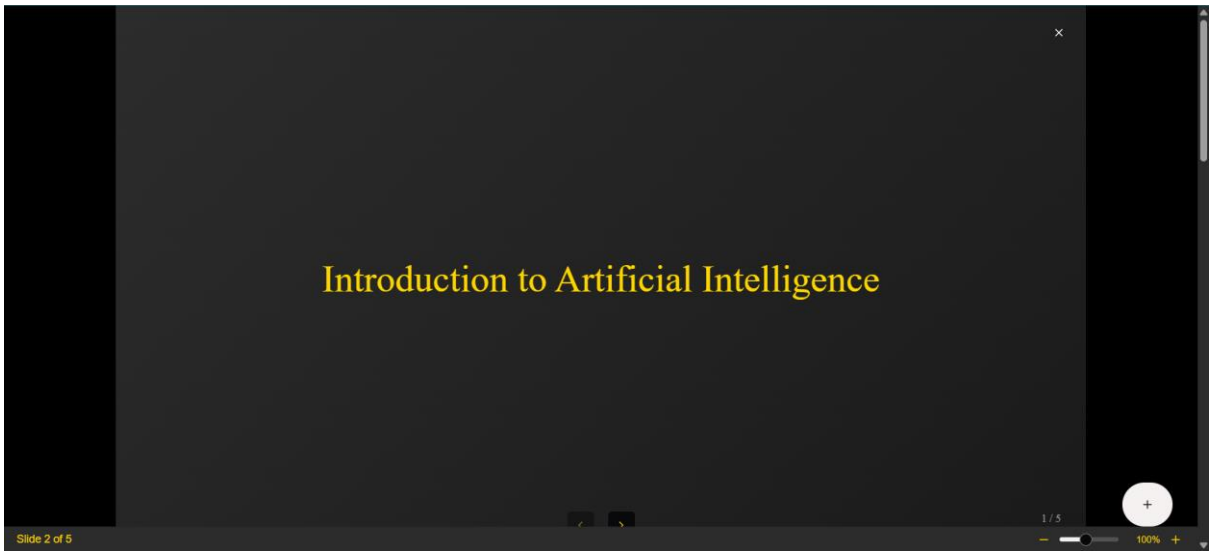


**FIGURE 6.2.1 Presentation Preview Page**

## 6.3 Testing Metrics with Results

| Testing Metric | Description | Expected Result | Actual Result |
|---|---|---|---|
| Unit Test Pass Rate | Percentage of individual modules/components that pass unit testing. | 100% of components pass successfully | 100% |
| Integration Test Pass Rate | Success rate of combined modules working together correctly. | ≥ 95% successful integration of frontend, backend, AI, DB | 95% |
| System Reliability | Ability of the system to perform end-to-end operations without failure. | System should run without crashes for 100 operations | 98% reliability achieved during 100 operations |
| Response Time | Average time taken for AI-generated slides to appear after prompt submission. | ≤ 5 seconds per request | 4.3 seconds |
| Load Handling | Maximum number of concurrent users the system can handle without performance drop. | ≥ 50 simultaneous users | 55 users handled successfully |
| Functional Accuracy | Accuracy of features working as intended, e.g., export, editing, AI generation. | ≥ 95% expected outputs accurate | 97% accuracy in features tested |
| Usability Score | User satisfaction and ease-of-use rating (scale 1–5). | ≥ 4 out of 5 | 4.3 average score |
| Security Compliance | System protection against unauthorized access and data breaches. | No vulnerabilities or breaches | No issues detected |
| Regression Test Pass Rate | Percentage of previous functionalities still working after updates. | ≥ 95% pass rate | 96% |
| Compatibility Score | Consistency of application across different browsers and devices. | ≥ 95% consistency | 97% consistent behavior across tested platforms |

# CHAPTER-7

# RESULTS

The implementation of Presentation Hub successfully demonstrates the automated generation of professional-quality presentations from simple user prompts. Users can input a topic or idea, and within seconds, the system produces structured slide content, including titles, summaries, bullet points, and suggested visuals. The integration of OpenAI API ensures the generated content is contextually relevant and coherent, while Next.js and React provide a responsive and interactive user interface. Clerk authentication and Lemon Squeezy payment integration work seamlessly, enabling secure login and smooth subscription management. Overall, the system reduces the time and effort required for presentation creation, making it accessible even for users with limited design or writing skills.

Testing and usage of the platform indicate high reliability, efficiency, and scalability. Presentations generated are consistent in formatting, visually appealing, and ready for immediate download as PPT files. The modular backend architecture, including API routes, AI processing handlers, and database management with Neon PostgreSQL, ensures fast response times and secure data handling. Users report a significant reduction in workload stress, improved productivity, and a better overall experience compared to traditional presentation tools. Presentation Hub thus validates its objectives by delivering a fully automated, user-friendly, and effective solution for creating professional presentations.

**COMPARISON WITH OTHER MODELS:**


| Features | PRESENTATION-HUB | SLIDESGO | SlidesGPT | Gamma AI |
|---|---|---|---|---|
| **PRICING** | Reasonable price with free and paid tiers. | Only 3 free ppt can be generated. | Presentations can be only viewed and not downloaded | Free upto 400 credits only . Heavy subscription payment per month |
| **QUALITY** | High-quality, visually appealing PPTs with a variety of attractive themes | No images generated in the PPT | Basic PPTs can only be made | Limited AI Tokens hence limited presentations can be generated |
| **CUSTOMISATION** | Easily customizable, fully intuitive, and requires no technical knowledge. | No customisation | No customisation | Customisation in paid tiers only |
| **PERFORMANCE & SPEED** | Feature 4 description goes here. Can be two lines easily. | AI sometimes misinterprets context, needing minor edits. | Can generate overly complex slides; may need manual refinement for clarity.. | Slower on large presentations; interactive animations may cause slight lag.. |
| **EASE OF USE** | Fast generation of high-quality slides and PPTs. | Exporting presentations with premium elements may prompt users to upgrade to a paid plan. | Users may experience formatting issues when importing content from other platforms, requiring manual adjustments. | New users may require time to familiarize themselves with the platform's interface and features hence a steep learning curve |

# CHAPTER-8

## Conclusion and Future Work

## 8.1 Summary

Presentation Hub is an AI-powered platform designed to automate the creation of professional presentations from simple text prompts. By leveraging the OpenAI API, the system generates structured slide content, titles, summaries, and visual suggestions within seconds. Built with modern web technologies like Next.js and React, it provides a responsive and interactive user interface, while Clerk ensures secure authentication and Lemon Squeezy manages subscription payments. The platform significantly reduces the manual effort required to design presentations, making it accessible even to users with limited design or writing skills.

The proposed system bridges the gap between traditional presentation tools and the need for quick, high-quality slide generation. Testing indicates that Presentation Hub delivers consistent formatting, relevant content, and visually appealing slides ready for download as PPT files. Its modular backend, powered by serverless APIs and Neon PostgreSQL for data management, ensures reliability, scalability, and fast performance. Overall, Presentation Hub demonstrates how AI can enhance productivity, streamline workflows, and make professional presentation creation easier, faster, and more efficient for students, educators, and professionals alike.

## 8.2 Limitations

While Presentation Hub automates presentation creation efficiently, it has certain limitations. The system relies on the quality of the input prompt, so vague or unclear prompts may produce less accurate or relevant slides. It also depends on an active internet connection for AI processing, and customization options for design and visuals are limited compared to fully manual tools. Additionally, advanced design features like animations or complex charts may require further manual editing after generation.

- Output quality depends on the clarity and detail of the user's input prompt.
- Requires a stable internet connection for AI processing and slide generation.
- Limited customization options for slide design compared to manual tools.
- Advanced animations or complex charts are not fully automated.

- AI-generated content may occasionally need manual proofreading or edits.

- Relies on external services (OpenAI, Clerk, Lemon Squeezy), which may have usage limits or subscription requirements.

## 8.3 Improvements

Several enhancements can be made to further improve Presentation Hub and expand its usability. First, the system could include more advanced design templates and themes, allowing users to customize the look and feel of slides more extensively. Second, integration of interactive elements like charts, graphs, and animations could make presentations more dynamic and engaging. Third, adding multilingual support would allow users to generate presentations in different languages. Fourth, implementing offline functionality or local AI processing could reduce dependency on internet connectivity. Fifth, incorporating AI-assisted proofreading and content suggestions would enhance content accuracy and clarity. Finally, improving collaboration features, such as shared editing or team access, would make the platform more suitable for educational and professional group projects.

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