Kingdom of Saudi Arabia
Ministry of Education
College of Computer
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المملكة العربية السعودية
وزارة التعليم
كلية الحاسب
قسم علوم الحاسب

MEETING MANAGEMENT SYSTEM POWERED BY AI

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A project report submitted to Qassim University in partial fulfillment of the requirements for the degree of B.Sc. in Computer Science

Qassim - Saudi Arabia
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CERTIFICATE

It is certified that this project report has been prepared and written under my direct supervision and guidance. This project report is approved for submission for its evaluation.

Dr. Ibrahim Alskiety

DEDICATION

This project is dedicated to the organizations and individuals aiming to make meetings more efficient and productive. It is our hope that this system contributes to enhancing collaboration and better communication in professional and academic environments.

Muath, Tariq

ACKNOWLEDGEMENT

We are grateful to Allah for His guidance and blessings throughout this project. Our sincere thanks to Dr. Ibrahim Alskiety whose expert supervision was critical in our success. We deeply appreciate our friends and colleagues who supported us and offered valuable insights during the work of this project.

Muath, Tariq

CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

In recent years, the increasing number of meetings and their importance have shown the need for intelligent systems to enhance productivity and efficiency. Traditional meeting management methods often involve manual effort, leading to inefficiencies and mistakes. Manual systems in the field are not an exceptional case and it has become a necessity to replace them with new automated systems. To address these challenges this project presents an AI-driven meeting management and assistant system. By leveraging artificial intelligence. This project aims to modernize the meeting process for

organizations and individuals, reducing the workload and improving the overall experience in professional and academic environments.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Effective communication and efficient meeting management are important in today's professional and academic environments. Traditional methods such as manual scheduling and handwritten notes often lead to inefficiencies, miscommunication and wasted time. With the increasing reliance on remote and hybrid work, the demand for intelligent systems to manage meetings has grown largely.

This project aims to develop an AI-powered meeting management and assistant system designed to change how organizations handle meetings. By leveraging artificial intelligence, the system will automate essential tasks and improve collaboration. Core features include automated meeting transcription, AI-generated summaries and follow-ups, attendance taking, document management and multilingual support (Arabic and English).

Through this project, we aim to create a solution that solve the inefficiencies of traditional meeting management. The result is a platform that helps users to save time, improve communication and increase productivity.

1.2 Project Scope

Project Scope This project involves developing an AI-powered meeting management system designed for professional and academic environments. The system will automate summarization and follow-ups, improving meeting efficiency. It will also provide features for meeting scheduling, attendance tracking, voting, document management, managing topics for each meeting, and adding comments. Additionally, the system will support multilingual functionality (English and Arabic) and integrate with platforms like Zoom and Microsoft Teams for seamless operation.

- Inclusions: Automation of summarization and follow-up tasks. Meeting scheduling, attendance tracking, and voting tools. Document management and topic organization for meetings. Commenting system for meetings. Multilingual support (English and Arabic). Integration with popular meeting platforms
- Exclusions: Automation of all meeting processes beyond summarization and follow-ups. The system will not host meetings.

1.3 Aim and Objectives

The aim is to develop an intelligent meeting management system that leverages AI technologies to automate and enhance meeting processes through transcription, smart summarization and automated follow-ups.

- Space Management:
  - To create a flexible system for managing meeting spaces/rooms
- Meeting Organization;
  - To develop a robust meeting management functionality
- AI-Powered Meeting Support
  - To implement speech-to-text transcription for automatic meeting documentation
  - To implement AI-based summarization capabilities that generate concise meeting highlights
- Knowledge Management:
  - To build a searchable repository of meeting transcripts and summaries

1.4 Motivation

Meetings play an important role in organizations, yet the inefficiencies in traditional meeting processes often lead to wasted time and miscommunication. With the increasing reliance on remote and hybrid work, there is a growing demand for intelligent systems that can improve the entire meeting workflow.

1.5 Project Plan and Schedule

	Task	Target	Work by weeks															
			September				October				November				December			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Chapter One: Introduction	• Project scope • Aim & Objectives • Motivation • Plan																
2	Chapter Two: Literature review	• Background • Related system • Contribution																
3	Chapter Three: System analysis	• Problem Specification • System Analysis • Implementation Plan																
4	Chapter Four: System design	• System design speciation • Design architecture																

Table 1 - Project Activities/Tasks Plan

1.6 Outline of the Report

This project is organized into four chapters:

Chapter 1: Introduction: Introduces the project and its goals.

- **Introduction:** an introduction to the project
- **Project Scope:** Describes the boundaries and features of the project.
- **Aim and Objectives:** States the goals and key objectives of the project.
- **Motivation:** Explains the reasons for undertaking the project.
- **Project Plan and Schedule:** Outlines the timeline and milestones for the project.

Chapter 2: Literature Review: Reviews background, related systems and contributions.

- **Introduction:** Overview of the literature review.
- **Background:** Key concepts and relevant information.
- **Existing Related Systems:** Analysis of similar systems.
- **Contribution:** Highlights the project's unique aspects.

Chapter 3: Problem Analysis: Details the problem, requirements, and system analysis

- **Introduction:** Overview of the problem analysis.
- **Problem Specification:** Defines the specific issues addressed.
- **System Analysis:** Examines system needs and functionality.
    - Requirement Collection: Gathers system requirements.
    - Requirement Analysis**:** Analyzes the gathered requirements
- **Implementation and Evaluation Plan:** Plans for execution and evaluation.
    - Technical Tools and Programming Languages: Tools and technologies used

Chapter 4: System Design: Describes the system architecture and design elements

- **Introduction:** Overview of system design.
- **System Design Specification:** Specifies design requirements.
- **Design Architecture:** Details the system's structure

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter, we will review past and current systems with similar goals to our proposed system, focusing on their successes and limitations. Then we will go through our new system and take a look at how it addresses some of the problems these systems had, and what functionalities our system will provide.

2.2 Background

Meeting management was traditionally handled by secretaries. They were responsible for tasks like scheduling meetings, taking notes, and organizing in-person coordination. While these methods were effective for old time, they required significant time and effort and human errors occur. So the process is less efficient and has miscommunication or forgotten details**.**

As AI advanced, it began to transform meetings management. Tools have made it easier to organize and keep track of meetings. These tools help the users to save time and reduce errors. However, while there is an improvement, many systems still have large issues. users need to rely on multiple applications to make different tasks, making it hard and time consuming.

AI-powered meeting assistants are the next major improvement in this field. using AI to solve the issues of older methods and tools. By bringing features like transcription and summarizing into a single platform with other tools, they improve the process of managing meetings. They save time and also improve communication and collaboration. For example, they can automatically generate summary of a two-hour meeting and ensuring that important details are not missed. They also make meetings paperless.

Overall, AI-powered systems are essentials today and with integrating other features into one platform, they make managing meetings more efficient.

2.3 Existing Related Systems

In this section, we will show some similar systems to our project, outlining their definitions, advantages, disadvantages to provide a comprehensive comparison with our project.

2.3.1 Fathom

AI-powered tool for automatic meeting transcription, summaries, and action items, integrated with popular meeting platforms

Advantages:

- Share specific video clips from meetings.
- AI assistant Chatbot
- Easily integrates with tools like Slack and Google Docs.

Disadvantages:

- No support for in-person meetings.
- Summaries are often too brief.
- Doesn’t provide Editing transcripts
- Doesn’t provide transcripts translation

2.3.2 Otter.ai

Transcription service that creates searchable transcripts and integrates with popular meeting platforms

Advantages:

- AI chat generates emails and updates.
- Auto-joins Zoom and Google Meet to take notes.

Disadvantages:

- Free plan limits transcription to 300 minutes.

- Doesn’t provide transcripts translation
- No Automatic text correction
- Only support English transcription

2.3.3 Fireflies.ai

AI tool that records, transcribes, and organizes meeting discussions with auto-summaries and task tracking.

Advantages:

- High transcription accuracy.
- Filter key meeting topics.
- AI-Powered Search
- Analyze meetings

Disadvantages:

- Privacy concerns with stored data.
- Lacks project management features.
- No Automatic text correction

2.3.4 Notta.ai

AI tool for transcription and note-taking, summaries, and integrations with popular platforms

Advantages:

- Real-Time Translation.
- Skip pauses Silence.
- Automatic text correction
- Record video and audio

Disadvantages:

- No Multi-meeting AI Insights
- No Desktop Apps.
- Pricing: Considered pricey compared to alternatives.

2.3.5 Qassim University E-meetings

A university-integrated system that ensures data privacy and designed to facilitate meetings

Advantages:

- Integration with Qassim University: Effectively integrated with university systems.
- Data Privacy: Ensures that user data is kept confidential and protected.

Disadvantages:

- Limited AI Features: Does not provide AI-supported features, resulting in limited functionality.
- It has a basic user interface

2.4 Contribution

Existing systems do not offer a complete management solution for meetings, particularly for Arabic-speaking users. Many systems offer limited features or solve a specific problem, and the difficulty of using different systems just to manage meetings is unreasonable. So we came up with the idea of combining essential features and adding new functionalities This includes:

• **Multi-Language Support:** Unlike many existing tools, our system supports both Arabic and English.

• **Customizable Meeting Spaces:** Users can create dedicated spaces for teams and manage meetings, documents within these spaces.

• **Document Management:** Our system includes a document management feature.

• **Attendance Taking:** Our system includes attendance taking with tools for marking participants present or absent

• **Voting Tool:** The system supports a voting mechanism

• **Combination of Features in One Space:** What sets our system apart is the integration of multiple key features within a single platform, including transcription, document management, attendance taking and many more.

Chapter Three

PROBLEM ANALYSIS

3.1 Introduction

In this chapter, we will analyze the problems associated with current meeting management systems and present our proposed AI-powered solution. The chapter begins by examining the challenges faced by organizations and individuals in managing meetings effectively. We will explore the various dimensions of the problem space, including the limitations of existing solutions and the growing demands of modern workplace collaboration.

3.2 Problem Specification

Existing systems do not offer a complete management solution for meetings. Many systems offer limited features or solve a specific problem and the headache of using different systems just to manage just the meetings is unreasonable. Also, all of the systems don’t properly support Arabic language. So we came up with the idea of combining the features and adding other features to provide an almost complete managing tool and leveraging AI in making an assistant with a full Arabic language support.

3.3 System Analysis

3.3.1 Requirement Collection

The system requirements were primarily collected through analysis of existing AI meeting systems and their limitations, also from many brainstorming sessions and lots of meetings and searching for other people's problem. These observations helped shape our understanding of essential features and functionality requirements.

3.3.2 Requirement Analysis

3.3.2.1 **Functional Requirements:**

1. Sign-Up:

- Description: New users can sign up for the system using an email, password, and a username.
- Key Features:
  - Username availability check.

2. Login:
   - Description: Existing users can log in using their username and password to access the system.
   - Key Features:
     - Username and password authentication.
3. Space Creation:
   - Description: Users will have the ability to create dedicated spaces for meetings. Each space will serve as a hub for a specific team. Users can be invited by admin to join these spaces, and all meetings for that group will take place within the space.
   - Key Features:
     - The user who created the space will be automatically the admin for the space
     - Only admins will have the ability to invite or remove members.
     - Manage and organize meetings within the space.
4. Meeting Transcription:
   - Description: The system will automatically transcribe meetings and will be stored and accessible for review after the meeting.
   - Key Features:
     - Support for Arabic and English transcription.
     - Accurate speech-to-text processing.
     - The system will provide the ability to Edit transcripts
5. Automated Summaries:
   - Description: The system will generate summaries of meetings, highlighting key decisions and action points
   - Key Features:
     - AI-generated summaries based on transcript analysis.
     - The system will provide the ability to Edit summaries
6. Automated Follow-Ups:
   - Description: The system will automatically generate follow-up tasks or actions based on the meeting discussion.
   - Key Features:

- Automated tasks point extraction.

7. Attendance Taking:
    - Description: The system will provide tools for recording attendance for each meeting.
    - Key Features:
        - Admins will be able to mark attendees present or absent
        - Admins will have access to attendance reports
8. Topics Management:
    - Description: meeting-related topics can be added to meetings.
    - Key Features:
        - Admin will have the ability for adding the topics
        - Admin will have the ability for deleting the topics
        - Members can view the topic.
9. Voting Tool:
    - Description: members can participate in voting processes the system will allow voting to be initiated by admins for any topic.
    - Key Features:
        - Voting will be initiated by admins
        - Different voting types (multiple-choice, Yes or NO).
10. Document Management:
    - Description: meeting-related documents can be uploaded such as agendas, minutes, and any additional supporting material for each topic.
    - Key Features:
        - Admin will be responsible for uploading the documents
        - Admin can delete any document.
        - Members can download the materials.
11. Commenting System:
    - Description: Meeting members can leave comments on topics.
12. Arabic Language Support:
    - Description: The system will primarily support Arabic for all functionalities, including transcription, summaries, and user interface, while also providing additional support for English as a secondary language.

3.3.2.2 Non-Functional Requirements

1. Accurate Transcription: The system should accurately transcribe conversations in real time, ensuring high-quality output for users.
2. Data Security: All meeting data, including transcriptions, summaries, and tasks, should be securely stored and protected from unauthorized access.
3. User-Friendly Interface: The system should be easy to use, featuring a simple interface.

3.4 Implementation and Evaluation Plan

The implementation will follow an agile approach, with regular testing cycles to ensure features work seamlessly. Evaluation will focus on transcription accuracy, system performance, and user experience in both languages.

3.4.1 Technical Tools and Programming Languages

3.4.1.1 Frontend and Backend:

- Node.js, Selected for its scalability, extensive package ecosystem with Express.js framework for RESTful API development and NPM package management
- React, chosen for building a responsive and interactive user interface.
- TypeScript, adding static typing to JavaScript for better code reliability and maintainability
- HTML, providing the fundamental structure and semantic markup for web content and user interfaces
- CSS handling layout, styling, animations, and responsive design across different devices and screen sizes

3.4.1.2 Additional Tools:

- PostgreSQL: For flexible document storage, ideal for meeting data and transcriptions.
- Git: Version control using feature branch workflow, conventional commits, and GitHub for repository hosting
- VS Code: Development environment configured with Prettier, GitLens and Live Server.
- Docker: for containerization and consistent deployment environments.

Chapter Four

SYSTEM DESIGN

4.1 Introduction

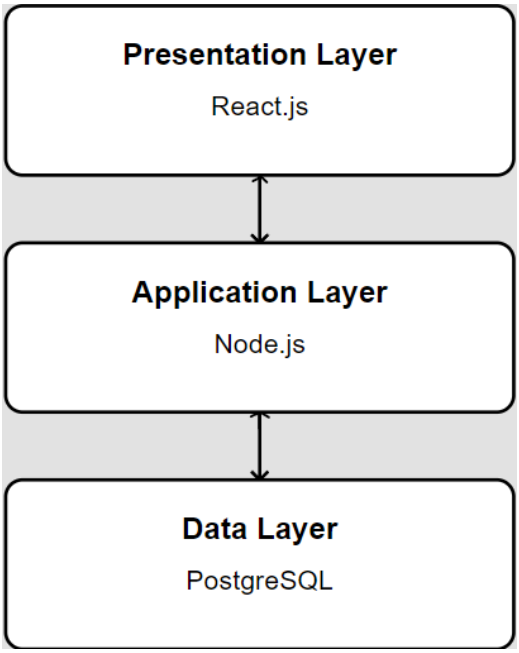
In this chapter, we define and describe the design of main components for our system with details and how the components interact with each other. The design breakdown shows how our meeting management and AI-assistant system handles user interactions, manages spaces and coordinates meeting. Through this approach, we show how each component contributes to creating a collaboration environment.

4.2 System Design Specification

The meeting management application is designed with a modular architecture to prioritize scalability, ease of maintenance, and seamless feature integration.

4.2.1 System Architecture

- **Client-Server Model:** The system uses a client-server architecture, with a web-based front-end and a cloud-hosted back-end.
- **Three-Tier Architecture:**
    1. **Presentation Layer:** User interface (UI) built with React.js for ease of use.
    2. **Application Layer:** The system logic is handled by the back-end using Node.js.
    3. **Data Layer:** A PostgreSQL database stores data in an organized way.



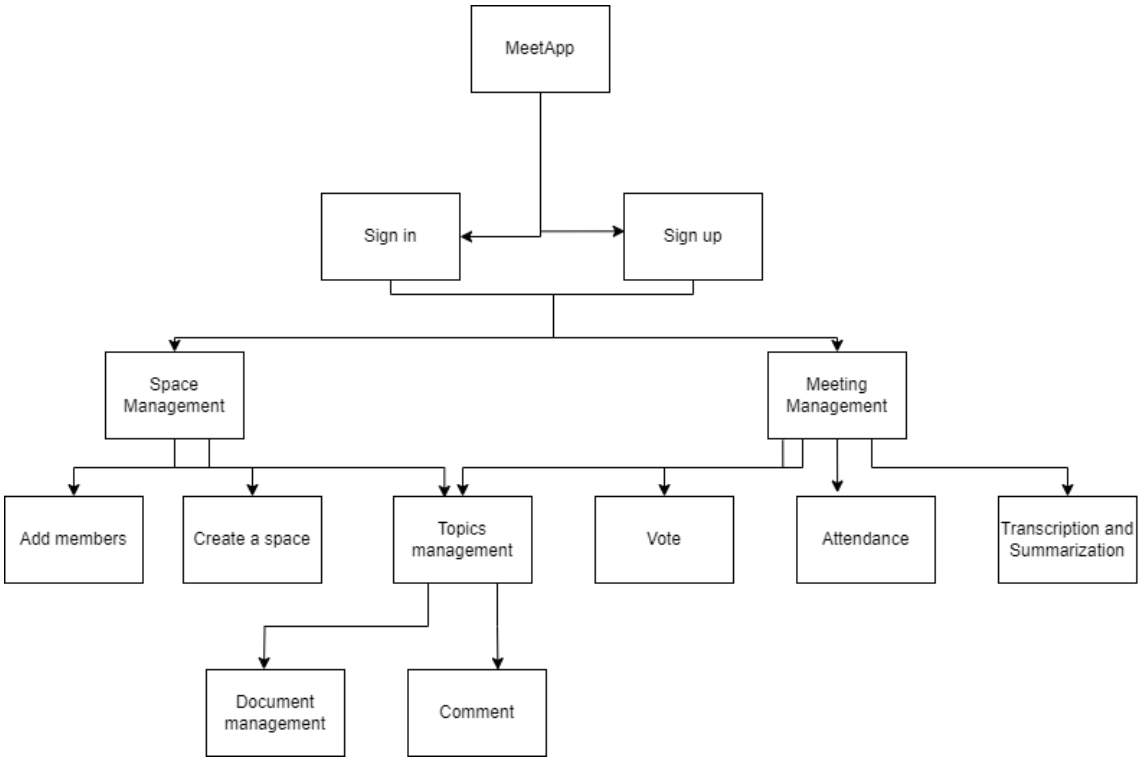
4.2.2 System Components

1. **User Management Module:**
    - Provides username availability checks and secure authentication.
2. **Space Management**:
    - Allows users to create spaces as dedicated group for the team.
    - Admins can manage members by inviting or removing them from the space.
3. **Meeting Management**:
    - Admins can schedule and organize meetings within a space.
4. **Topics management:**
    - Enables admins to create topics for meetings.
5. **Attendance Tracking:**
    - Enables admins to mark attendance and generate attendance reports.
    - Attendance data is securely stored and accessible for review.
6. **Voting Module:**
    - multiple-choice and yes/no voting feature.
    - Stores voting results for future reference.

7. **Document Management:**
    - Admins can upload and delete meeting-related documents for each topic.
    - Members can download documents.
8. **Commenting System:**
    - Members can add comments for each topic.
9. **Transcription and Summarization:**
    - The system automatically transcribes meetings in both Arabic and English.
    - It generates summaries from the transcriptions, highlighting key points and action items.
10. **Automated Follow-Ups:**
    - Extracts tasks from meeting transcripts.
11. **Language Support:**
    - The user interface and transcription services fully support Arabic and English.

This design ensures that the system is capable of meeting user expectations while maintaining flexibility for future improvements

4.2.3 System Information Architecture



4.3 Design Architecture

In this section, we will introduce the diagrams that we used to design and understand the structure and functionality of our system. These diagrams include the Data Flow Diagram (DFD) and the Entity-Relationship Diagram (ERD), which together provide a detailed representation of the system's processes and database design. These diagrams serve as essential tools for visualizing the system's architecture and ensuring a clear, logical design.

4.3.1 Data Flow Diagram (DFD)

The DFD captures the flow of information across different components, showing how data is processed and transferred within the system.

4.3.1.1 DFD LEVEL 0:

This represents the highest-level view of the entire system, showing how the how it interacts with external entities, the users, admins, transcription and the AI.

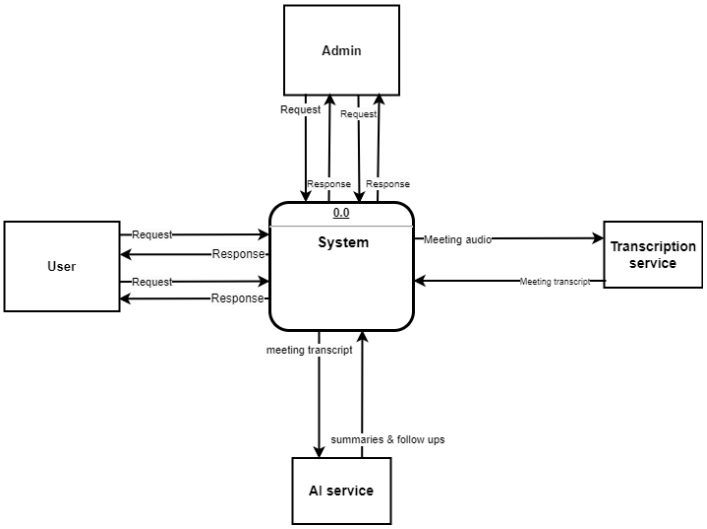


Figure 1: DFD LEVEL 0

4.3.1.2 DFD LEVEL 1:

This level breaks down the primary processes into more specific tasks:

- Sign Up/Login: Handles user authentication and authorization.
- Space Management: Organizes the meetings and manage members.
- Meeting Management: The Core of the system, its functionality involving the selection, scheduling and organization of the meeting's processes.

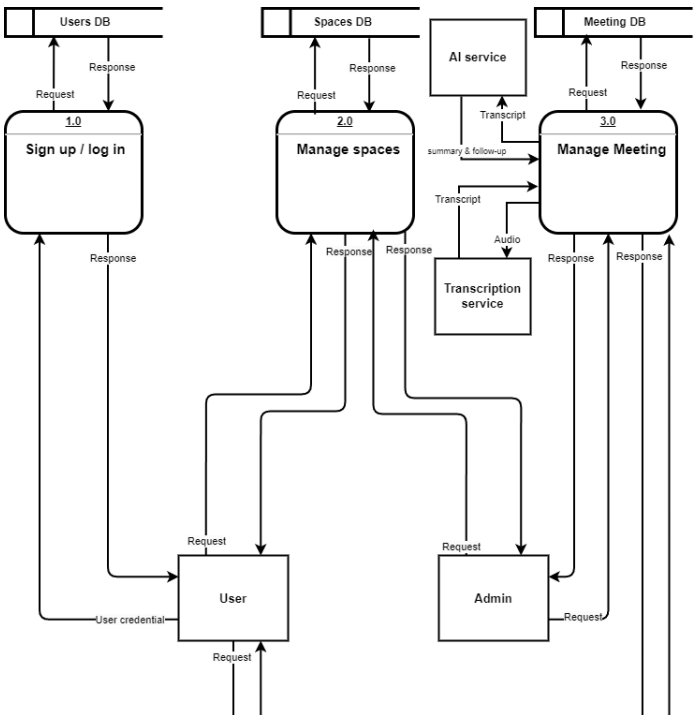


Figure 2: DFD LEVEL 1

4.3.1.3 Process 1 Level 2 (Sign up/ log in):

Inputs: User credentials.

Processes: Validates credentials against the database to authenticate users.

Outputs: Grants secure access or provides error messages for failed authentication attempts.

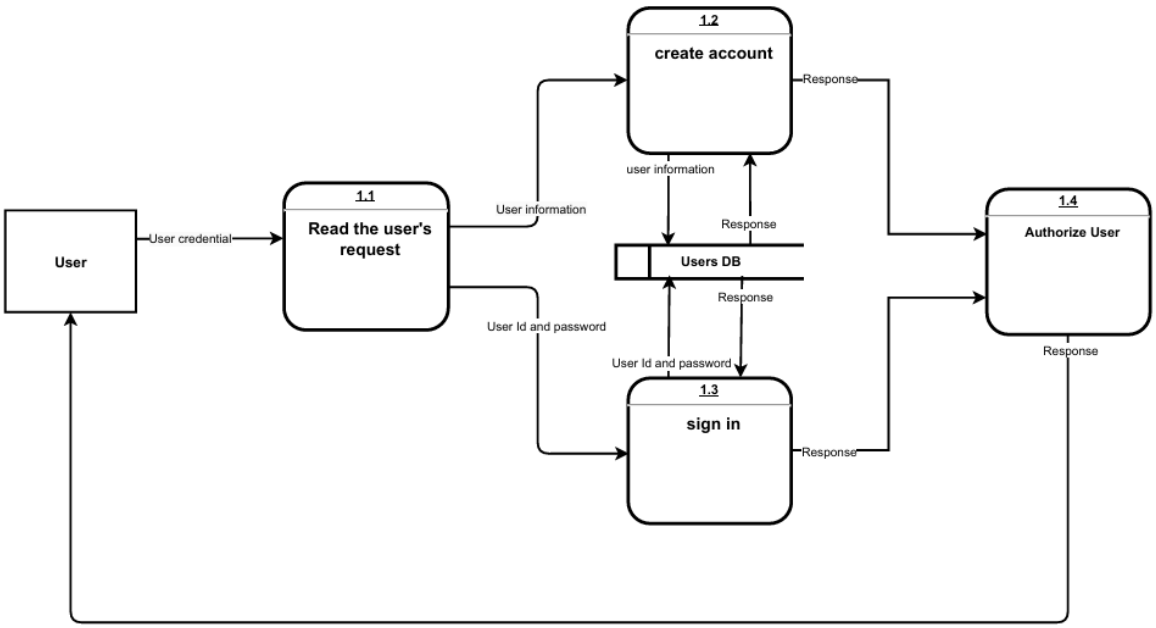


Figure 3: Process 1 Level 2 (Sign up/ log in)

4.3.1.4 Process 2 LEVEL 2 (Manage spaces):

The system allows for the management of meeting spaces. Each space can contain multiple meetings, as well as a list of members who are members of the space.

- Create a space: A user can create a new space within the system and he will be the admin of this space.
- Select joined space: Members can only access the space but not modify it.
- Assign members: The admin can add members to the space.
- Edit space: The admin can modify the details of the existing space.
- Delete members: The admin can remove members from the space.
- Delete space: The admin can completely remove the space from the system including all the meetings and members associated with it.

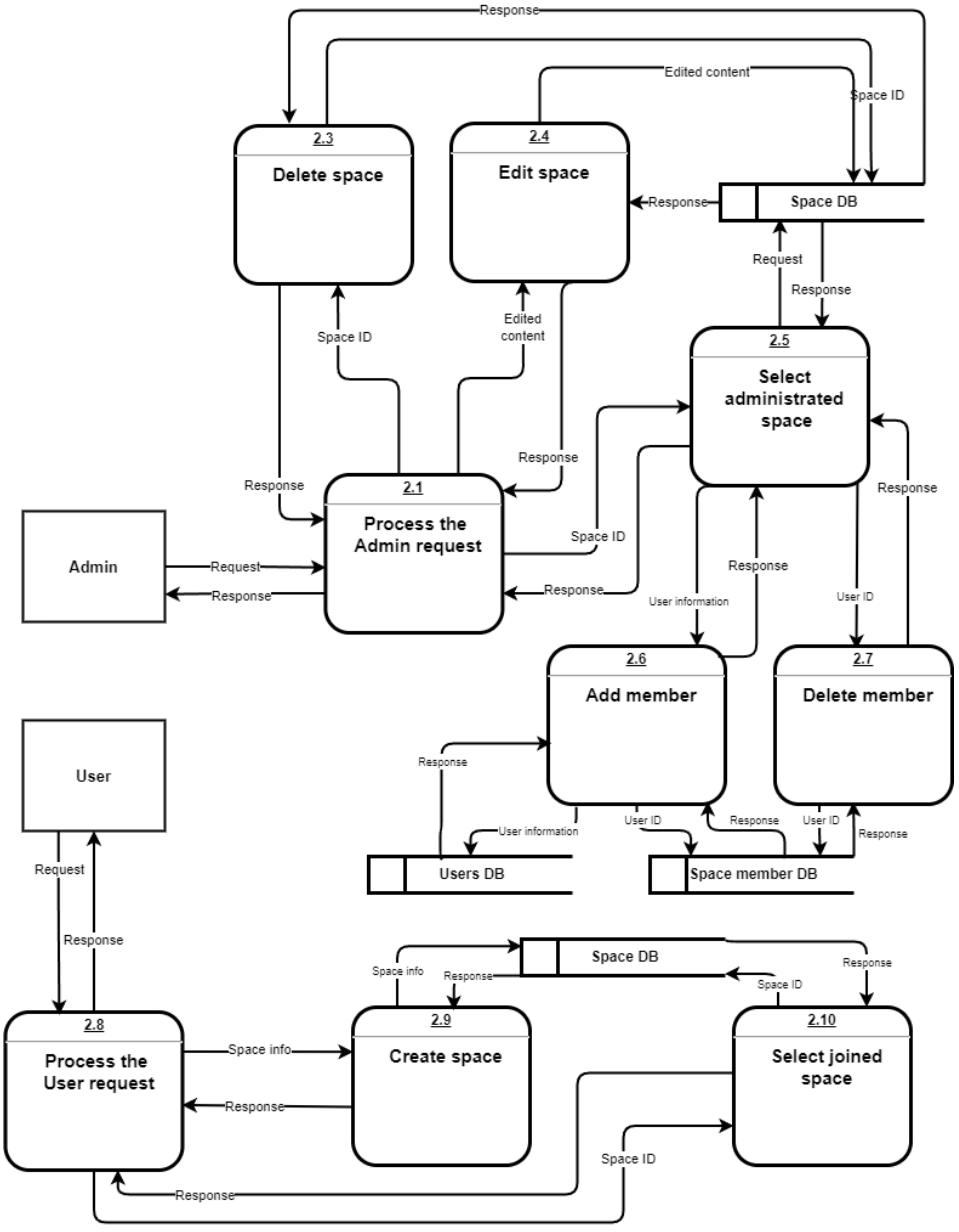


Figure 4: Process 2 LEVEL 2 (Manage spaces)

4.3.1.5 Process 3 LEVEL 2 (Manage meetings):

The system allows for the creation, deletion, and editing of meetings within the virtual spaces.

- Create meeting: Admins can create a new meeting within a selected space.
- Delete meeting: If a meeting is no longer needed, the system allows admins to delete it from the space.
- This removes the meeting from the system completely.
- Edit meeting: For meetings that need to be modified, the system provides the ability for admins to edit their details.
- This may include changing the meeting title, date, time, or any other relevant information.
- Select meeting: This will show the meeting page where most of the system functionalities at. (Details are in the level 3).

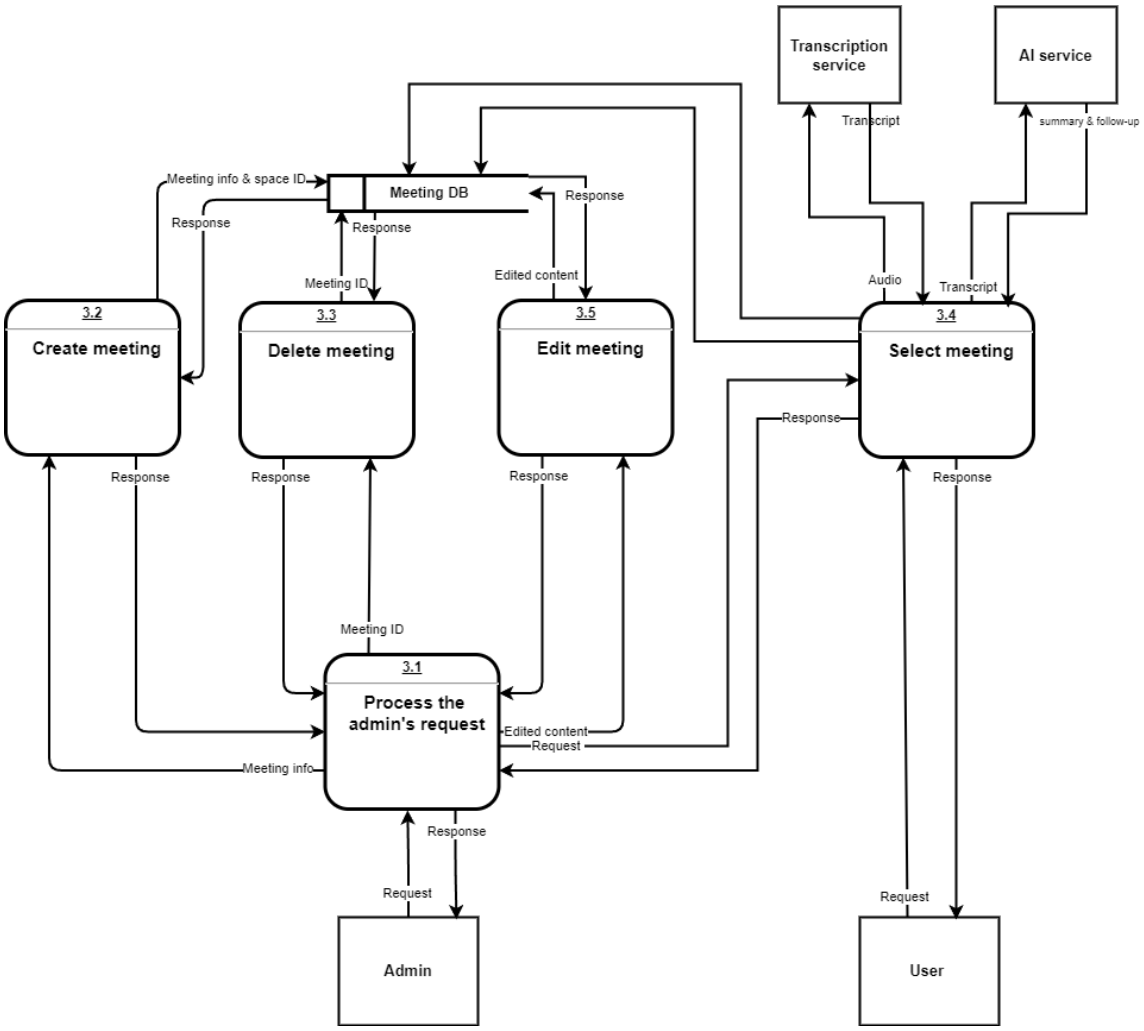


Figure 5: Process 3 LEVEL 2 (Manage meetings)

4.3.1.6 Process 3.4 LEVEL 3 (Select meeting):

The "Select Meeting" is the core of our system where most of the processes and functionalities are available at. Here's a detailed explanation of the key components within this section:

- Select Scheduled Meetings: This process allows the admin to browse and select meetings that have been previously scheduled. When a meeting is selected, the admin can send a request to start the meeting.
- Start Meeting: Once a scheduled meeting is selected, the admin can send a request to start the meeting.
- Taking Attendance: The system provides the ability to the admin to take the attendance.
- Manage Topics: The system allows to create, organize and manage the topics discussed during or before the meeting. more details are in level 4
- Select In-Progress Meetings: Users can select and view details of ongoing meetings.
- View Summary & Follow-ups: Users can access a summary of the meeting and follow-ups.
- View Meeting Engagements: The system provides the ability to show user engagement, like topics, comments, documents, voting etc.
- View Transcript: Users can access the full transcript of the recorded meeting.
- Transcribe: after the meeting ends, the voice will go to the transcription service and the transcribed data is sent to the Meeting DB for storage and further use.
- Create Summaries and Follow-ups: After the transcription is completed, this process uses an AI service to generate summaries and follow-up based on the meeting transcript. The resulting summaries and follow-ups are stored in the Summary & Follow-ups DB for future reference.

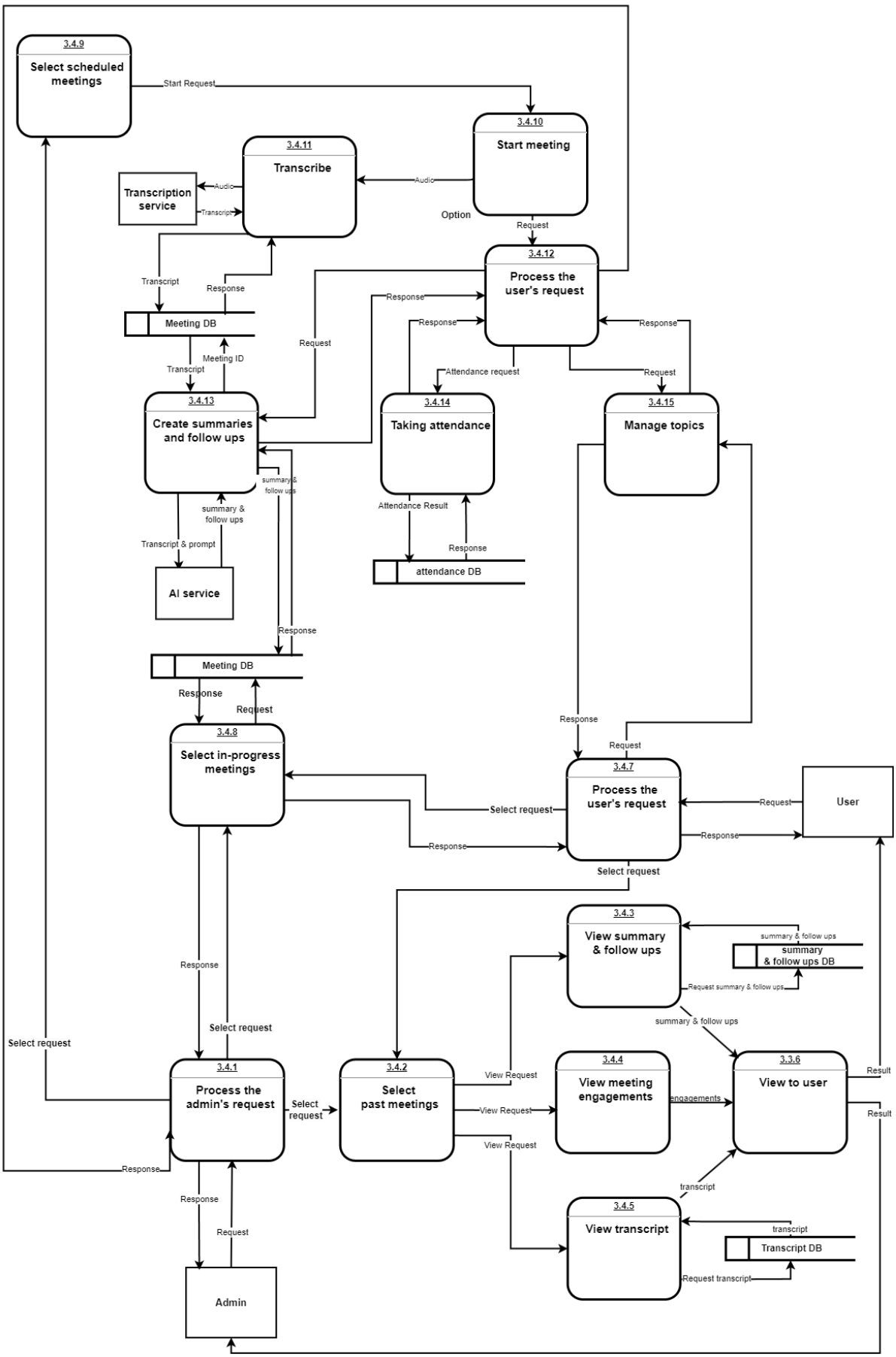


Figure 6: Process 3.4 LEVEL 3 (Select meeting)

4.3.1.7 Process 3.4.15 LEVEL 4 (Manage topics):

The topic management system allows users to create, delete and edit the topics associated with a meeting.

- Create Topic: Admins can add new topics to a meeting.
- Delete Topic: If a topic is no longer relevant or needed, Admins can remove it from the meeting.
- Edit Topic: Admins can modify the details of an existing topic, such as the title or description.
- Select Topic: users can select a topic and further more processes in the next level

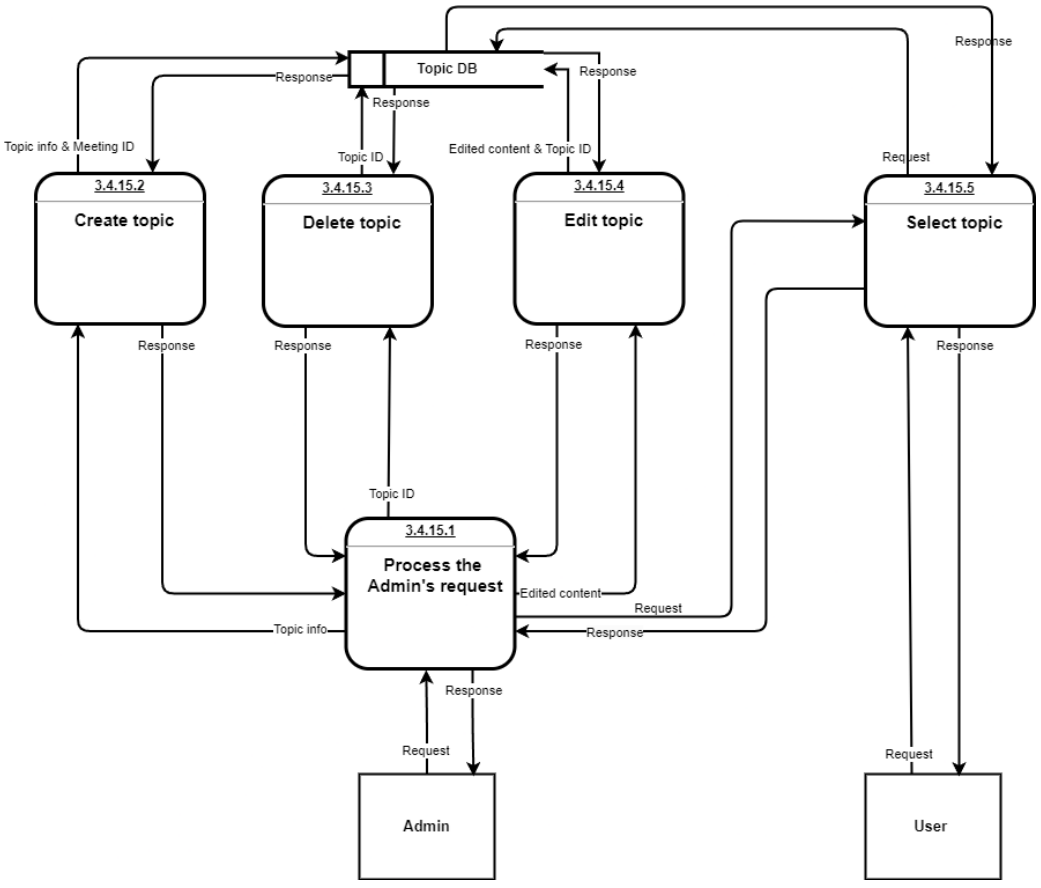


Figure 7: Process 3.4.15 LEVEL 4 (Manage topics)

4.3.1.8 Process 3.4.15.5 LEVEL 5 (Select topic):

The select topic allows users to interact with documents and comments that are part of the topic. This includes uploading, downloading and deleting documents, as well as adding and removing comments on those topics.

- Upload Document: Users can upload documents to the system, which are then stored in the Documents DB.
- Download Document: Users can download documents from the system that have been uploaded by others.
- Delete Document: If a document is no longer needed, admins can delete it from the system.
- Add Comment: Users can add comments. These comments are stored in the Comments DB and are associated with the specific topic.
- Delete Comment: If a comment is no longer relevant or needed, admins can remove it. This deletes the comment from the Comments DB.

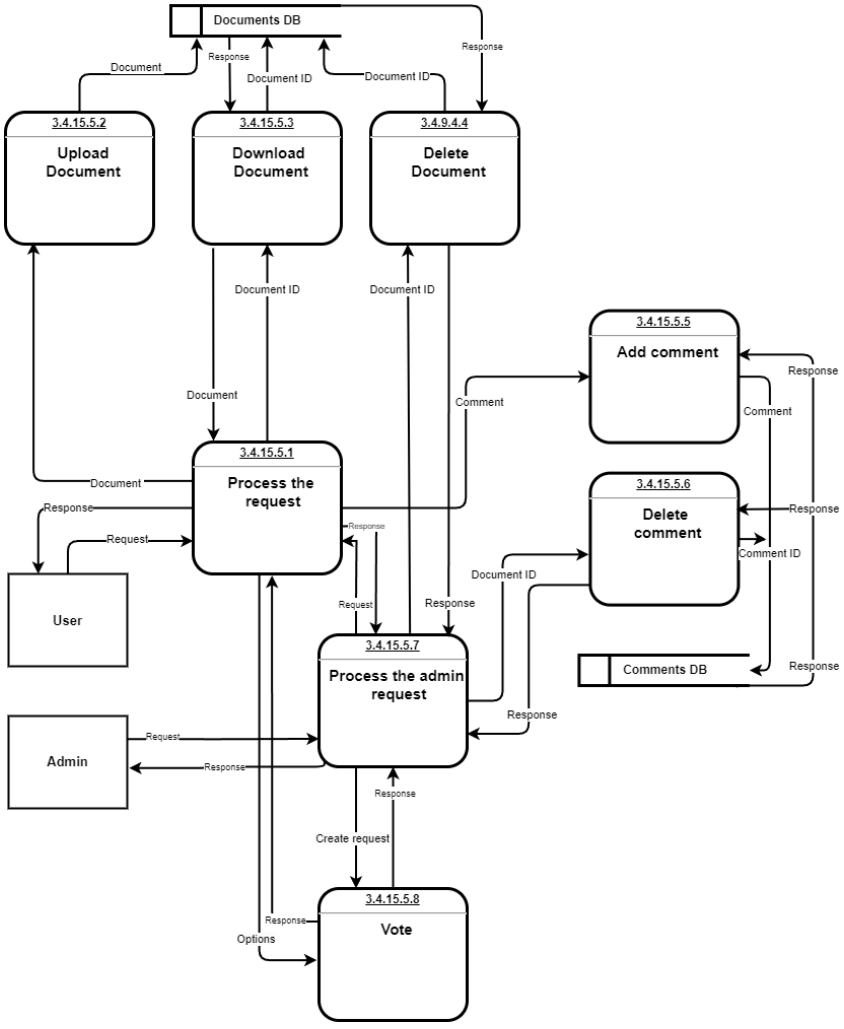


Figure 8: Process 3.4.15.5 LEVEL 5 (Select topic)

4.3.2 ERD (Entity-Relationship Diagram)

The ERD defines the relationships between various entities in the database, highlighting how the data is organized and interconnected.

Entities and Their Attributes:

- USER:
  - Primary Key: user_id (int)
  - username (string) - Unique Key
  - email (string) - Unique Key
  - password (string)

- SPACE:
  - Primary Key: space_id (int)
  - Foreign Key: user_id (int) - References USER
  - space_name (string)
  - created_at (datetime)

- SPACE_MEMBER:
  - Composite Primary Key: space_id, user_id (both int)
  - Foreign Keys:
  - space_id - References SPACE
  - user_id - References USER
  - joined_at (datetime)

- MEETING:
  - Primary Key: meeting_id (int)
  - Foreign Key: space_id (int) - References SPACE
  - title (string)
  - scheduled_time (datetime)
  - created_at (datetime)
  - summary (string)
  - follow_ups (string)
  - transcript (string)

- TOPICS:
  - Primary Key: topic_id (int)
  - Foreign Key: meeting_id (int) - References MEETING
  - topic_title (string)

- uploaded_at (datetime)

- COMMENT:
  - Primary Key: comment_id (int)
  - Foreign Keys:
  - meeting_id - References MEETING
  - user_id - References USER
  - content (string)
  - created_at (datetime)
  -

- VOTING_SESSION:
  - Primary Key: vote_id (int)
  - Foreign Key: topic_id (int) - References TOPICS
  - question (string)
  - type (string)
  - is_anonymous (boolean)
  - results (string)
  - options (string)
  - created_at (datetime)

- DOCUMENT:
  - Primary Key: document_id (int)
  - Foreign Key: topic_id (int) - References TOPICS
  - file_name (string)
  - file_type (string)
  - file_size (int)
  - uploaded_at (datetime)

- ATTENDANCE:
  - Primary Key: attendance_id (int)
  - Foreign Keys:
  - meeting_id - References MEETING
  - user_id - References USER
  - is_present (boolean)
  - marked_at (datetime)

Relationships:

1. USER to SPACE: One-to-Many
   - One user can create multiple spaces
   - Each space has one admin (user)
2. SPACE to SPACE_MEMBER: One-to-Many
   - One user can be a member of multiple spaces
3. SPACE to MEETING: One-to-Many

    - One space can have multiple meetings
    - Each meeting belongs to one space
4. MEETING to TOPICS: One-to-Many
    - One meeting can have multiple topics
    - Each topic belongs to one meeting
5. TOPICS to VOTING_SESSION: One-to-Many
    - One topic can have multiple voting sessions
    - Each voting session belongs to one topic
6. TOPICS to DOCUMENT: One-to-Many
    - One topic can have multiple documents
    - Each document belongs to one topic
7. TOPICS to COMMENT: One-to-Many
    - One topic can have multiple comments
    - Each comment belongs to one topic
8. MEETING to ATTENDANCE: One-to-One or Zero
    - One meeting can have only attendance record or none.
    - Each attendance record belongs to one meeting
9. USER to COMMENT: One-to-Many
    - One user can create multiple comments
    - Each comment is created by one user
    - This enables tracking which user made which comments in meetings
10. USER to ATTENDANCE: One-to-Many
    - One user can have multiple attendance records (for different meetings)
    - Each attendance record belongs to one user
    - This allows tracking user attendance across multiple meetings

11. USER to SPACE_MEMBER: One-to-Many
    - One user can be a member of multiple spaces

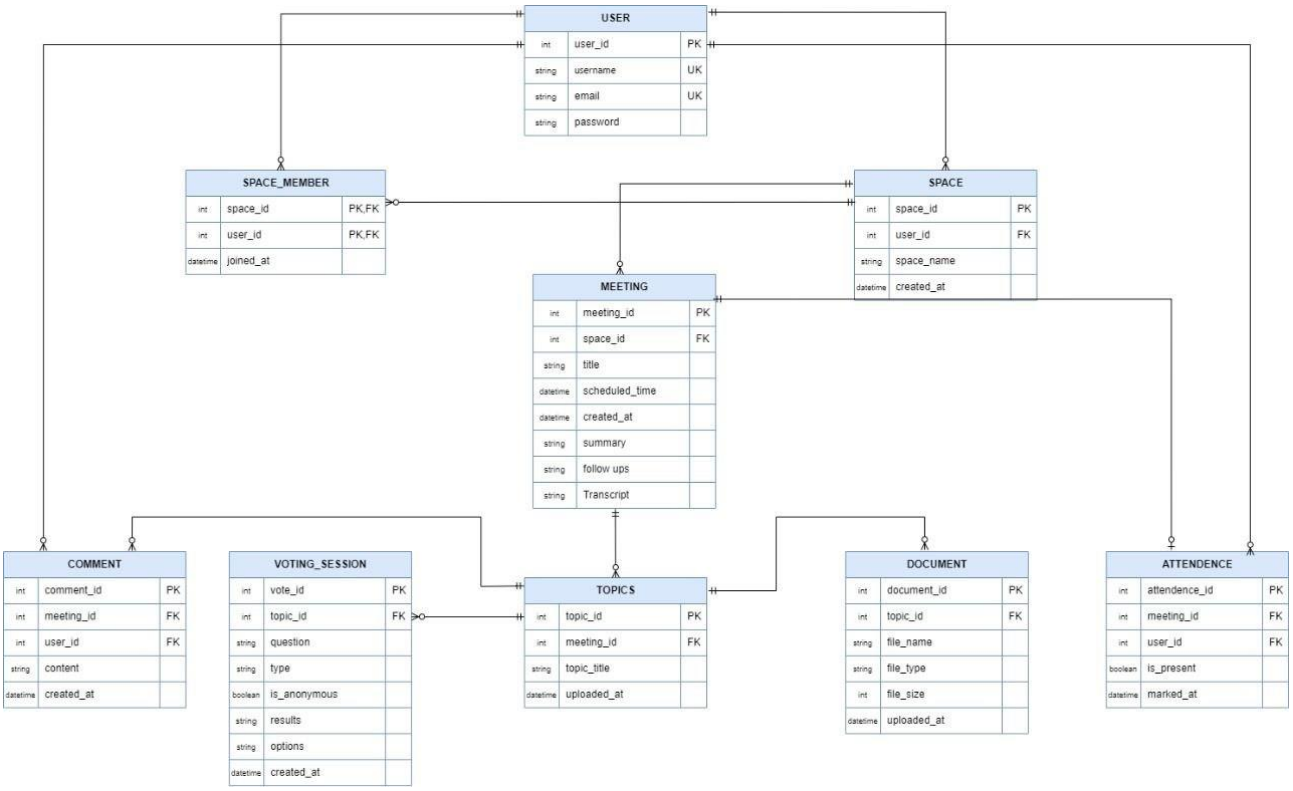


Figure 9: ERD (Entity-Relationship Diagram)

4.3.2 User Interface

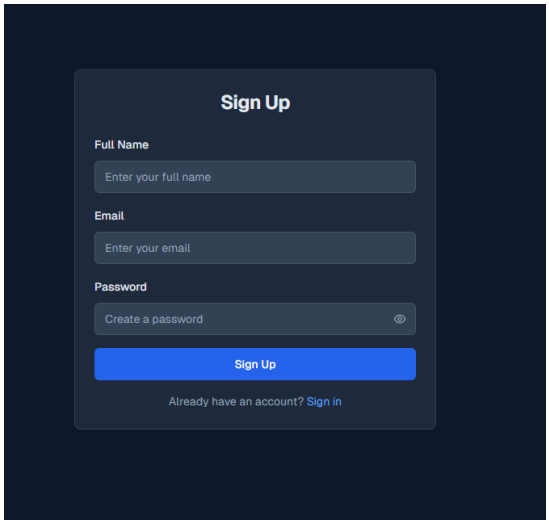
In this section, we want show the user interface design that will be shown to users. Outlining the structure and layout of the system, we chose low-fidelity for the initial design concepts representation.

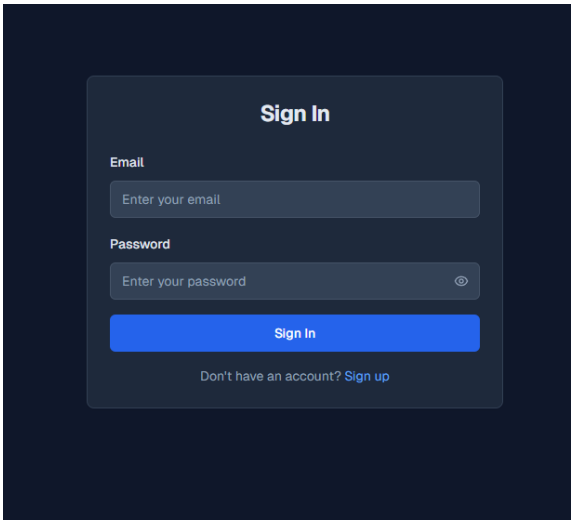
4.3.2.1 Low-Fidelity (Lo-Fi)

the Low-Fidelity is typically used at the early stages of the design of the interface, it represents the structure of the screens to decide the positioning of the components and have an overview on the skeleton of the webpages.

4.3.2.2 Login and sign-up Pages

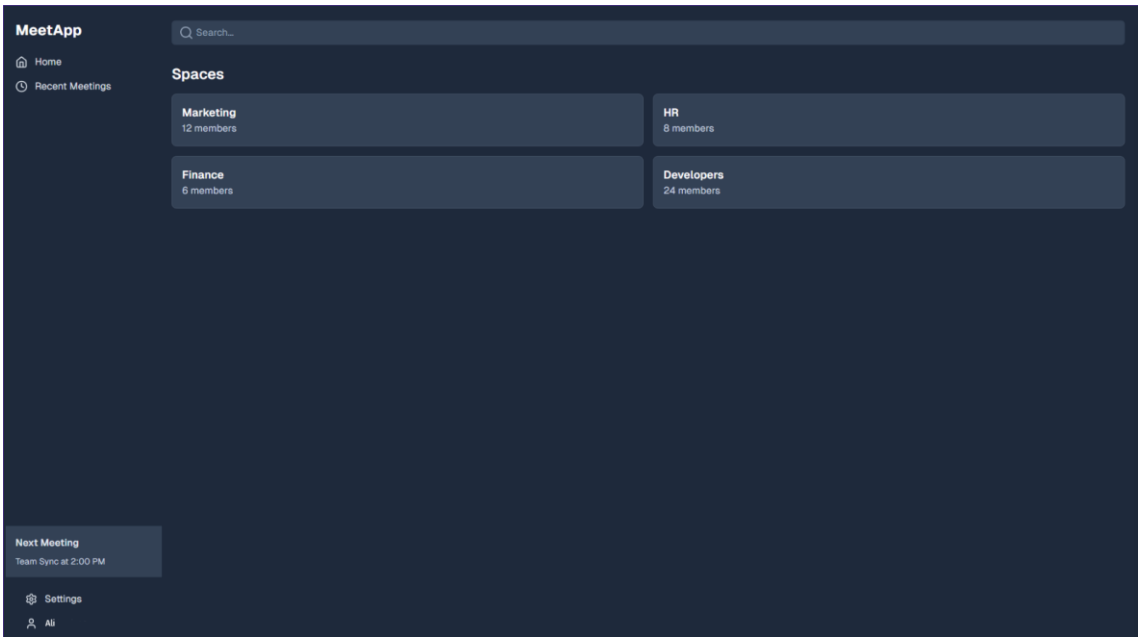
The left UI is designed for Sign-Up allowing new users to create an account by entering their full name, email and password. the second right UI is for Sign-In enabling existing users to log into the system by entering their email and password. the two interfaces provide a clean and minimalistic design.





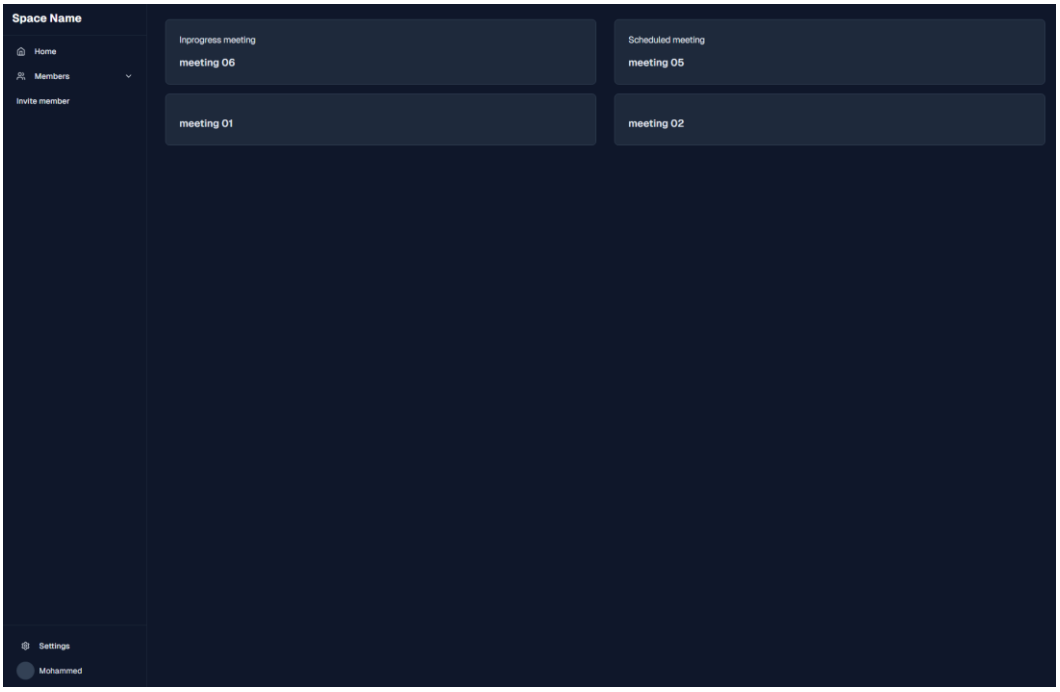
4.3.2.3 Home Page

This Home Page UI provides a clear layout with a sidebar for navigation Home and shows the next meeting. With a main area that displays spaces with member counts. At the bottom we have user profile and settings.



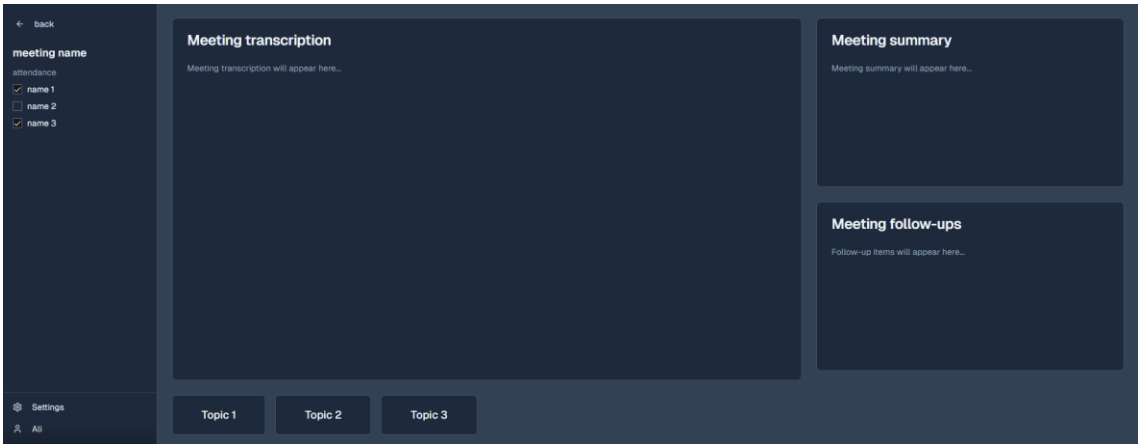
4.3.2.3 Space Page

This Managing Space UI provides a clear layout with a sidebar for navigation (Home, Space members, inviting member) and a main area that categorizes meetings with a label on each meeting labels can be In-Progress or Scheduled. meetings without labels are previous meeting**.**



4.3.2.4 Meeting Page

This Managing Meeting UI provides a clear layout with a sidebar for taking the attendance and a main area for meeting transcription, summary, follow-ups and buttons for selecting different topics meetings.



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- Algorithm Design by Michael T. Goodrich and Roberto Tamassia