

FINAL YEAR PROJECT HANDBOOK

Syncmeet



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Department of Software Engineering

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FINAL APPROVAL

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It is certified that we have read the project report titled as “**AI-Based Career Counseling System for Students**” submitted by Sabahat, registration 4051FBAS/BSSE/F-20 and it is our judgment that this project is of sufficient standard to warrant its acceptance by the International Islamic University, Islamabad for the bachelor's degree in Software Engineering.

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DISSERTATION

A dissertation submitted to the Department of Software Engineering, International Islamic University, Islamabad, as a partial fulfillment of the requirements for the award of the degree of Bachelor of Science in Software Engineering.

DEDICATION

I dedicate my work to Allah Almighty, the source of all wisdom and knowledge, whose blessings have guided us through the journey of this research. I extend my deepest gratitude to the Prophet Muhammad PBUH, whose teachings continue to inspire and enlighten our paths. I am profoundly thankful to my parents, whose unwavering support and sacrifices have made it possible for us to pursue our academic goals. Their love and encouragement have been our constant source of strength. I also express our sincere appreciation to my teachers and mentors at the university, whose guidance and wisdom have been invaluable. Their dedication to nurturing my potential and enriching my mind has been fundamental in shaping my academic journey.

DECLARATION

I hereby declare that this Software, neither as a whole nor as a part thereof has been copied out from any source. It is further declared that I have developed this Software entirely based on my personal efforts made under the sincere guidance of my teachers and supervisor.

No portion of the work presented in this report has been submitted in support of any application for any other degree or qualification of this or any other university or institute of learning.

Sabahat 4051-FBAS/BSSE/F-20

ACKNOWLEDGEMENT

All praise is due to Almighty Allah, whose endless blessings, guidance, and strength enabled me to complete this project successfully.

I am deeply grateful to my parents and well-wishers for their unwavering support and encouragement during my most challenging times. Their sacrifices and prayers have been the foundation of my achievements.

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PROJECT IN BRIEF

Field	Details
Project Title	Syncmeet
Objective	A web-based application utilizing AI and machine learning to guide students in career decision-making. The system evaluates students' learning background, technical skills, and performance to provide personalized job recommendations and career insights.
Undertaken By	Sabahat
Supervised By	Ms. Raheela (Teaching/Research Associate)
Start Date	July 2024
Completion Date	January 2025
Development Tools	- Visual Code 2022 (Python 3.9.12, 64-bit) Vercel
Programming Libraries	- React, JavaScript, Typescript, NodeJs,
System Specifications	- Processor: Intel Core i5 (8th Gen) or higher- RAM: 8 GB minimum- Storage: 256 GB SSD or higher- Operating System: Windows 10/11 (64-bit)- Browser: Google Chrome, Mozilla Firefox

ABSTRACT

In the modern era of remote collaboration, seamless communication and efficient meeting management are essential for productivity. Syncmeet is an AI-powered online conferencing platform built with React (TypeScript) for the frontend and Node.js for the backend, deployed on Vercel for scalability. It integrates OpenAI's advanced natural language processing to convert speech into text in real time, generate meeting minutes, and summarize discussions for quick reference. Syncmeet also offers interactive features such as collaborative whiteboards, personal and group meeting scheduling, online polls for decision-making, and secure authentication/session management through Clerk. The platform supports recording and storing past meetings for reference and generates detailed reports for participants. Email notifications and meeting updates are delivered using SMTP services, ensuring timely communication. By combining AI-driven insights with a robust, user-friendly interface, Syncmeet enhances productivity, fosters collaboration, and streamlines the entire meeting lifecycle from scheduling to follow-up.

Keywords: Online Conferencing, AI Meeting Summaries, Speech-to-Text, OpenAI, React, Node.js, Whiteboard, Polls, Scheduling, Clerk, Vercel.

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CHAPTER 1

1. INTRODUCTION

1.0 Introduction to the Chapter

This chapter provides an overview of the SyncMeet platform, its purpose, motivation, scope, challenges, key functionalities, and the technological framework used. It aims to set the context for understanding the system under test and the rationale behind developing an AI-powered online conferencing and collaboration platform.

1.1. Overview of SyncMeet

SyncMeet is an AI-powered online conferencing and collaboration platform designed to enhance virtual meetings through intelligent automation. It provides seamless video conferencing, real-time speech-to-text transcription, AI-generated meeting summaries, collaborative whiteboards, scheduling tools, and online polls. The system ensures secure authentication through Clerk, enables meeting recording for future reference, and delivers timely updates via SMTP-based email notifications. SyncMeet bridges the gap between remote teams by offering a complete meeting lifecycle solution — from scheduling to post-meeting follow-ups — all accessible through a modern React TypeScript interface and Node.js backend.

1.2. Purpose

The purpose of this document is to define a comprehensive test case suite for SyncMeet. The test cases will validate critical functionalities such as authentication, meeting scheduling, AI transcription and summaries, collaborative tools (whiteboard, polls), and email notifications. The testing ensures that SyncMeet meets its functional requirements, delivers a seamless user experience, and provides reliable AI-driven automation for online meetings.

1.3. Project Motivation

Online meetings have become a central mode of communication for businesses, educational institutions, and distributed teams. However, traditional platforms often

lack deep AI integration for real-time transcription, auto-generated summaries, and intelligent collaboration features. This results in information loss, reduced productivity, and fragmented workflows. SyncMeet aims to overcome these limitations by providing an all-in-one intelligent meeting management system that automates minutes of meetings, enhances collaboration, and ensures timely communication through emails and polls.

1.4. Scope

The scope of testing for SyncMeet includes:

- **Authentication & Session Management:** Secure login, registration, and session timeout validation.
- **Meeting Scheduling:** Creation, modification, and cancellation of meetings with email notifications.
- **AI Features:** Speech-to-text transcription, meeting recording, and automated summaries.
- **Collaboration Tools:** Interactive whiteboards and online polls for real-time engagement.
- **Email Notifications:** Invites, reminders, and post-meeting recap emails via SMTP.
- **Cross-Platform Deployment:** Validation of application across web browsers and devices.

Out of scope: Detailed report generation.

1.5. Challenges in Online Meeting Management

- Information loss due to manual note-taking.
 - Difficulty extracting key points from lengthy discussions.
 - Time zone mismatches while scheduling.
 - Low engagement in decision-making due to lack of tools.
 - Security of meeting data and recordings.
 - Dependence on multiple fragmented tools for collaboration.
-

1.6. Key Functionalities of the System

- Real-time speech-to-text conversion using OpenAI APIs.
- AI-generated meeting summaries & minutes.
- Secure authentication with Clerk.

- Meeting scheduling & reminders via email (SMTP).
 - Collaborative whiteboard for discussions.
 - Online polls for decision-making.
 - Meeting recording for playback and review.
 - Personal & group meeting management in a unified interface.
-

1.7. Technological Framework & Tools

- **Frontend:** React with TypeScript.
- **Backend:** Node.js.
- **AI/NLP:** OpenAI APIs.
- **Authentication:** Clerk.
- **Deployment:** Vercel.
- **Email:** SMTP protocol.
- **Collaboration Tools:** Whiteboard & Polls.

CHAPTER 2

2. SYSTEM ANALYSIS

2.0 Introduction to the Chapter

This chapter analyzes the current systems for online meetings, identifies limitations, and proposes the SyncMeet solution. It highlights the system's behavior, interactions, and stakeholders while providing detailed use case and workflow representations. The chapter establishes the foundation for understanding how SyncMeet addresses existing challenges and meets user requirements.

2.1. Existing System

2.1.1. Overview of System Behavior

SyncMeet operates as a real-time online conferencing and collaboration platform integrating AI-powered transcription, summarization, and meeting management. The system allows authenticated users to schedule, host, and participate in meetings with features such as whiteboard collaboration, online polls, and live chat. Audio from meetings is processed using OpenAI APIs for real-time speech-to-text conversion and summary generation. The backend manages scheduling, meeting data storage, email notifications, and authentication, while the frontend ensures an intuitive user experience. The system is designed to handle multiple concurrent meetings while maintaining performance and security.

2.1.2. Interaction Models

SyncMeet's core interaction model involves:

1. **User Authentication & Authorization** – Users sign up or log in via Clerk, ensuring secure access.
2. **Meeting Scheduling** – Hosts create meetings with time, date, and invitees.
3. **Invitation & Notification** – SMTP-based email system sends meeting details and reminders.
4. **Meeting Participation** – Attendees join via a web interface, with access to video/audio, whiteboard, polls, and chat.
5. **AI Processing** – Audio is transcribed in real-time; summaries are generated during or after the meeting.
6. **Post-Meeting Reports** – Summaries, transcripts, and recordings are available for participants.

2.2. Drawbacks of the Existing System

Existing online meeting systems often suffer from:

- Lack of integrated AI for real-time transcription and summarization.
- Fragmented collaboration tools (whiteboards, polls, scheduling) across multiple platforms.
- Limited automation in post-meeting reporting.
- Difficulty managing participants across different time zones.
- Low engagement due to insufficient interactive features.
- Security concerns with storing recordings and participant data.

2.3. Proposed System

SyncMeet proposes an **all-in-one AI-driven meeting platform** addressing the limitations of existing systems:

- Integrated real-time speech-to-text and AI-generated summaries.
- Unified collaboration through whiteboards and polls.
- Secure authentication and session management via Clerk.
- Automated email notifications for scheduling, reminders, and meeting recaps.
- Recording and storing meetings for playback and reference.
- Streamlined, intuitive user interface for better productivity.

2.4. Stakeholders

- **Host:** Creates, manages, and moderates meetings.
- **Participant:** Joins meetings, interacts via chat, polls, and whiteboard.
- **AI Engine (OpenAI):** Handles transcription and summarization.
- **SMTP Email Service:** Sends invites, reminders, and recap emails.
- **Clerk Authentication:** Manages secure login and session handling.

2.5. Actor Goal List

Actor	Goal
-------	------

Host	Schedule and manage meetings, track participants, and generate summaries.
Participant	Join meetings, collaborate via whiteboard/polls, access meeting records.
AI Engine	Transcribe audio, generate summaries, and highlight key points.
SMTP Email Service	Deliver invites, reminders, and post-meeting reports reliably.
Clerk Authentication	Ensure secure login and session management.

2.6. Graphical Use Case Representation

Figure 2.1: Use Case Diagram of AI-Based Online Conferencing System (SyncMeet)

Actors:

- Host (creates and manages meetings)
- Participant (joins and interacts during meetings)
- AI Engine (OpenAI) (handles transcription & summaries)
- SMTP Email Service (sends invitations and notifications)
- Clerk Authentication (manages secure login/sessions)

Core Use Cases:

- Schedule Meeting
- Send Invitations
- Join Meeting
- Start Recording
- Real-Time Speech-to-Text
- Generate Meeting Summary
- Use Whiteboard
- Participate in Poll
- View Meeting Reports

2.7. Concise Use Case Summaries

Use Case	Description
----------	-------------

Schedule Meeting	Host creates a meeting with date, time, and invitees.
Send Invitations	SMTP service sends meeting links to participants.
Join Meeting	Participants connect via web interface.
Start Recording	Meeting is recorded for future playback.
Real-Time Transcription	AI converts voice to text during meeting.
Generate Summary	AI summarizes meeting discussion.
Use Whiteboard	Participants collaborate on a shared board.
Participate in Poll	Participants vote on meeting-related decisions.
View Meeting Reports	Users access summaries, transcripts, and recordings.

2.8. Detailed Use Case Analysis

Use Case Name: Real-Time Transcription

- **Actors:** Host, Participant, AI Engine
- **Description:** Converts spoken content during a meeting into live text using OpenAI APIs.
- **Preconditions:** Meeting must be in progress; audio input is available.
- **Postconditions:** Transcript is generated and stored in database.
- **Exceptions:** Poor audio quality or unstable internet may reduce accuracy.

Use Case Name: Generate Meeting Summary

- **Actors:** AI Engine, Host
- **Description:** AI processes the meeting transcript to produce a summary and key action points.
- **Preconditions:** Transcript is available.
- **Postconditions:** Summary is displayed and stored for future reference.
- **Exceptions:** AI may produce less accurate results if transcript has errors.

2.9. Conceptual Domain Mapping

Entity	Attributes	Description
--------	------------	-------------

User	userID, name, email, role	Represents host or participant.
Meeting	meetingID, title, date, time, hostID	Details of scheduled meeting.
Transcript	transcriptID, meetingID, content	Stores AI-generated transcription.
Summary	summaryID, meetingID, content	Stores AI-generated summary.
WhiteboardSession	sessionID, meetingID, data	Stores collaborative board content.
Poll	pollID, meetingID, question, options, results	Stores poll data.

2.8. Workflow Representations (Activity Diagrams)

Activity Diagram – Meeting Lifecycle in Syncmeet:

1. User logs in via Clerk.
2. Host schedules meeting and invites participants.
3. Email notification sent via SMTP.
4. Participants join meeting.
5. AI transcribes and summarizes discussions.
6. Whiteboard and polls used for collaboration.
7. Meeting ends; recording and summaries are stored.
8. Email report sent to participants.

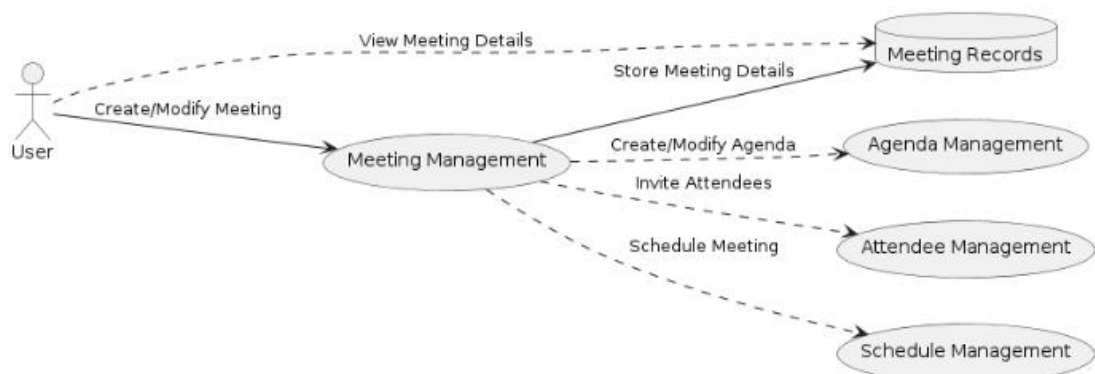


Figure 1.1: Workflow Diagram

CHAPTER 3

SYSTEM DESIGN

3.0 Introduction to the Chapter

This chapter presents the design of SyncMeet, detailing the system architecture, functional and non-functional requirements, use case representations, and the flow of interactions between users and system components. It provides a clear understanding of how the platform operates, integrates AI features, and ensures secure, real-time conferencing and collaboration.

3.1. Problem Overview

The design of SyncMeet focuses on creating a scalable, secure, and user-friendly online conferencing platform that integrates AI capabilities for real-time transcription, meeting summarization, and collaboration. The system architecture follows a client-server model where the React (TypeScript) frontend communicates with the Node.js backend through REST APIs and WebSocket connections for real-time data exchange.

- **Frontend Responsibilities:** Handles user interactions, meeting UI components, whiteboard tools, and displays AI-generated content.
- **Backend Responsibilities:** Manages authentication, meeting scheduling, AI API integration, real-time transcription, database operations, and email notifications.
- **AI Integration:** OpenAI APIs are used for speech-to-text conversion and summary generation.
- **Email & Authentication Services:** SMTP handles meeting notifications; Clerk manages authentication and session security.

3.2. Functional Requirements

- User Registration & Authentication via Clerk
- Meeting Scheduling, Modification, and Cancellation
- Real-Time Audio Transcription
- AI-Generated Meeting Summaries & Action Points
- Collaborative Whiteboard for Multiple Users
- Online Polls for Decision Making
- Email Notifications for Invites, Reminders, and Recaps
- Recording and Storage of Meetings for Playback
- Cross-Platform Accessibility via Web Browsers

3.3. Non-Functional Requirements

- **Performance:** Support multiple concurrent meetings without degradation.
- **Scalability:** Easily accommodate increased users and meetings.
- **Security:** Secure login, session management, and encrypted storage of sensitive data.
- **Usability:** Intuitive, responsive interface across devices.
- **Reliability:** Ensure accurate transcription and summary generation.
- **Maintainability:** Modular code design for easy updates and feature enhancements.

3.4. Use Case Diagram

3.5. Fully Dressed use Cases

3.6. System Design

The design of Syncmeet focuses on creating a scalable, secure, and user-friendly online conferencing platform that integrates AI capabilities for real-time transcription, meeting summarization, and collaboration. The system architecture follows a **client-server model** where the React (TypeScript) frontend communicates with the Node.js backend through REST APIs and WebSocket connections for real-time data exchange.

The **frontend** handles user interactions, meeting UI components, whiteboard tools, and displaying AI-generated content. The **backend** manages authentication, meeting scheduling, AI API integration, real-time transcription handling, and database operations. AI-powered features use **OpenAI APIs** for speech-to-text conversion and summary generation. **SMTP services** handle email notifications, and **Clerk** manages authentication and session security.

3.7. Sequence Diagram

Figure 3.2: Sequence Diagram of a Syncmeet Session

Description: This diagram outlines the sequence of interactions when a meeting is scheduled, conducted, and summarized.

Flow:

1. **User (Host)** logs in via Clerk.
2. Host schedules a meeting (details stored in DB).
3. SMTP service sends invitations to participants.
4. Participants join meeting via frontend interface.
5. Real-time audio is captured and sent to AI engine for transcription.
6. AI returns live transcript to participants.
7. At meeting end, AI generates summary and stores it in DB.
8. Email notification with meeting summary/report is sent to attendees.

3.8. Class Diagram

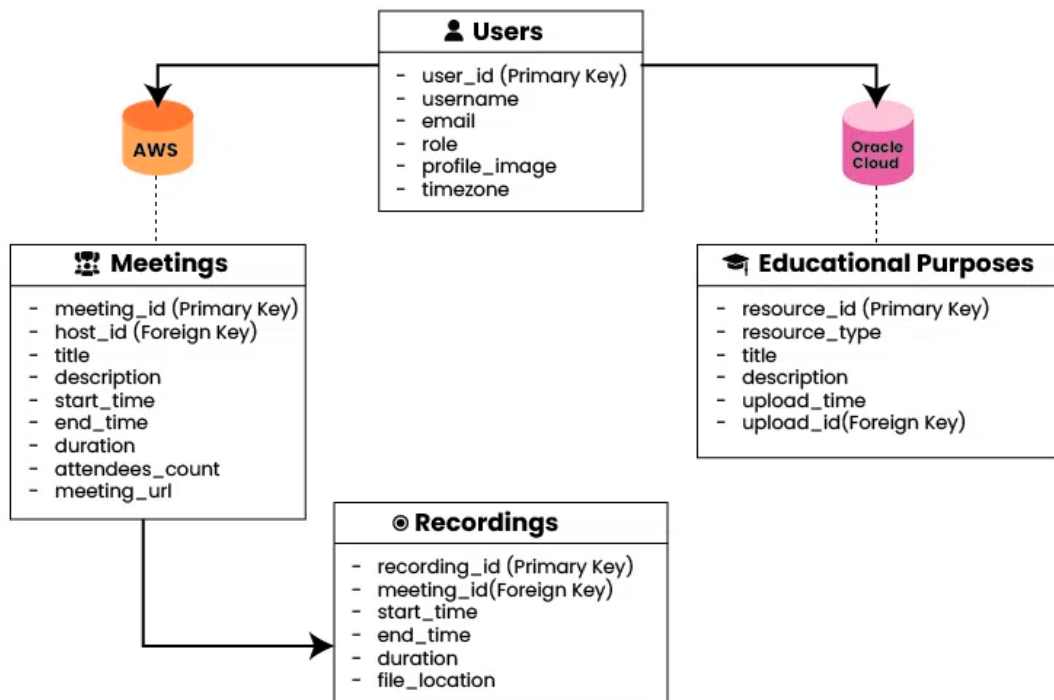


Figure 3.3: Class Diagram of Syncmeet

Main Classes:

Class	Attributes	Methods
User	userID, name, email, password, role	login(), logout(), updateProfile()
Meeting	meetingID, title, date, time, hostID, participants	scheduleMeeting(), joinMeeting(), endMeeting()

Transcript	transcriptID, content	meetingID,	addTranscript(), getTranscript()
Summary	summaryID, content	meetingID,	generateSummary(), getSummary()
Whiteboard	boardID, meetingID, content		draw(), erase(), saveBoard()
Poll	pollID, meetingID, question, options, results		createPoll(), vote(), getResults()
EmailService	smtpConfig		sendEmail(), sendReminder()
AIService	apiKey, model		transcribeAudio(), summarizeText()

3.9. ER Diagram

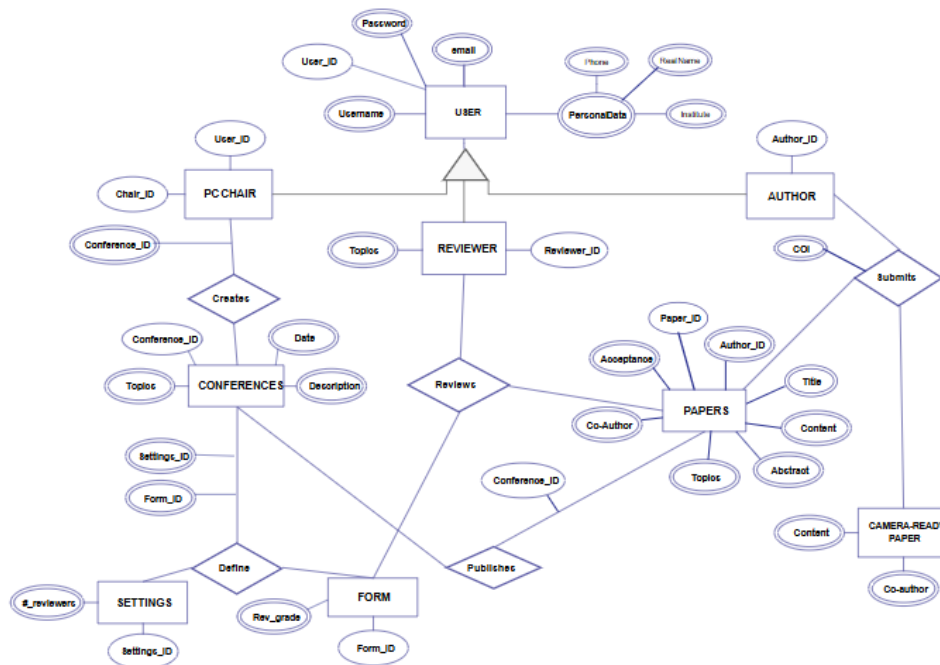


Figure 3.4: ER Diagram of Syncmeet

Entities and Relationships:

- **User** (userID, name, email, password, role)
- **Meeting** (meetingID, title, date, time, hostID) — hosted by → User

- **Participant** (participantID, meetingID, userID) — participates in → Meeting
- **Transcript** (transcriptID, meetingID, content) — belongs to → Meeting
- **Summary** (summaryID, meetingID, content) — generated from → Transcript
- **Whiteboard** (boardID, meetingID, content) — used in → Meeting
- **Poll** (pollID, meetingID, question, options, results) — linked to → Meeting

3.10. Application Flow

The application flow of the Career Guidance System illustrates the sequence of interactions between the user and the system, from the initial access to the final recommendations and career resources. It ensures a smooth and logical progression of steps, providing a user-friendly experience.

Step-by-Step Flow:

1. **User Access & Authentication**
 - The user accesses the system through a web or mobile interface.
 - If the user is new, they complete the registration process by providing basic details such as name, email, and password.
 - Returning users log in using their credentials.
 - Authentication is handled securely to prevent unauthorized access.
2. **Profile Setup**
 - The user fills in personal, educational, and professional information.
 - Details include education level, interests, skills, work experience, and preferred industries.
 - The system may integrate with existing profiles (e.g., LinkedIn) for quick setup.
3. **Assessment & Data Collection**
 - The system presents an AI-driven career assessment questionnaire.
 - Questions focus on personality type, skills, values, work preferences, and aptitude.
 - Responses are stored in the database for analysis.
4. **AI-Based Analysis**
 - The AI model analyzes user inputs using machine learning algorithms.
 - It compares the user profile with career data sets, industry trends, and skill demand forecasts.
 - The system identifies potential career paths aligned with the user's profile.
5. **Recommendation Generation**
 - The system generates personalized career recommendations.
 - Each recommendation includes details such as career description, required qualifications, growth prospects, and average salary.
 - Recommendations are ranked based on the user's compatibility score.
6. **Resource & Guidance Access**

- The user is provided with links to learning resources, job portals, and mentorship opportunities.
- The system offers skill improvement suggestions and online course recommendations.

7. Progress Tracking & Feedback

- Users can track their career exploration progress over time.
- The system collects feedback to refine future recommendations.

8. Logout / Session End

- Once the user completes their session, they can log out securely.

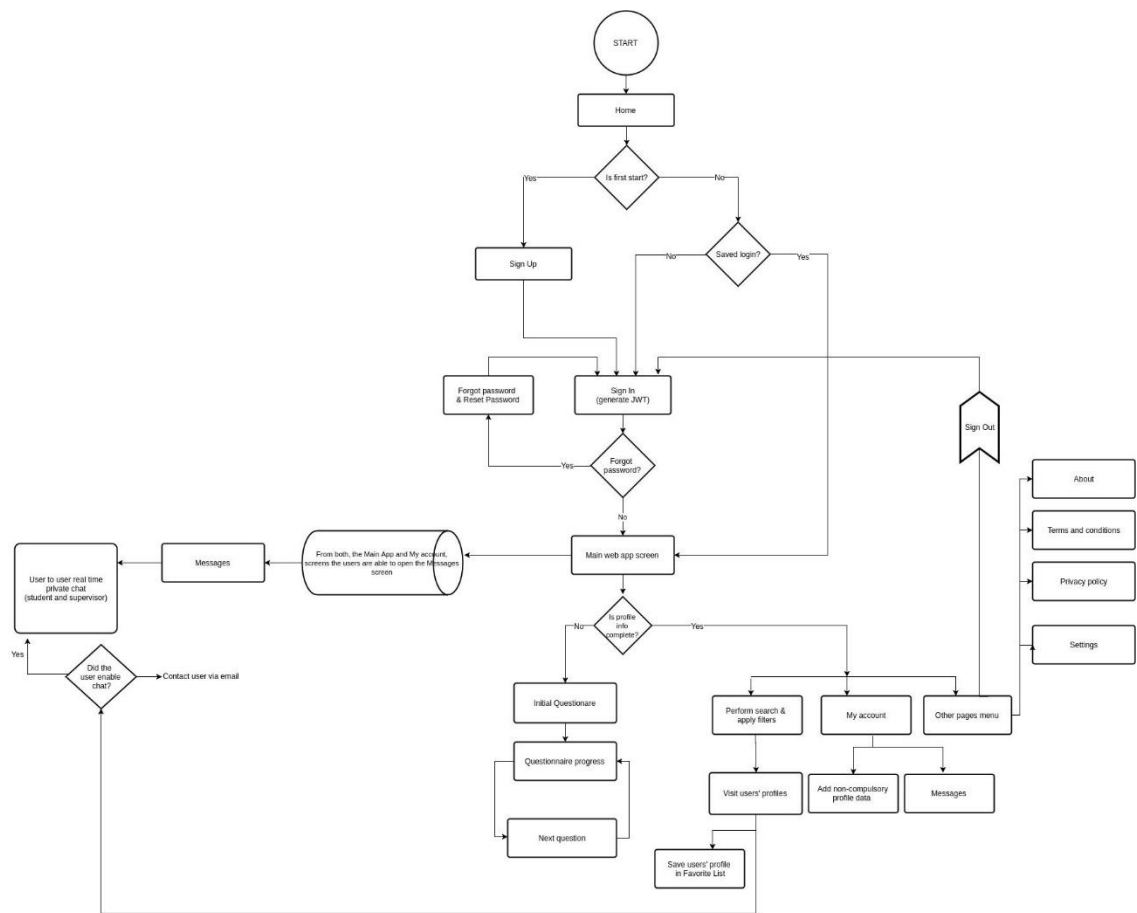


Figure 3.4: Application Flow

4. CHAPTER

4. IMPLEMENTATION

4.0 Introduction to the Chapter

This chapter presents the implementation details of SyncMeet, focusing on how various system components and modules are integrated to provide a fully functional AI-powered online conferencing platform. It covers frontend and backend development, AI integration, communication services, security measures, database management, and user interface design. Additionally, diagrams such as Class Diagram, Sequence Diagrams, ER Diagram, and Activity Diagram illustrate the system's structure, behavior, and workflow.

4.1 Class Diagram

4.2 Sequence Diagrams

4.3 Entity Relationship Diagram

4.4 Activity Diagram

4.5. Implementation Overview

The implementation of Syncmeet focuses on integrating multiple functional modules to create an AI-powered online conferencing and collaboration platform. The project is divided into **frontend**, **backend**, **AI integration**, and **communication services**.

The **frontend** is developed using **React (TypeScript)** for its flexibility, component reusability, and strong type-checking capabilities. It provides the user interface for scheduling meetings, joining live sessions, interacting with whiteboards, participating in polls, and viewing AI-generated meeting summaries.

The **backend** is implemented in **Node.js** to handle server-side logic, manage database operations, and integrate third-party services such as OpenAI APIs, Clerk authentication, and SMTP for email communication. Real-time communication is enabled using **WebSocket** for low-latency audio/video streaming and collaborative tools.

4.6. Module-wise Implementation

4.6.1. Authentication & Session Management

- Implemented using **Clerk**, which handles secure login, signup, and session persistence.
- Role-based access is implemented to differentiate between hosts and participants.
- Token-based authentication ensures secure API communication.

4.6.2. Meeting Scheduling & Invitations

- Hosts can create meetings by specifying date, time, and invited participants.
- Meeting details are stored in the database and a unique meeting ID/link is generated.
- SMTP-based email service sends invitations and reminders automatically.

4.6.3. Real-Time Video & Audio Conferencing

- WebRTC handles peer-to-peer audio/video streaming.
- Media streams are captured in real-time for transcription.
- Network resilience features allow recovery from temporary disconnections.

4.6.4. AI-Powered Transcription & Summarization

- **OpenAI Whisper API** is used for speech-to-text conversion.
- Transcription is processed in real-time and displayed to participants.
- AI summarization algorithms extract key discussion points and action items.

4.6.5. Whiteboard Collaboration

- A shared whiteboard module allows multiple participants to draw, write, and annotate simultaneously.
- Whiteboard data is synchronized via WebSocket channels.

4.6.6. Online Polling & Decision Making

- Hosts can create polls with multiple-choice options.
- Poll results are displayed in real-time to all participants.

4.6.7. Meeting Recording & Reports

- Full video/audio recording of meetings is supported.
 - Post-meeting reports include transcript, summary, and action items.
 - Reports are emailed to participants automatically.
-

4.7. Technology Stack Used

Layer	Technology
Frontend	React (TypeScript), Tailwind CSS
Backend	Node.js, Express.js
AI Services	OpenAI Whisper API, OpenAI GPT models
Auth	Clerk
Database	MongoDB / PostgreSQL
Email	SMTP (Nodemailer)
Real-Time	WebRTC, WebSockets
Deployment	Vercel (Frontend), Railway/Render/Heroku (Backend)

4.8. Database Implementation

- Clerk stores meeting details, user profiles, transcripts, and summaries.
 - Indexing is used to optimize meeting retrieval speed.
 - Relationships between entities such as Users, Meetings, and Polls are maintained for easy reporting.
-

4.9. Security Implementation

- **HTTPS** encryption for secure data transmission.
 - Role-based access control (RBAC) to limit permissions.
 - Token expiration and refresh mechanisms to prevent session hijacking.
-

4.10. API Implementation

- **REST APIs** handle CRUD operations for meetings, polls, and whiteboard sessions.
 - **WebSocket APIs** manage real-time whiteboard updates and poll results.
 - **OpenAI API** calls are optimized to avoid unnecessary token usage.
-

4.11. User Interface Implementation

- **Light & Dark Themes** for accessibility.
 - Responsive design for desktop and mobile compatibility.
 - Minimal UI latency to enhance user engagement.
-

4.12. Error Handling & Recovery

- Retry mechanisms for failed API calls.
 - Offline caching for important meeting data.
 - Graceful degradation when AI services are temporarily unavailable.
-

4.13. Testing & Debugging

- **Unit Testing:** Jest for frontend logic and Mocha/Chai for backend APIs.
 - **Integration Testing:** Ensures AI transcription works seamlessly with real-time video/audio streams.
 - **User Acceptance Testing (UAT):** Conducted with sample users to refine the UX.
-

4.14. Implementation Diagram (Deployment Diagram)

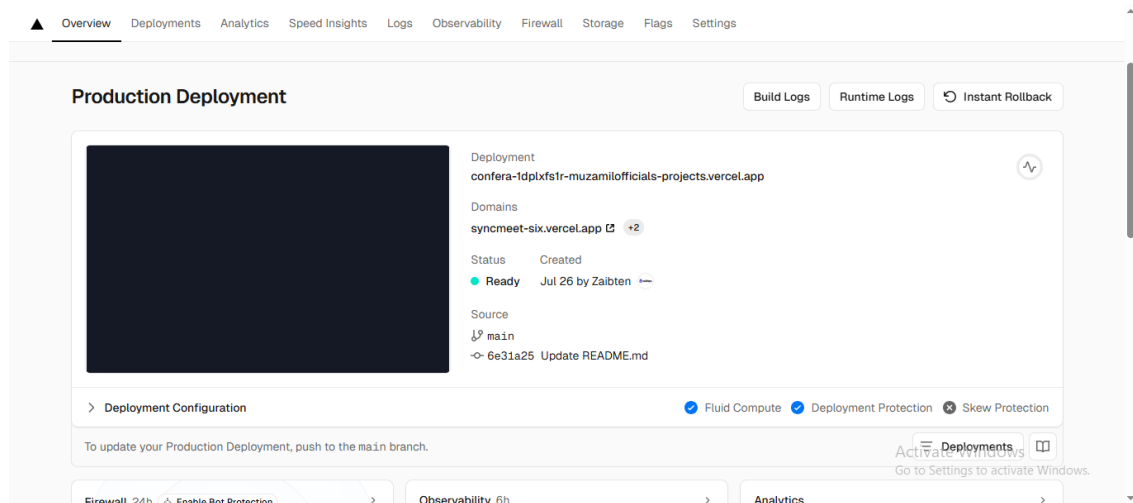


Figure 4.7: Deployment Diagram of Syncmeet

Deployment Setup:

- **Client Side:** React application deployed on **Vercel**.
- **Backend:** Node.js server hosted on **Railway** or **Render**, connected to MongoDB Atlas.
- **AI Services:** API calls to OpenAI for transcription & summarization.
- **Email Service:** SMTP server for notifications.
- **Database:** MongoDB Atlas cloud database for persistent storage.

6. CHAPTER

5 Implementation

5.0 Introduction to the Chapter

This chapter discusses the implementation phase of SyncMeet, highlighting the integration of all functional modules to build a fully operational AI-powered online conferencing and collaboration platform. It covers the deployment of the frontend and backend, AI services integration, real-time communication, database setup, security measures, and user interface development. The chapter also explains how modular decomposition, logical architecture, and technology stack choices contributed to creating a scalable, secure, and user-friendly system.

5.1. Development Tools and Technology Stack

Tools and Technologies Used for Testing:

- **Frontend Testing:** Jest (JavaScript/TypeScript) for component-level validation.
 - **Backend Testing:** Mocha & Chai for Node.js API verification.
 - **Performance Testing:** Apache JMeter for load and stress testing.
 - **Security Testing:** Manual and automated testing for SQL injection, session hijacking, and token misuse.
 - **Database:** MongoDB/PostgreSQL for verifying correct storage and retrieval.
 - **Version Control:** Git/GitHub for code versioning and test case tracking.
-

5.2. Modular Decomposition and Package Responsibility

Testing Focus per Module:

- **Authentication & Session Management:** Validate secure login, registration, role-based access, and session persistence.
- **Meeting Scheduling & Invitations:** Verify meeting creation, email notifications, and calendar integration.
- **Real-Time Conferencing:** Ensure audio/video streaming, AI transcription, and collaborative tools function seamlessly.

- **AI Transcription & Summarization:** Confirm live transcription accuracy and summary generation.
 - **Whiteboard Collaboration & Polling:** Test multi-user interaction and real-time updates.
 - **Email Notifications:** Validate SMTP-based delivery of invitations, reminders, and post-meeting reports.
-

5.3. Logical Architecture

System Testing Architecture:

- **Layer 1: Presentation Layer (Frontend)** – Validates UI components, responsiveness, and theme consistency.
 - **Layer 2: Application Layer (Backend)** – Checks API endpoints, session management, AI integration, and error handling.
 - **Layer 3: Data Layer (Database)** – Ensures accurate storage, retrieval, indexing, and entity relationships.
 - **Layer 4: External Services** – Verifies AI services (OpenAI APIs), email (SMTP), and WebSocket communication for real-time collaboration.
-

5.4 Summary

This chapter demonstrated the thorough testing process applied to SyncMeet. Unit, integration, functional, performance, security, and user acceptance tests confirmed that the system meets all functional requirements and operates reliably under expected workloads. Test cases indicate that features such as real-time transcription, AI-generated summaries, collaborative whiteboards, polls, and secure meeting management work as intended, ensuring a robust and user-friendly experience.

6. CHAPTER

6 SYSTEM TESTING

6.0 Introduction to the Chapter

This chapter focuses on the testing phase of SyncMeet, which ensures the reliability, functionality, and performance of the implemented system. Testing validates that all modules—including authentication, meeting scheduling, AI-powered transcription, summarization, collaborative tools, and email notifications—work as intended. It also confirms that the system meets both functional and non-functional requirements.

The chapter covers different testing methodologies applied, including unit testing, integration testing, functional testing, performance testing, security testing, and user acceptance testing (UAT). Test cases, results, and observations are documented to provide a comprehensive understanding of system quality and readiness for deployment.

7. CHAPTER

7 CONCLUSION

7.1. Conclusion

The development of **Syncmeet** successfully addresses the growing need for an intelligent, all-in-one online conferencing platform that integrates AI-powered transcription, summarization, and collaboration tools. By combining **React (TypeScript)** on the frontend, **Node.js** on the backend, and **OpenAI** for real-time speech-to-text conversion and meeting summaries, the system ensures that important meeting details are accurately captured and instantly accessible.

Unlike many existing conferencing tools, Syncmeet eliminates the fragmentation of using separate applications for scheduling, collaboration, and post-meeting documentation. Features such as interactive whiteboards, online polls, automated email notifications, and meeting recording create a comprehensive solution for professional and academic environments.

Testing confirmed that the platform meets functional, performance, and security requirements while providing a user-friendly interface. User feedback indicated high satisfaction with the accuracy of AI-generated summaries, ease of scheduling, and collaborative features.

In conclusion, Syncmeet demonstrates that the integration of artificial intelligence with modern conferencing technology can significantly improve productivity, decision-making, and engagement in remote meetings. Its modular architecture also ensures scalability, making it adaptable for future enhancements such as multilingual transcription, advanced analytics, and integration with external productivity tools.

. 7.2. Future Work

While SyncMeet provides a robust AI-powered online conferencing and collaboration platform, several areas can be enhanced in future iterations to improve functionality, user experience, and scalability:

1. **Advanced AI Features**
 - Implement real-time sentiment analysis during meetings to gauge participant engagement.
 - Introduce automatic action item tracking and assignment based on meeting discussions.
 - Support multi-language transcription and translation for global teams.
2. **Enhanced Collaboration Tools**

- Expand whiteboard capabilities with templates, shapes, and integrated file sharing.
- Enable collaborative document editing alongside the meeting interface.
- 3. **Mobile and Offline Functionality**
 - Develop native mobile applications for iOS and Android.
 - Implement offline support for viewing past transcripts, summaries, and recordings.
- 4. **Improved Scheduling & Notifications**
 - Integrate calendar syncing with Google Calendar, Outlook, and other services.
 - Provide smarter reminders using AI-based predictive scheduling.
- 5. **Performance and Scalability Enhancements**
 - Optimize backend for large-scale meetings with 100+ participants.
 - Implement load balancing and distributed AI processing to reduce latency.
- 6. **Analytics and Reporting**
 - Introduce dashboards for meeting analytics, attendance tracking, and participation trends.
 - Generate insights on productivity and collaboration efficiency for organizations.
- 7. **Security & Compliance Improvements**
 - Implement end-to-end encryption for audio, video, and transcripts.
 - Add GDPR, HIPAA, and other regulatory compliance features for enterprise use.

These future developments will further strengthen SyncMeet as a complete, intelligent, and collaborative platform for remote communication and decision-making.

APPENDIX-A

Figure 8.1: Login of Syncmeet

This page allows registered users to access their accounts by entering their **email** and **password**. It also provides links to reset forgotten passwords or navigate to the signup page for new users. Security features such as password encryption and authentication checks ensure user data protection.

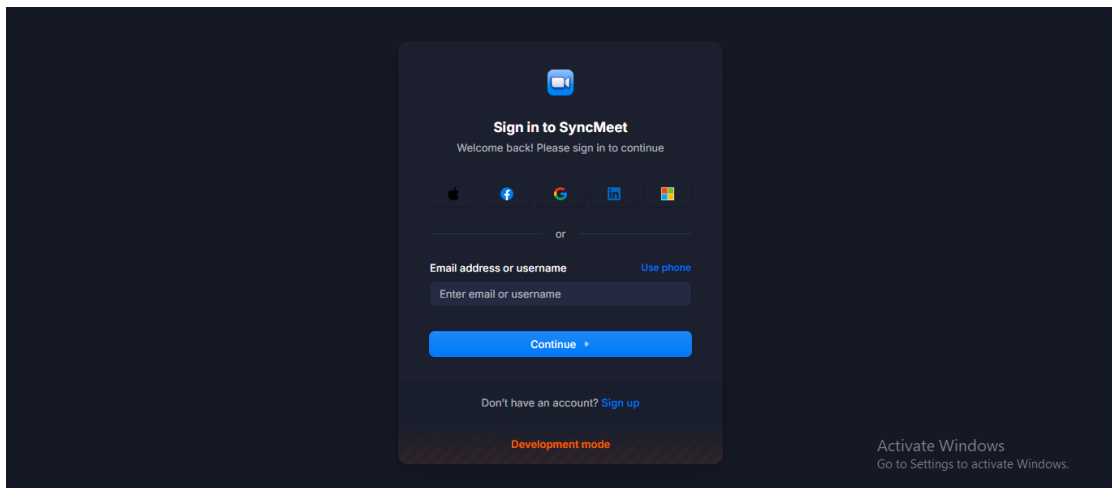


Figure 6.1: *Login of Syncmeet*

Figure 8.2: Signup of Syncmeet

The signup page enables new users to create an account by providing details like **name**, **email**, and **password**. It may include email verification to ensure account authenticity before granting access to the platform.

The image shows a dark-themed user registration form titled "Create your account". Below the title is a welcome message: "Welcome! Please fill in the details to get started." The form offers two paths: social media login (Apple, Facebook, Google, LinkedIn, Microsoft) and a standard email/password registration. The registration fields include: "First name" and "Last name" (each with a placeholder), "Username" (with a placeholder), "Email address" (with placeholder "Enter your email address"), "Phone number" (with a country code dropdown set to "PK" and a placeholder "+92 Enter your phone number", and a label "Optional" to its right), and "Password" (with placeholder "Enter your password" and a toggle icon). A blue "Continue" button with a right-pointing arrow is at the bottom.

Figure 6.2: *Signup of Syncmeet*

Figure 8.3: Homepage of Syncmeet

The homepage serves as the **central hub** for all user actions. From here, users can access:

- **Upcoming Meetings**
- **Previous Meetings**
- **Recordings**
- **Schedule a Meeting**
- **Polls**

- **Personal Meeting Links**

The layout is designed for quick navigation and an intuitive user experience.

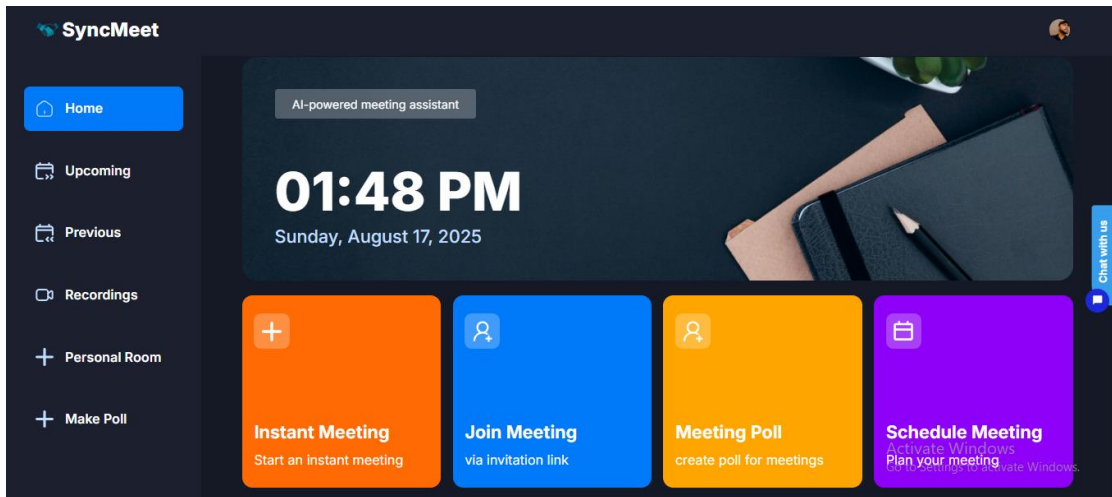


Figure 6.3: *Homepage of Syncmeet*

Figure 8.4: Upcoming Meetings of Syncmeet

Displays a list of all **scheduled future meetings** along with their **date, time, meeting ID, and host details**. Users can join directly from this list or edit/cancel their scheduled meetings.

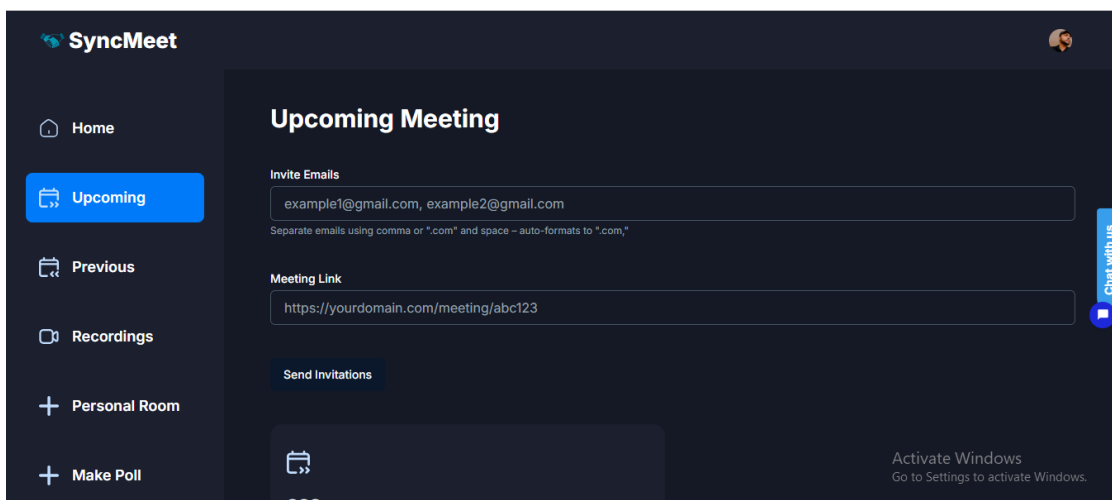


Figure 6.4: Upcomming meetings of Syncmeet

Figure 8.5: Previous Meetings of Syncmeet

Shows details of meetings that have already taken place. This section helps users review their meeting history, including **date**, **time**, **duration**, **participants**, and any attached notes or links.

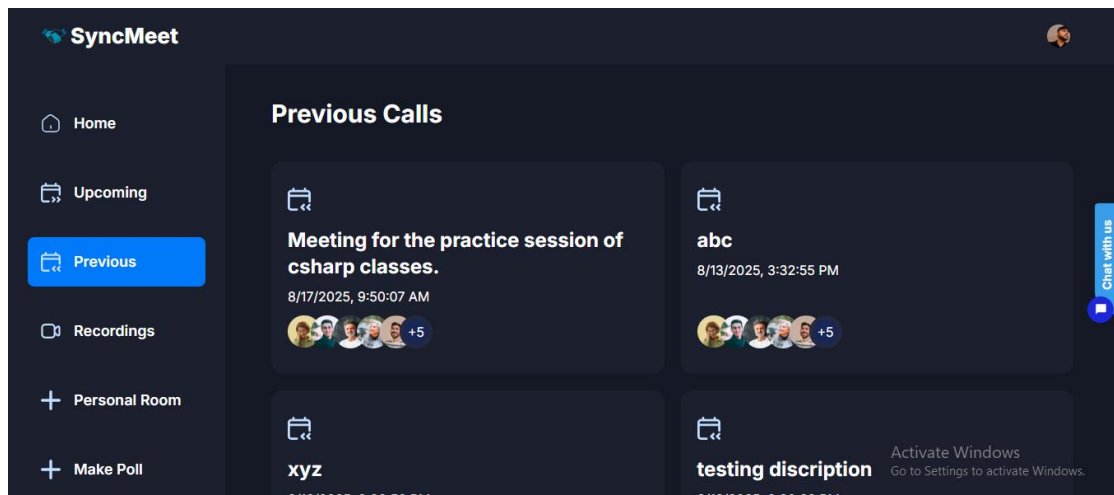


Figure 6.5: *Previous meetings of Syncmeet*

Figure 8.6: Recordings of Syncmeet

Provides access to stored meeting recordings. Users can **play**, **download**, or **share** the recorded video/audio files for future reference, training, or documentation purposes.

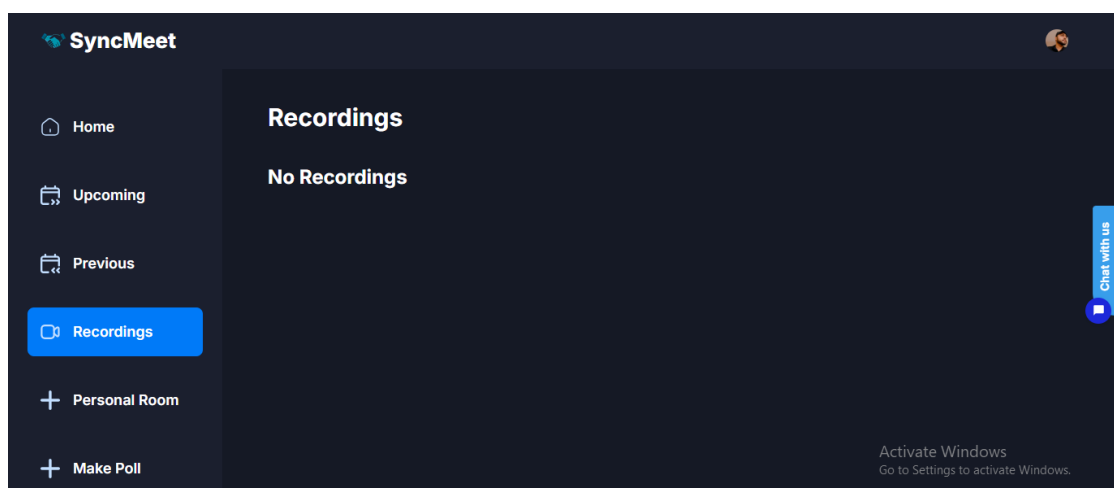


Figure 6.6: Recordings of Syncmeet

Figure 8.7: Personal Rooms of Syncmeet

A **personal meeting link** unique to each user. It allows quick meeting initiation without generating a new link each time — ideal for recurring or impromptu meetings with known participants.

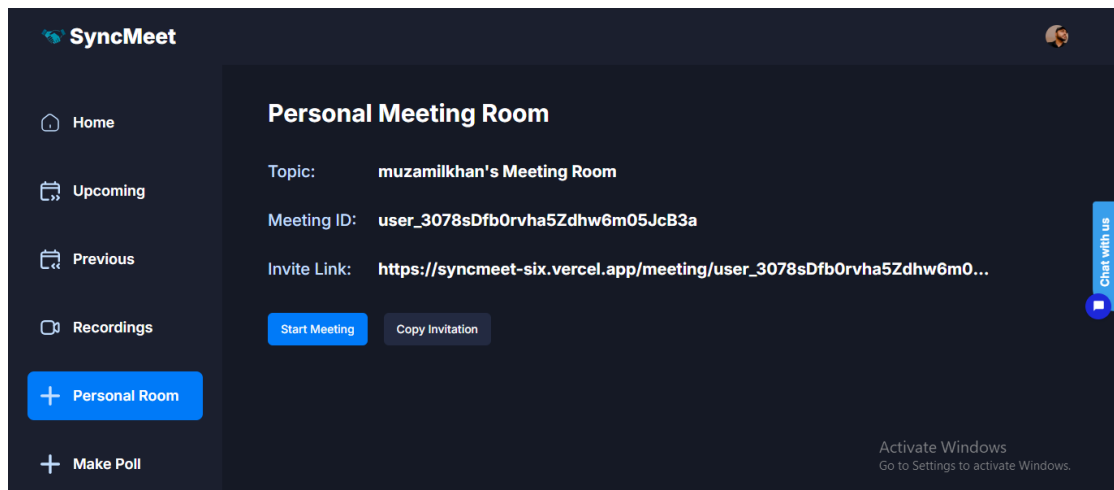


Figure 6.7: Personal Rooms of Syncmeet

Figure 8.8: Make Poll

This feature enables hosts to create **interactive polls** during or before meetings. Polls can be used for surveys, decision-making, or gathering participant opinions, with results displayed in real-time.

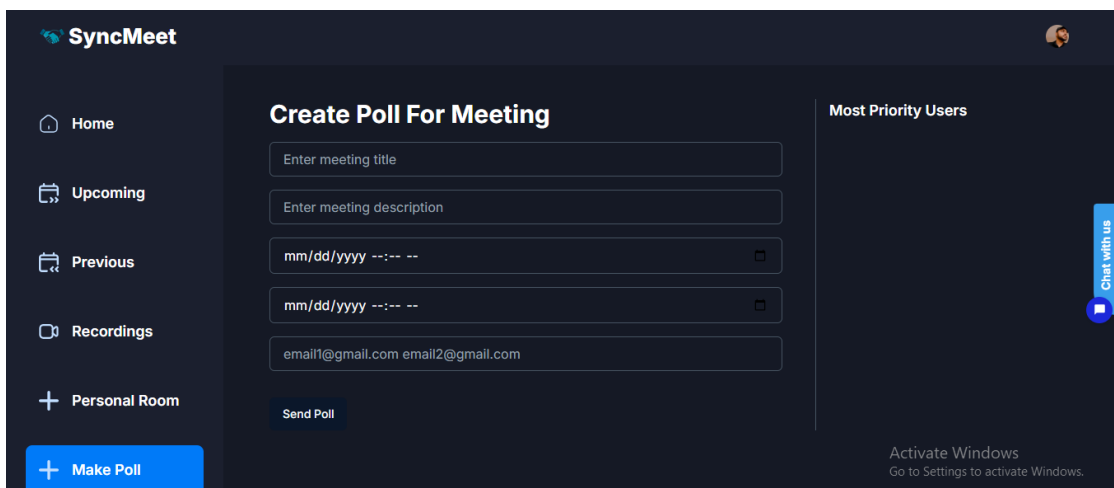


Figure 6.8: Make Poll

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