National University of Computer and Emerging Sciences, Lahore

MentorMe

Abdurehman Saleemi 20L-2082 BS(CS)

Abuzar Saeed ..... 20L-2919 BS(CS)

Usama Waseem ..... 18L-2140 BS(CS)

Supervisor: Mr. Razi Uddin

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Date: .....

Name: Abdurehman Saleemi

Signature: .....

Name: Abuzar Saeed

Signature: .....

Name: Usama Waseem

Signature: .....

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Abstract

MentorMe is a web-based platform designed to enhance the learning experience. We aim to develop a web-based environment that allows effortless registration and access for both students and teachers. At the core of MentorMe is an advanced query-video matching algorithm that analyzes student queries and recommends relevant instructor videos, providing personalized learning experiences. An AI advisor/chatbot is integrated to offer round-the-clock assistance on a wide range of FAST-related inquiries, and a scheduling system enables students to arrange virtual meetings with department instructors while considering instructor availability. Moreover, it offers a curated repository of educational materials. User feedback is actively solicited from students and teachers to continually enhance the platform's functionality and usability, making MentorMe a comprehensive and dynamic educational tool tailored to the needs of FAST University's academic community.

Executive Summary

In the age of digitalization, education is undergoing a transformative shift. Students and educators alike are presented with unprecedented opportunities and challenges in this evolving landscape. University life offers students a chance for growth in academics, personal development, and social skills. It revolves around attending lectures, discussions, assignments, and exams, with FAST University known for its challenging programs. However, sometimes students can't attend or struggle to grasp concepts, turning to online resources for help. Online learning has advantages but also drawbacks like unreliable information, limited support services, communication challenges, and varying course quality. Some students may use external resources like Chegg or Coursera due to limited access to academic materials.

To overcome these challenges, a comprehensive educational platform will be developed with aims to serve as a vibrant amalgamation of technology, education, and collaboration. Key features of this platform will include an intelligent query-video matching algorithm that recommends relevant instructor videos, an AI advisor available 24/7 to address inquiries, and an efficient scheduling system for virtual meetings with instructors. Moreover, it offers a curated repository of educational materials. User feedback will be actively collected and will be used to improve the platform, making it a dynamic fusion of technology, education, and collaboration.

The project serves a diverse range of users within FAST University and potentially external users. It primarily focuses on students, educators, and university support services. Students seek access to educational resources, personalized assistance, and virtual meetings with instructors, facing challenges like limited resource accessibility and online learning complexities. Educators aim to deliver content effectively and enhance teaching with resources, while support services offer specialized assistance. External users, if included, desire access to educational content and collaboration opportunities. Understanding these user needs is crucial for tailoring the platform to create an inclusive and effective educational environment, ultimately improving the educational experience at FAST University.

The problem statement for this project revolves around the challenges faced by students and educators in the context of FAST University's educational environment. These challenges include limited access to educational resources, difficulties associated with online learning, and the need for improved support services for students. Additionally, instructors may encounter obstacles in effectively teaching and engaging with students in online settings, as well as coordinating virtual meetings and communication.

The scope of project is creating a user-friendly web-based platform tailored for FAST University students and educators. It includes an advanced query-video matching algorithm for personalized learning support and a 24/7 AI advisor for academic assistance. A scheduling system facilitates virtual meetings

with instructors, and user feedback drives ongoing improvements. The platform also features a comprehensive resource repository to enhance the learning experience. The technology stack includes Next.js for the front-end, a choice between FASTAPI or Node.js with Bun.js for the back-end, Supabase for the database, Langchain for the chatbot, and Heroku and Cloudflare for hosting and deployment, ensuring reliability and performance. This project scope serves as a guide throughout development.

In addition to this, the constraints within the project include time, quality, and work resources. The project must be completed within a year, meeting industry standards and end-user expectations. Specific feature constraints include ensuring accurate natural language understanding for the AI advisor, integrating the scheduling system with instructor calendars, encouraging user feedback, curating diverse educational materials, and addressing the complexity of the query-video matching algorithm.

In conclusion, the MentorMe Educational Platform represents a forward-thinking initiative aimed at transforming education within FAST University. It directly addresses the contemporary challenges faced by both students and educators in the digital era through the development of a user-friendly web-based platform. This platform is designed to offer tailored support, featuring cutting-edge elements such as an intelligent query-video matching algorithm, a 24/7 AI advisor, and a scheduling system facilitating virtual meetings with instructors. The project is committed to continuously gathering and incorporating user feedback to drive ongoing improvements and maintains a comprehensive repository of educational resources. The project's meticulously selected technology stack ensures optimal performance, and its stakeholders encompass students, educators, university support services, and potentially external users. The overarching goal is to create an all-encompassing and efficient educational environment, ultimately enhancing the educational journey at FAST University and beyond.

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Chapter 1 Introduction

University life can be a life-changing and highly valuable journey for students, filled with opportunities for academic, personal, and social growth. Life at university primarily revolves around academic pursuits. Students attend lectures, take part in discussions, complete assignments, and prepare for exams. FAST is renowned for its rigorous academic programs in fields such as computer science, engineering, business, and more. Students often engage in challenging coursework. However, there may be situations when students are unable to attend classes due to various reasons or somehow attend classes but are unable to get a grip on concepts. To get grip on concepts, students switch to online resources. While online resources offer numerous advantages for learning and grasping concepts, they also come with some disadvantages and challenges such as internet contains a vast amount of information, but not all of it is accurate or credible [**?**], students may have limited access to support services like tutoring, counseling, or career guidance in online learning environments[**?**], effective communication with instructors and peers may be more challenging in online settings[**?**], leading to misunderstandings or misinterpretations, some online courses may lack a strong teacher presence, making it harder for students to connect with instructors for guidance and support, quality of online courses can vary widely, some may be well-designed and engaging, while others may lack depth and interactivity. Students may have limited access to resources (eg. chegg, coursera etc).

To address these challenges comprehensively, the MentorMe Educational Platform will acts as a visionary project aimed at revolutionizing the educational experience at FAST University. It will empower students and supports educators by providing easy access to valuable resources and personalized assistance. Key features include an intelligent query-video matching algorithm, a 24/7 AI advisor, and an efficient scheduling system. User feedback is actively collected to enhance the platform's functionality. Additionally, it offers a curated repository of educational materials. This platform envisions a future where education transcends physical classrooms, fostering an environment where students can thrive.

1.1 Purpose of this Document

The primary objective of the project is to create a web-based educational platform that is finely tuned to cater to the distinctive requirements of FAST University. The core purpose of this endeavor is to construct a solution that effectively addresses the challenges encountered by both students and educators within the FAST University community. This comprehensive online platform has been thoughtfully crafted to elevate the educational experience by harnessing advanced technology and a steadfast dedication to fostering student success. It is specifically aimed at mitigating key obstacles associated with online learning and offers a wealth of valuable resources and guidance to bolster student achievement.

1.2 Intended Audience

The project's primary audience is the FAST University academic community, including students, educators, and support services. Students benefit from improved learning experiences and valuable resources, while educators can engage more effectively with students using platform features. University support services like counseling and tutoring can offer assistance through the platform. Depending on its scope, the project may also attract external users interested in educational content. Overall, it aims to serve the university community and potentially a broader audience.

1.3 Definitions, Acronyms, and Abbreviations

Here are some important definitions, acronyms, and abbreviations that may be used in the project:

Definitions:

- **Query-Video Matching Algorithm**: An intelligent algorithm that analyzes student queries and recommends relevant instructor videos from the platform's repository.
- **AI Advisor/Chatbot**: A virtual assistant powered by artificial intelligence, capable of providing assistance and answering inquiries related to FAST University.
- **Scheduling System**: A feature that enables students to schedule virtual meetings with department instructors, considering instructor availability.
- **User Feedback Integration**: The process of actively collecting and incorporating feedback from platform users to enhance its functionality and usability.
- **Resource Repository**: A central hub that stores and maintains a wide range of educational materials and resources to supplement teaching and learning.
- **Technology Stack**: The combination of tools, frameworks, and programming languages used for web-based application development.

Acronyms and Abbreviations:

- **SDG**: Abbreviation for Sustainable Development Goal.
- **AI**: Acronym for Artificial Intelligence.
- **DB**:Database
- **ERD:** Entity Relationship Diagram
- **API:** Application Programming Interface

- **GUI:** Graphical User Interface
- **UI**: Acronym for User Interface.
- **UX**: Acronym for User Experience.
- **URL**: Acronym for Uniform Resource Locator.
- **HTML**: Acronym for Hypertext Markup Language.
- **CSS**: Acronym for Cascading Style Sheets.
- **AWS**: Acronym for Amazon Web Services.

1.4 Conclusion

The opening chapter of this report provides an introduction, outlining its purpose and identifying the target audience. It highlights the transformative opportunities and challenges within university life, emphasizing the need for solutions. The central objective of the project is to develop a customized web-based platform for FAST University, specifically designed to tackle these challenges. The platform's primary aim is to enrich the educational journey for students and educators by leveraging advanced technology and offering dedicated support. The intended audience encompasses students, educators, and university support services, while also having the potential to engage external users interested in educational content.

Chapter 2 Project Vision

The project's vision is to revolutionize and elevate the educational experience at FAST University by creating a cutting-edge web-based platform that overcomes challenges in online learning. This platform aims to empower students and educators with advanced technology and dedicated support, enhancing their learning and teaching experiences. It envisions a future where students have easy access to valuable resources, personalized guidance, and seamless communication with instructors, ultimately fostering academic success and growth. The project aspires to become an indispensable tool within the university community and potentially extend its impact to a broader audience seeking educational content and support.

2.1 Problem Domain Overview

The problem domain overview for this project is twofold, encompassing challenges faced by both students and educators within the educational landscape of FAST University.

For students, challenges include limited access to essential educational resources, difficulties associated with online learning, and a lack of accessible support services. These challenges can hinder their academic progress and overall learning experience.

For educators, the challenges involve effectively delivering course content and engaging with students in online environments. Ensuring students have access to materials, resources, and timely support is also a concern. Coordinating virtual meetings and maintaining effective communication with students can be challenging without dedicated tools and systems.

2.2 Problem Statement

The problem statement for this project revolves around the challenges faced by students and educators in the context of FAST University's educational environment. These challenges include limited access to educational resources, difficulties associated with online learning, and the need for improved support services for students. Additionally, instructors may encounter obstacles in effectively teaching and engaging with students in online settings, as well as coordinating virtual meetings and communication.

2.3 Problem Elaboration

Within the educational landscape of FAST University, a myriad of challenges confront both students and educators. For students, limited access to vital educational resources often impedes their academic

progress, while the transition to online learning has brought forth new hurdles, including effective communication difficulties and disparities in online course quality. Moreover, students frequently encounter constraints in accessing essential support services such as tutoring and counseling in virtual learning environments.

Conversely, educators face their set of challenges, particularly concerning effective teaching in online settings. Ensuring student accessibility to course materials and active participation presents its own complexities. Instructors may also require easy access to educational resources to enrich their teaching and further support students. Coordinating virtual meetings and timely communication with students pose additional challenges.

Collectively, these challenges contribute to an educational environment that may not fully support the academic needs of students nor facilitate optimal teaching practices for educators.

2.4 Goals and Objectives

The overarching goal of this project is to create a web-based educational platform specifically designed to enhance the learning experience at FAST University. This platform aims to address the challenges faced by students and educators, providing them with valuable resources, personalized support, and an enriched educational environment. Project's objective includes:

- Designing and developing a user-friendly web-based platform that facilitates registration, login, and access for both students and teachers.
- Creating and integrating an efficient query-video matching algorithm capable of analyzing student queries and providing recommendations from the platform's video repository.
- Implementing an AI advisor or chatbot to offer extensive support and answers to a wide range of inquiries related to FAST, enhancing the available support for students.
- Developing a scheduling system enabling students to arrange virtual meetings with relevant department instructors, factoring in instructor availability.
- Actively collecting and incorporating user feedback from students and educators to continually enhance the platform's functionality and usability.
- Empowering students to seek assistance from the AI advisor for any FAST-related inquiries.
- Curating and maintaining a comprehensive repository of educational materials and resources to augment the teaching and learning experience.

2.5 Project Scope

The project encompasses the development of a user-friendly web-based platform tailored for FAST University students and educators. It incorporates an advanced query-video matching algorithm that efficiently recommends pertinent instructor videos in response to student queries, ensuring personalized learning support. An AI advisor or chatbot stands ready to provide around-the-clock assistance across a spectrum of academic subjects. The implementation of a scheduling system empowers students to arrange virtual meetings with department instructors, optimizing their access to guidance. Valuable user feedback is systematically gathered and integrated, fueling ongoing enhancements to the platform's functionality. Moreover, a comprehensive resource repository houses educational materials, supplementing the learning experience. In sum, the project's overarching goal is to elevate the educational journey, effectively supporting the FAST University community.

The development of the platform relies on a carefully selected technology stack designed to optimize its performance and functionality. At the front-end, Next.js is chosen to drive the development, promising a fast and efficient web application experience for users. For the back-end, the project team has the flexibility to choose between FASTAPI and Node.js with Bun.js, aligning the choice with their expertise. The database system is powered by Supabase, which is built on PostgreSQL, known for its robust data storage and retrieval capabilities. To enhance user interaction and support, the chatbot functionality leverages Langchain. Additionally, for hosting and deployment, Heroku and Cloudflare are utilized to ensure the platform's reliability and performance. This comprehensive technology stack integrates front-end and back-end frameworks with a resilient database system and cloud services, forming the core infrastructure for the MentorMe Educational Platform's development. This project scope will be used as a guide throughout the development.

2.6 Sustainable Development Goal (SDG)

The sustainable development goal (SDG) in this project is "Quality Education". The project aligns with this SDG, which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. This project seeks to enhance the educational experience for students by providing accessible resources, personalized support, and a user-friendly platform. By improving the quality of education and supporting students' academic growth, the project contributes to the broader goal of achieving quality education and lifelong learning opportunities.

Figure 2.1: Quality Education

The target SDG is SDG 4: Quality Education

2.7 Constraints

Certainly, constraints can exist within the specific features of the MentorMe Educational Platform project. Here are potential constraints:

1. **Time**: The project must be completed within a year, requiring strict adherence to timelines.
2. **Quality**: The platform must meet industry and end-user standards, emphasizing reliability.
3. **Work Resources**: A team of three members will work on the project.

Specific feature constraints include:

- **AI Advisor/Chatbot**: Ensuring accurate natural language understanding.
- **Scheduling System**: Integrating with instructor calendars.
- **User Feedback Integration**: Encouraging user feedback.
- **Resource Repository**: Curating diverse educational materials.
- **Algorithm Complexity**: Developing an efficient query-video matching algorithm may face complexity constraints.

2.8 Business Opportunity

The project opens up several promising business prospects. Firstly, it can extend its market reach both locally and globally, leading to increased student enrollment and diversification of its user base. Secondly,

the project can generate revenue through avenues such as partnerships with educational institutions and companies, sponsorships, and licensing of educational content. These revenue streams contribute to the project's financial sustainability. Additionally, the successful implementation of the platform can bolster FAST University's reputation as an institution embracing technology for educational enhancement. The project can also utilize user data for valuable insights, aiding in decision-making, curriculum development, and service improvements. The platform's repository of educational materials presents an opportunity for monetizing. Furthermore, the project's dedication to ongoing enhancement ensures its adaptability to evolving educational requirements, ensuring its competitiveness. Lastly, the digital nature of the platform allows for global outreach, fostering international collaboration and knowledge sharing. These business opportunities are mutually beneficial for FAST University and the project team.

2.9 Stakeholders Description/ User Characteristics

The project serves a range of users within the FAST University community and, potentially, external users. Students, as the primary users, exhibit diverse characteristics, including varying academic backgrounds, levels of expertise, and learning needs. These characteristics encompass different degrees of familiarity with online learning tools, a wide array of academic interests, and a shared desire for personalized support. Instructors and educators, who also engage with the platform, bring their extensive teaching experience and subject matter expertise to the table. Their characteristics include a strong commitment to student success, proficiency in their respective fields, and varying levels of familiarity with online educational platforms. Additionally, the platform may attract external users with diverse backgrounds and interests, such as educators, researchers, and professionals seeking knowledge. These potential users can exhibit a wide range of characteristics, reflecting their unique roles and needs within the educational community. Understanding these user characteristics is crucial for tailoring the platform to their specific requirements and ensuring an inclusive and effective educational environment for all.

2.9.1 Stakeholders Summary

The stakeholders of the MentorMe Educational Platform project include a diverse range of individuals and entities within and potentially outside FAST University:

- **Students**: The primary users and beneficiaries of the platform, seeking enhanced learning experiences and support.
- **Educators/Instructors**: Faculty members and department instructors who engage with the platform to facilitate teaching and support students.
- **University Support Services**: Various university services, such as counseling and tutoring, can

utilize the platform to offer specialized assistance to students.

- **External Users (Potential)**: Depending on the project's scope, external users interested in educational content or collaborating with FAST University may also engage with the platform.

These stakeholders collectively contribute to the platform's objectives of improving the educational experience, fostering collaboration, and providing valuable resources within the academic community. Their distinct roles and needs shape the platform's development and functionality.

2.9.2 Key High-Level Goals and Problems of Stakeholders

The project is driven by the goals and challenges of its various stakeholders within the FAST University community and potentially external users.

Students, as primary users, seek seamless access to high-quality educational resources, personalized assistance, and the ability to schedule virtual meetings with instructors. They often encounter difficulties related to limited resource accessibility, online learning complexities, and the need for tailored support.

Educators and Instructors, on the other hand, aspire to effectively deliver course content, engage with students in online settings, and supplement teaching with educational materials. Their challenges may include coordinating virtual meetings, ensuring active student participation, and having access to a diverse repository of resources.

Potential External Users, if included, are motivated by the desire to access valuable educational content, resources, and opportunities for collaboration within the FAST University ecosystem. However, they may face entry barriers to engaging with the academic community.

2.10 Conclusion

This chapter outlines the primary aim of the project, which is to serve a diverse set of stakeholders within the FAST University community and potentially external users. Students, as primary users, seek access to quality educational resources, personalized support, and the ability to schedule virtual meetings with instructors. Educators and Instructors aim to deliver effective online teaching, engage students, and access valuable resources. Potential External Users are interested in educational content and collaboration opportunities but may face entry barriers. These distinct stakeholder groups have their unique characteristics, needs, and challenges, which shape the project's goals and objectives. Students require enhanced learning experiences, educators need effective teaching tools, and external users seek valuable educational content. Understanding these stakeholder dynamics is vital for creating a platform that caters to their specific requirements and fosters an inclusive and supportive educational environment.

Chapter 3 Literature Review / Related Work

3.1 Definitions, Acronyms, and Abbreviations

- **AI** :Acronym for Artificial Intelligence, which refers to the simulation of human intelligence processes by machines, particularly computer systems. -
- **Online Learning**: The use of internet technologies to deliver educational content and facilitate learning, often referred to as e-learning. -
- **Chatbot**:: A computer program designed to simulate conversation with human users, especially over the internet. -
- **Recommendation Algorithm**:: A mathematical model or set of rules used to provide personalized suggestions or recommendations to users, commonly used in e-commerce and content recommendation systems.

3.2 Detailed Literature Review

This section will include a detailed literature review of your problem area. Make different categories for different types of work done in the past. In addition to textual descriptions, make a summary table that describes each paper that you have read, along with references.

3.2.1 Proposal of an Architecture for the Integration of a Chatbot with Artificial Intelligence in a Smart Campus for the Improvement of Learning

3.2.1.1 Summary of the research item

In this article, the authors present an architectural framework designed to integrate a chatbot with artificial intelligence (AI) into a smart campus, with the primary goal of enhancing the learning experience. They assert that traditional teaching methods, relying on masterclasses and passive learning, are becoming less effective. The implementation of information and communication technologies (ICT) is considered pivotal in addressing the dynamic educational landscape. The article emphasizes the importance of analyzing student-generated data to identify individual needs and enhance learning through personalized education, which can be achieved through the use of AI. The proposed system uses AI to analyze data and recommend tailored learning activities to students, creating a dynamic and interactive educational environment.[1]

3.2.1.2 Critical analysis of the research item

While the concept of integrating chatbots and AI into a smart campus for personalized education is compelling, it comes with notable challenges. Implementing such a system on a large scale requires substantial resources, technical expertise, and a robust infrastructure. Furthermore, the collection and analysis of student data raise important concerns about data privacy and security, necessitating stringent policies and safeguards. To ensure the success of such a system, user experience is paramount, and the chatbot's interface must be user-friendly and intuitive. Additionally, the seamless integration of chatbots with existing educational platforms, such as learning management systems (LMS), presents a complex task. Compatibility and user experience within these platforms are crucial for achieving the intended benefits. ous AI technologies and their applications in education.

3.2.1.3 Relationship to the proposed research work

The architectural framework proposed in this article aligns with the objectives outlined in the "Mentor Me" report. Both emphasize the potential of chatbots and AI in enhancing the learning experience and personalizing education for students. The architectural model introduced in the article can offer valuable insights for the development of features like the AI advisor or chatbot in the "Mentor Me" platform, allowing for tailored recommendations and improved interactions between students and instructors. The integration of AI and chatbots in the smart campus environment mirrors the broader mission of "Mentor Me" in fostering collaboration and knowledge acquisition within the academic community.

3.2.2 Chatbot generation and integration: A review

3.2.2.1 Summary of the research item

The article explores the significance of chatbots in the realm of conversational services. It highlights the value of integrating chatbots into businesses as part of their customer service strategy, leading to substantial advancements in customer satisfaction and business growth. The article emphasizes the need to understand the core technology of chatbots and offers insights into generating and integrating these conversational agents. Various methodologies for creating chatbots are discussed, focusing on text-based virtual assistants, and different types of integration approaches are explored, including APIs, manual integration, and third-party integratio.[2]

3.2.2.2 Critical analysis of the research item

The article rightly recognizes the potential of chatbots in enhancing customer service and the considerable benefits they bring to businesses. However, the text lacks depth when it comes to discussing

the challenges and potential drawbacks associated with chatbot integration. Privacy and security concerns, maintaining a consistent user experience, and the need for robust natural language processing are essential aspects that could have been addressed more comprehensively.

3.2.2.3 Relationship to the proposed research work

The article aligns with the ”Mentor Me” report’s goals in enhancing student support and engagement through technology. While the primary focus of this article is on chatbots in customer service, the methodologies and principles discussed can be relevant to the development of chatbots in an educational context. The integration methods and technology considerations could offer valuable insights for building an AI-driven chatbot in the ”Mentor Me” platform, facilitating personalized student support and interactions.

3.2.3 The Use of a Mobile Learning Management System at an Online University and Its Effect on Learning Satisfaction and Achievement3

3.2.3.1 Summary of the research item

This study investigates the acceptance of mobile learning among online university students and its impact on learning achievement. It employs a comprehensive model merging the Information System Success (ISS) model and the extended Technology Acceptance Model (TAM) to examine factors influencing mobile learning’s acceptance and its effects on learning satisfaction and achievement. The findings suggest students at online universities are embracing mobile technology as a learning tool, which significantly influences learning achievement. These insights offer guidance for the development and implementation of mobile learning systems in higher education..[3]

3.2.3.2 Critical analysis of the research item

The study’s use of a comprehensive model is a strength, allowing a holistic examination of mobile learning acceptance. Applying structural equation modeling provides a solid empirical foundation for the findings. The study highlights the growing importance of mobile learning and offers practical implications for educators. It extends the TAM by including variables like self-efficacy, personal innovativeness, and subjective norms, recognizing the complexity of technology acceptance.

The ”Mentor Me” project can benefit in several ways. It can tailor technology integration to students’ needs, adopt a data-driven approach, enhance learning achievement through technology, and consider individual, social, and systemic factors when designing mentorship initiatives. Incorporating these findings can guide the project in leveraging mobile technology to enhance mentorship and contribute to

students' learning achievement and satisfaction.

3.2.4 Examining pre-service teachers' design capacities for webbased 21st century new culture of learning

3.2.4.1 Summary of the research item

This study explores the alignment of pre-service teachers' beliefs and competencies with the evolving 21st-century culture of learning. It emphasizes the need for teachers to adapt to the changing landscape of education, where technology, collaboration, and self-directed learning play pivotal roles. The research aims to develop a comprehensive survey instrument to assess teachers' beliefs about new and traditional learning, their design capabilities, and their Technological Pedagogical Content Knowledge (TPACK). The study involves pre-service teachers in Singapore who undergo an ICT for Meaningful Learning course, which focuses on harnessing technology for constructivist-oriented education. The survey results are analyzed to validate the instrument, evaluate changes in participants' beliefs and competencies after the course, and identify significant predictors of TPACK..[4]

3.2.4.2 Critical analysis of the research item

This study addresses a crucial aspect of modern education by examining the alignment of pre-service teachers' beliefs and competencies with the 21st-century learning culture. It highlights the need to prepare educators for a changing educational landscape driven by technology, collaboration, and student-directed learning. The study's use of a comprehensive survey instrument, incorporating factors like TPACK, beliefs about different learning paradigms, and design capacities, ensures a holistic exploration of the research questions. The findings offer valuable insights into the impact of a specific course on pre-service teachers' beliefs and competencies

3.2.4.3 Relationship to the proposed research work

The "Mentor Me" project can gain insights from this study by considering the alignment of mentors' beliefs and competencies with the changing educational landscape. As mentors guide and support mentees, understanding their capacity to integrate technology, promote collaboration, and facilitate self-directed learning is crucial. The survey instrument used in the study can be adapted and used to assess mentors' readiness and effectiveness in mentoring within the context of 21st-century education. Additionally, the findings can inform the design of mentorship programs and professional development initiatives to better prepare mentors for guiding the next generation of learners in this dynamic educational environment.

3.2.5 Semantic search with Pinecone

3.2.5.1 Summary of the research

Pinecone's semantic search capabilities can save time and boost productivity for internal teams by enabling them to self-serve and search through various internal data and documents to answer their questions. In fact, 71percent of consumers expect personalized results, and 76percent get frustrated when they don't find it. Pinecone's search capabilities can help meet these expectations and reduce user frustration. Pinecone is also HIPAA compliant, making it suitable for use in healthcare applications..[4]

3.2.5.2 Critical analysis of the research item

Pinecone excels in efficient data searching with its semantic search capabilities and use of Large Language Models (LLMs) and vector databases, providing accurate results even with imprecise queries. It enables internal teams to self-serve and search through internal data swiftly, boosting productivity. Additionally, its compliance with HIPAA regulations makes it fitting for healthcare applications. However, being a newer tool, it may lack the widespread recognition of established search tools and has a usage-based pricing model that could be costlier for high search volumes. The quality of its search capabilities depends on the LLMs used, and it may not be suitable for all use cases.

3.2.5.3 Relationship to the proposed research work

The research on Pinecone's semantic search aligns closely with your work on the MentorMe Educational Platform. Both projects harness AI algorithms to optimize search and query experiences. Pinecone's semantic search refines results beyond exact matches, much like your platform's query-video matching algorithm that tailors educational content suggestions based on student inquiries. Additionally, both projects integrate AI-driven

3.2.6 OpenAI Embeddings for Text

3.2.6.1 Summary of the research

This Research discusses the effectiveness of unsupervised pre-training on large-scale data in producing high-quality vector representations of text and code. The resulting embeddings achieve state-of-the-art results in linear-probe classification and display impressive semantic search capabilities. The work also explores the use of embeddings in various downstream tasks, including sentiment analysis, sentence similarity, and question answering. While the unsupervised models do not always outperform fine-tuned models, they offer a promising alternative for scenarios where labeled data is scarce or expensive to

obtain. Overall, this work highlights the potential of unsupervised pre-training in advancing natural language processing and related fields..[2]

3.2.6.2 Critical analysis of the research item

The strengths of this research lie in its thorough analysis of unsupervised pre-training using extensive datasets, showcasing remarkable performance in embeddings across diverse downstream tasks. The work significantly contributes to the field of natural language processing, providing valuable insights and a detailed exploration of its broader societal impact. On the other hand, there are several notable weaknesses in this study. First, there is a deficiency in comparing the proposed approach with other state-of-the-art methods, which could provide a better understanding of its relative effectiveness. Additionally, the research underperforms in sentence similarity tasks, revealing a specific area that requires improvement. Moreover, the study lacks a detailed analysis of the computational requirements and scalability, essential aspects for practical implementation. Lastly, ethical implications of the work are not sufficiently discussed, indicating a need for a more comprehensive exploration of the ethical considerations associated with the proposed approach.

3.2.6.3 Relationship to the proposed research work

The research on unsupervised pre-training's effectiveness in generating high-quality vector representations of text and code aligns well with the MentorMe Educational Platform. Both projects emphasize leveraging advanced AI techniques for improved representation and understanding of data. Just as the research explores embeddings for various downstream tasks, our platform aims to utilize AI algorithms like query-video matching to enhance educational content recommendations, reflecting a

Author	Method	Results	Limitations
Mr. William Villegas .[1]	Data-driven AI personalization in university learning.	Enhanced student engagement.	The potential for technological disparities among students.
Aarsh Trivedi .[3]	Discusses chatbot generation using techniques like AIML, ChatScript, heuristic approaches.	Enhanced understanding of chatbot creation and integration.	Technical diversity and application specificity.
Ching Sing Chai .[4]	Surveys assessing preservice teachers' beliefs about new culture and school-based learning, design dispositions, learning design practices.	Found changes in teachers' beliefs about learning and design capacities along with their TPACK efficacy.	Limited scope of teacher experiences and the specific educational context of Singapore.
Won Sug Shin .[2]	Examines online students' acceptance of mobile learning using an extended technology acceptance model.	Revealed a significant relationship between technology acceptance, learning satisfaction, and achievement.	Related to sample specificity and model applicability.

Chapter 4 Software Requirement Specifications

4.1 List of Features

Major Features of our web app are:

- **Query-Video Matching Algorithm:** AI is used to create an algorithm that analyzes student queries and recommends relevant instructor videos from the platform's repository.
- **AI Advisor or Chatbot:** An AI advisor or chatbot is integrated into the platform to provide assistance and answers to a wide range of queries related to FAST University.
- **Scheduling System:** A scheduling system enables students to schedule virtual meetings with relevant department instructors, taking into account instructors' availability.
- **User Feedback:** Feedback from users (students and teachers) is collected to continuously improve the platform's functionality and usability.

4.2 Functional Requirements

The functional requirements fully describe the external behavior of the system. Identify and list each functionality and give a brief description, along with the user of each functionality.

4.2.1 User Accounts

- Users (students and instructors) can create and manage their accounts. (User can create and manage their account.)
- Users can log in to the platform and access its features. (User can log in and access features.)
- Users can view and edit their profile information. (User can view and edit profile information.)
- Users can reset their forgotten passwords. (User can reset forgotten password.)

4.2.2 Query-Video Matching Algorithm

- The algorithm can analyze student queries and recommend relevant instructor videos from the platform's repository. (Algorithm can analyze queries and recommend videos.)
- The algorithm can consider various factors, such as the student's academic level, course of study, and specific topic of interest, when making recommendations. (Algorithm can consider various factors when making recommendations.)

4.2.3 AI Advisor or Chatbot

- The AI advisor or chatbot can answer a wide range of questions related to FAST University, such as academic policies, course schedules, and student support services. (AI advisor can answer questions related to FAST University.)
- The AI advisor or chatbot can operate 24/7 and provide instant and accurate responses to user inquiries. (AI advisor can provide instant and accurate responses to user inquiries.)

4.2.4 Scheduling System

- Students can use the scheduling system to book virtual meetings with department instructors. (Students can book virtual meetings with instructors.)
- The scheduling system can take into account instructors' availability when generating meeting times. (Scheduling system can take into account instructors' availability.)

4.2.5 User Feedback

- Users can provide feedback on the platform's features, usability, and overall experience. (Users can provide feedback on the platform.)
- The platform's developers can use this feedback to improve the platform over time. (Developers can use feedback to improve the platform.)

4.3 Quality Attributes

In developing our web app, we're not just focused on what it does, but also on how well it does it. That's why we've honed in on several key quality attributes:

4.3.1 Usability

First and foremost, we want our platform to be a breeze to use. This means:

- *Intuitive Interface:* We're making sure that navigating the app feels natural. You shouldn't need a manual to figure out where to click!
- *Accessibility:* We're committed to ensuring our platform is accessible to all users, including those with disabilities.

4.3.2 Performance

No one likes a slow app, right? We're working hard to ensure:

- *Speed:* Our app responds swiftly to your actions. No twiddling thumbs waiting for pages to load.
- *Efficiency:* We optimize resource usage so the app runs smoothly, even on older devices.

4.3.3 Reliability

We understand the importance of reliability:

- *Uptime:* Our goal is to have the platform available whenever you need it, minimizing downtime.
- *Data Integrity:* We take the accuracy and security of your data seriously. No compromises here.

4.3.4 Scalability

As our user base grows, so does our platform:

- We're building the app to handle increased loads without a hitch. More users? No problem.

4.3.5 Security

Last but not least, security is a top priority:

- *Data Protection:* Your data is safe with us. We're implementing robust security measures to protect against unauthorized access and data breaches.
- *Privacy:* We respect your privacy and are committed to maintaining the confidentiality of your information.

These attributes are the pillars of our development philosophy. We're not just building a web app; we're crafting an experience that's reliable, efficient, and a joy to use.

4.4 Non-Functional Requirements

This section details the non-functional requirements that are crucial for the overall quality and effectiveness of the platform. These requirements are essential to ensure the platform operates efficiently, securely, and reliably.

4.4.1 Performance

- The platform is designed to handle a high volume of users and concurrent sessions, ensuring no performance degradation even under heavy load.

4.4.2 Scalability

- Scalability is key; the platform is capable of scaling resources up or down based on user demand, maintaining stability and performance.

4.4.3 Availability

- The platform aims for round-the-clock availability, minimizing downtime to ensure continuous and reliable access for all users.

4.4.4 Security

- Security measures are in place to protect sensitive user data against unauthorized access, ensuring a safe and secure environment.

4.4.5 Reliability

- The platform is built to be reliable, functioning consistently without unexpected failures, and maintaining its performance over time.

4.4.6 Maintainability

- Regular maintenance and updates are streamlined, ensuring the platform remains current, efficient, and less prone to issues.

4.4.7 Usability

- With an emphasis on user experience, the platform is intuitive and easy to navigate for both students and instructors.

4.4.8 Accessibility

- The design and features of the platform accommodate users with disabilities, ensuring accessibility and inclusivity.

4.4.9 Performance Testing

- Comprehensive performance testing is conducted to confirm the platform meets all established performance criteria.

4.5 Assumptions

List down all the assumptions made for the specification.

4.6 Use Cases

This section lists use cases or scenarios from the use-case model if they represent some significant, central functionality of the final system, or if they have a large architectural coverage—they exercise many architectural elements, or if they stress or illustrate a specific, delicate point of the architecture.

4.6.1 Login

Name	Login	
Actors	Admin, Writer, Reviewer, Investor	
Summary	The user provides their email and password and selects their role on the login form. After successful verification, the system redirects the user to the relevant home page.	
Pre-Conditions	The user must be in the database records. The user must not already be logged in.	
Post-Conditions	The user's session is successfully established and they are redirected to the respective home page.	
Special Requirements	None	
Basic Flow	**Actor Action**	**System Response**
1	The user accesses the login page.	2 The login page is displayed asking for email, password, and role.
2	The user enters valid email, password, and selects role.	3 The system verifies the credentials and, if valid, establishes a session and redirects the user to the appropriate home page.
Alternative Flow	If the user enters invalid email, password, or selects the wrong role, the system responds with an error message: Incorrect credentials or role selected.	

4.6.2 Search For Videos

Name	Search For Videos	
Actors	Student	
Summary	The student enters a search term in the search bar and the system displays a list of relevant videos.	
Pre-Conditions	The student must be logged in.	
Post-Conditions	The student is presented with a list of relevant videos.	
Special Requirements	None	
Basic Flow	**Actor Action**	**System Response**
1	The student accesses the search feature.	2 The system presents a search bar to enter search terms.
2	The student enters a search term and submits the query.	3 The system processes the search and displays relevant video results.
Alternative Flow	If no relevant videos are found, the system informs the student: ”No videos found matching the search criteria.”	

4.6.3 Ask a Question

Name	Ask a Question		
Actors	Student		
Summary	The student types a question in the text box and the system displays a list of answers. If the student does not find a satisfactory answer, they can submit their question to an instructor.		
Pre-Conditions	The student must be logged in.		
Post-Conditions	The student is presented with a list of answers to their question. If they do not find a satisfactory answer, they can submit their question to an instructor.		
Special Requirements	None		
Basic Flow			
Actor Action		**System Response**	
1	The student	2	Types a question in the text box and submits the question.
Alternative Flow			
-	No satisfactory answer found.		
3	The student	4	Submits their question to an instructor for further assistance.

4.6.4 Watch a Video

Name	Watch a Video		
Actors	Student		
Summary	The student selects a video from the list of videos and watches it.		
Pre-Conditions	The student must be logged in.		
Post-Conditions	The student watches the video.		
Special Requirements	None		
Basic Flow			
Actor Action		**System Response**	
1	The student	2	Selects a video from the list of videos and initiates video playback.

4.6.5 Get Help from an Instructor

Name	Get Help from an Instructor	
Actors	Student	
Summary	The student selects the ”Get help from an instructor” button and the system presents a list of available instructors. The student can then select an instructor and send them a message.	
Pre-Conditions	The student must be logged in.	
Post-Conditions	The student is presented with a list of available instructors and can send a message to the instructor of their choice.	
Special Requirements	None	
Basic Flow	**Actor Action**	**System Response**
1	The student selects the ”Get help” feature.	2 The system shows a list of available instructors.
2	The student selects an instructor and sends a message.	3 The system notifies the selected instructor about the student’s message.
Alternative Flow	If no instructors are available, the system informs the student: ”No instructors are available at the moment. Please try again later.”	

4.6.6 Schedule a Meeting with an Instructor

Name	Schedule a Meeting with an Instructor	
Actors	Student	
Summary	The student selects the ”Schedule a meeting” option and the system displays a calendar. The student chooses a date and time for the meeting and sends a request to the instructor.	
Pre-Conditions	The student must be logged in. The instructor’s availability must be displayed on the calendar.	
Post-Conditions	The student receives a confirmation message for their meeting with the instructor.	
Special Requirements	None	
Basic Flow	**Actor Action**	**System Response**
1	The student navigates to the ”Schedule a meeting” section.	2 The system shows the scheduling interface with the instructor’s availability.
2	The student selects a time and date and requests a meeting.	3 The system sends the meeting request to the instructor and awaits confirmation.
Alternative Flow	If the selected time is not available, the system prompts the student to choose another time.	

4.6.7 Manage Users

Name	Manage Users	
Actors	Administrator	
Summary	The administrator accesses the user management panel to add, edit, or delete user accounts within the system.	
Pre-Conditions	The administrator must be logged in and have the necessary permissions to manage user accounts.	
Post-Conditions	The user accounts are updated according to the changes made by the administrator.	
Special Requirements	None	
Basic Flow	**Actor Action**	**System Response**
1	The administrator opens the user management section.	2 The system displays the list of users.
2	The administrator selects an action: add, edit, or delete a user.	3 The system provides the interface to perform the selected action.
3	The administrator submits the changes.	4 The system updates the user accounts accordingly and confirms the action.
Alternative Flow	If the system cannot update the user accounts (e.g., due to a conflict or network issue), it displays an appropriate error message.	

4.6.8 Chat with AI Advisor

Name	Chat with AI Advisor	
Actors	Student, AI Advisor	
Summary	The student initiates a conversation with the AI Advisor by asking a question through the chat interface.	
Pre-Conditions	The student must be logged into the system.	
Post-Conditions	The student receives the information they requested or is guided to the appropriate resources.	
Special Requirements	The AI Advisor must be operational and accessible.	
Basic Flow	**Actor Action**	**System Response**
1	The student accesses the chat feature and inputs a question.	2 The AI Advisor processes the question and provides a response.
2	If necessary, the student continues the conversation for clarification or additional information.	3 The AI Advisor responds to follow-up questions and provides further assistance.
Alternative Flow	If the AI Advisor cannot understand the query or provide an appropriate response, it directs the student to contact a human advisor.	

4.6.9 Manage Settings

Name	Manage Settings	
Actors	Administrator	
Summary	The administrator adjusts various system settings, configuring features, and preferences to ensure optimal platform performance and user experience.	
Pre-Conditions	Administrator must be logged in with sufficient permissions to modify system settings.	
Post-Conditions	System settings are updated to reflect the changes made by the administrator.	
Special Requirements	None	
Basic Flow	**Actor Action**	**System Response**
1	The administrator navigates to the settings panel.	2 The system displays the current configuration options.
2	The administrator makes necessary changes to settings.	3 The system updates the settings as per the changes and confirms the update.
Alternative Flow	If the system encounters an error while saving the settings, it displays an error message and asks the administrator to try again.	

4.7 Hardware and Software Requirements

List the hardware and software requirements that will be required to develop and deploy the project.

4.7.1 Hardware Requirements

A computer system will be required to develop this website. Core i5 or later processors will be ideal for development of this web-based project.

4.7.2 Software Requirements

- React.js/Next.js Framework
- Node.js Framework
- Express.js Framework
- Stable browser: Chrome or Firefox
- An IDE we will use preferably Visual Studio Code
- Supabase (as a database)

- Cloudflare
- Railway or Heroku

4.8 Graphical User Interface

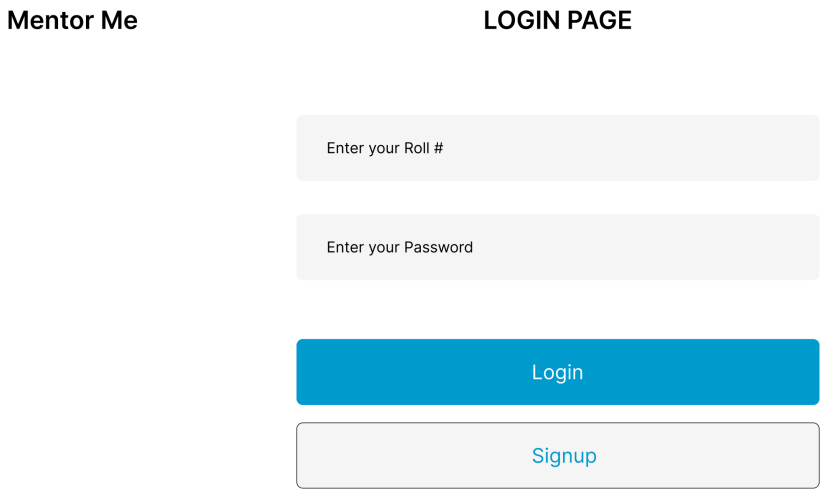

Figure 4.1: Login Page

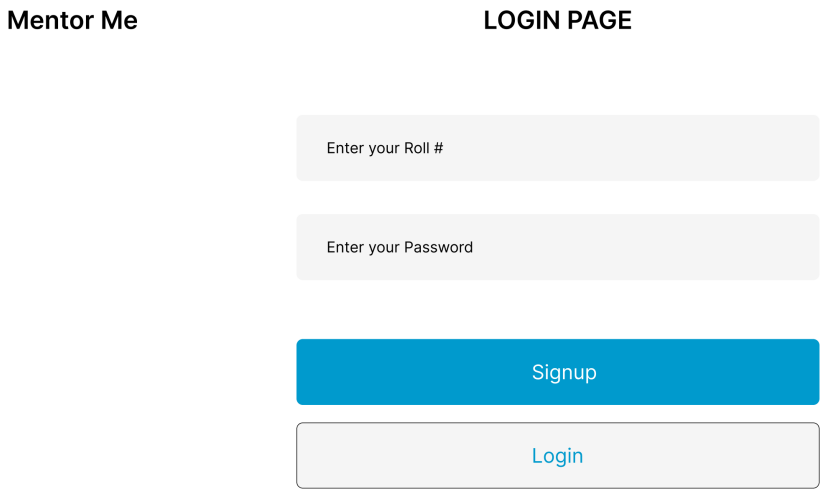

Figure 4.2: Sign up Page

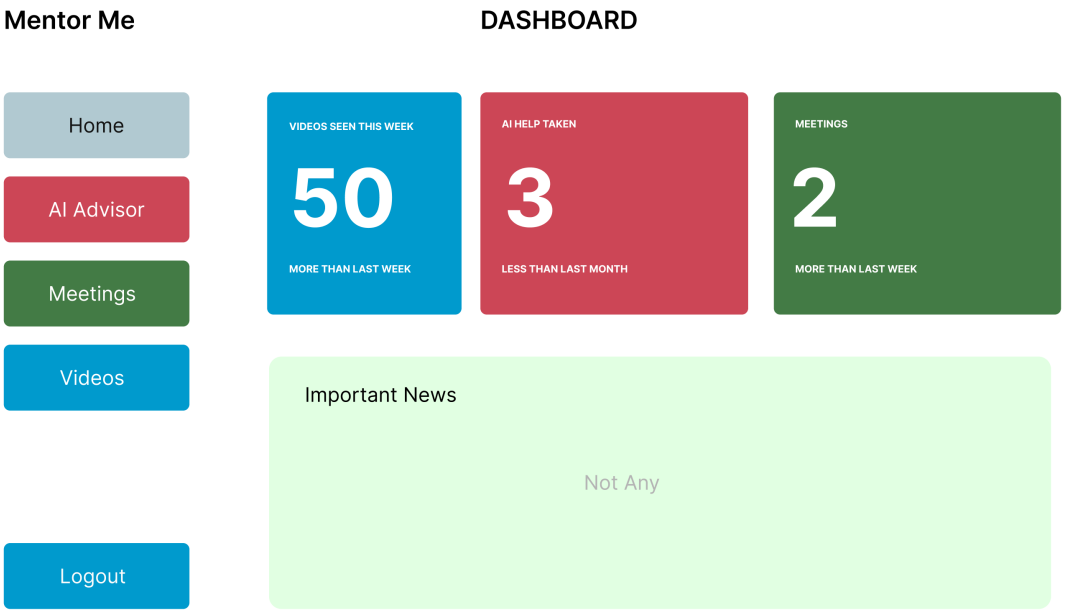

Figure 4.3: User Dashboard

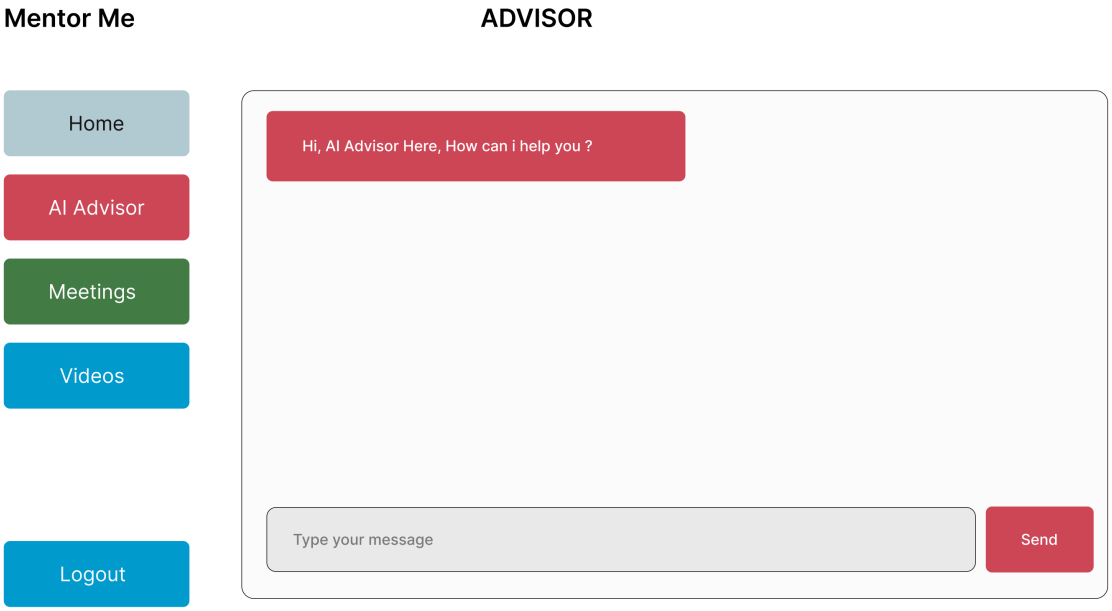

Figure 4.4: AI Advisor Chat Window

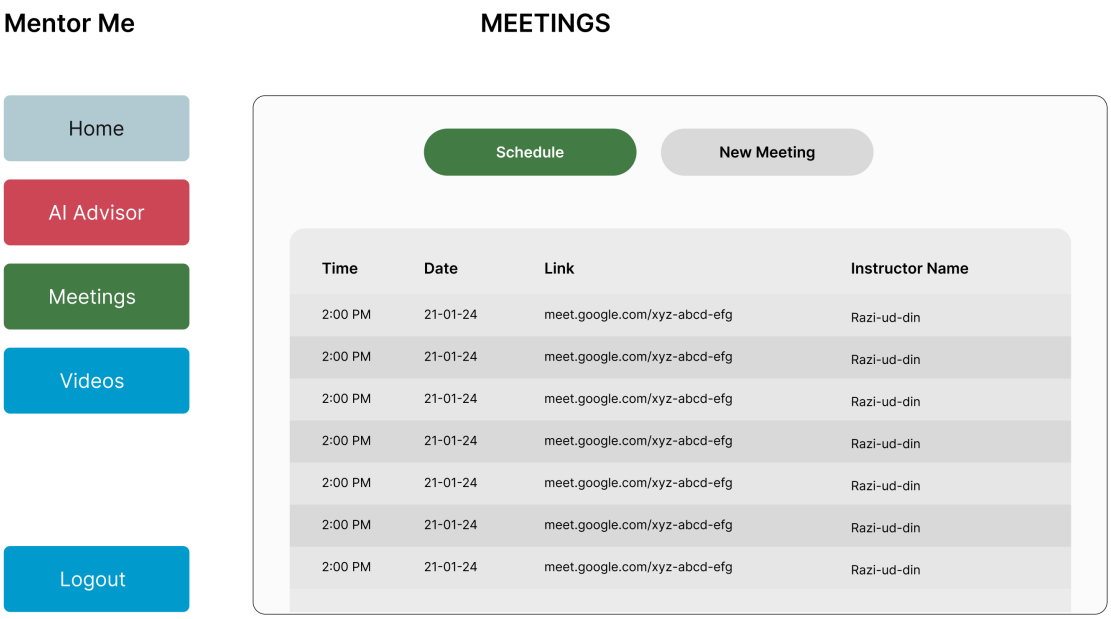

Figure 4.5: User Meetings View

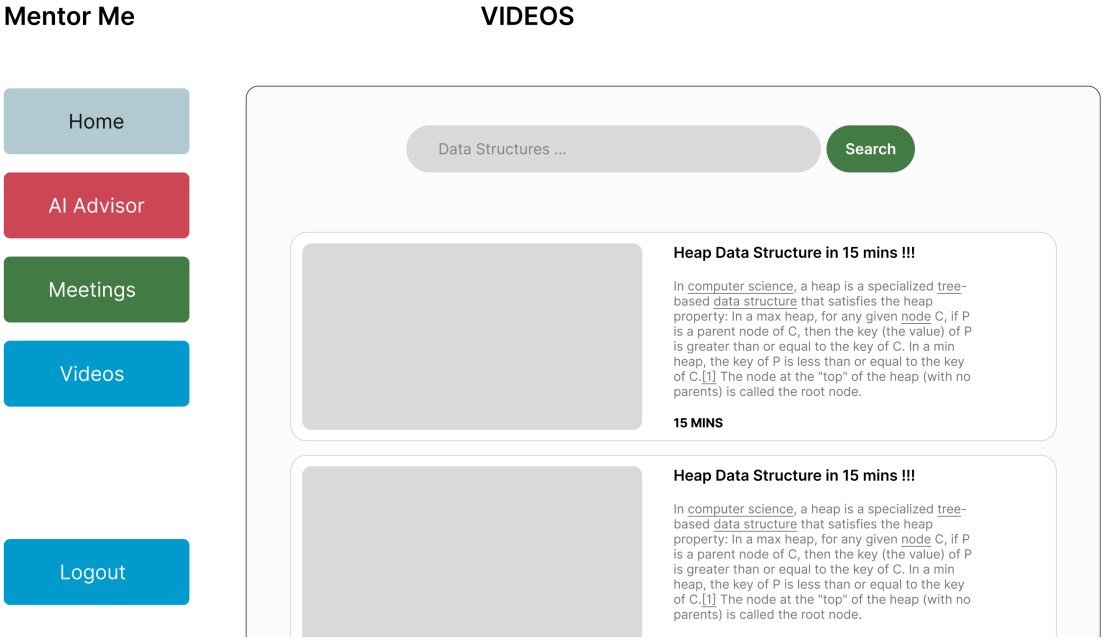

Figure 4.6: Videos Search Page

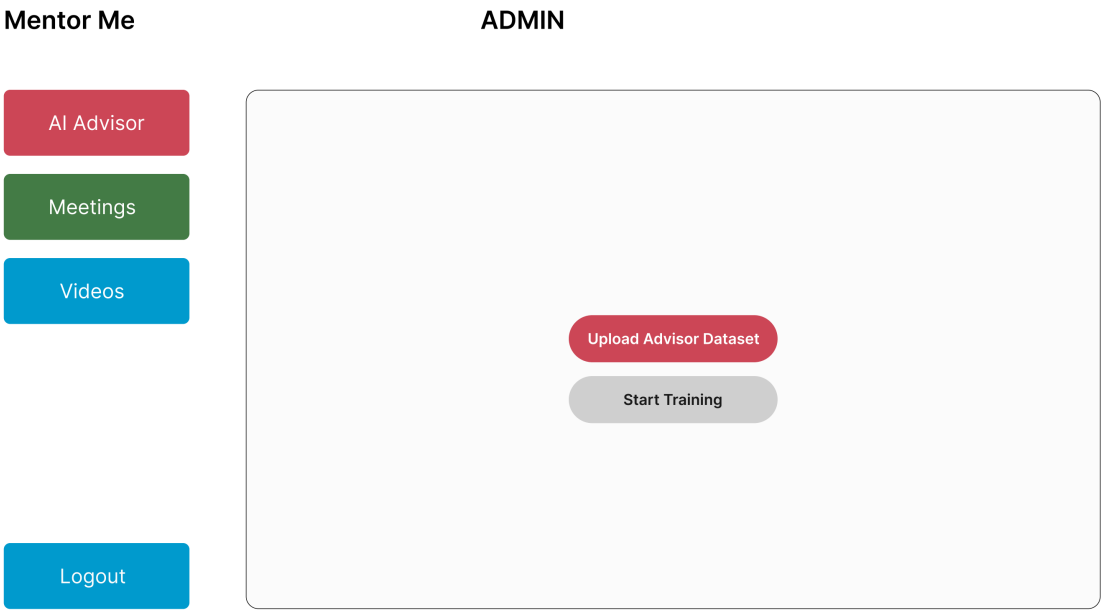

Figure 4.7: Admin Advisor View

Figure 4.8: Admin Meetings View

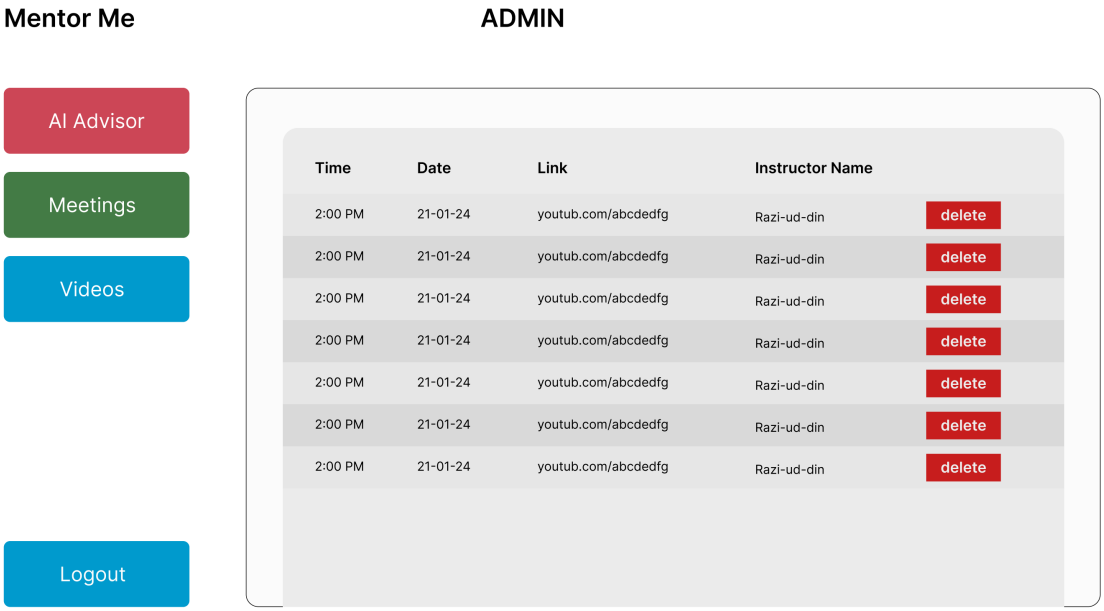

Figure 4.9: Admin Videos View

4.9 Database Design (if required)

4.9.1 ER Diagram

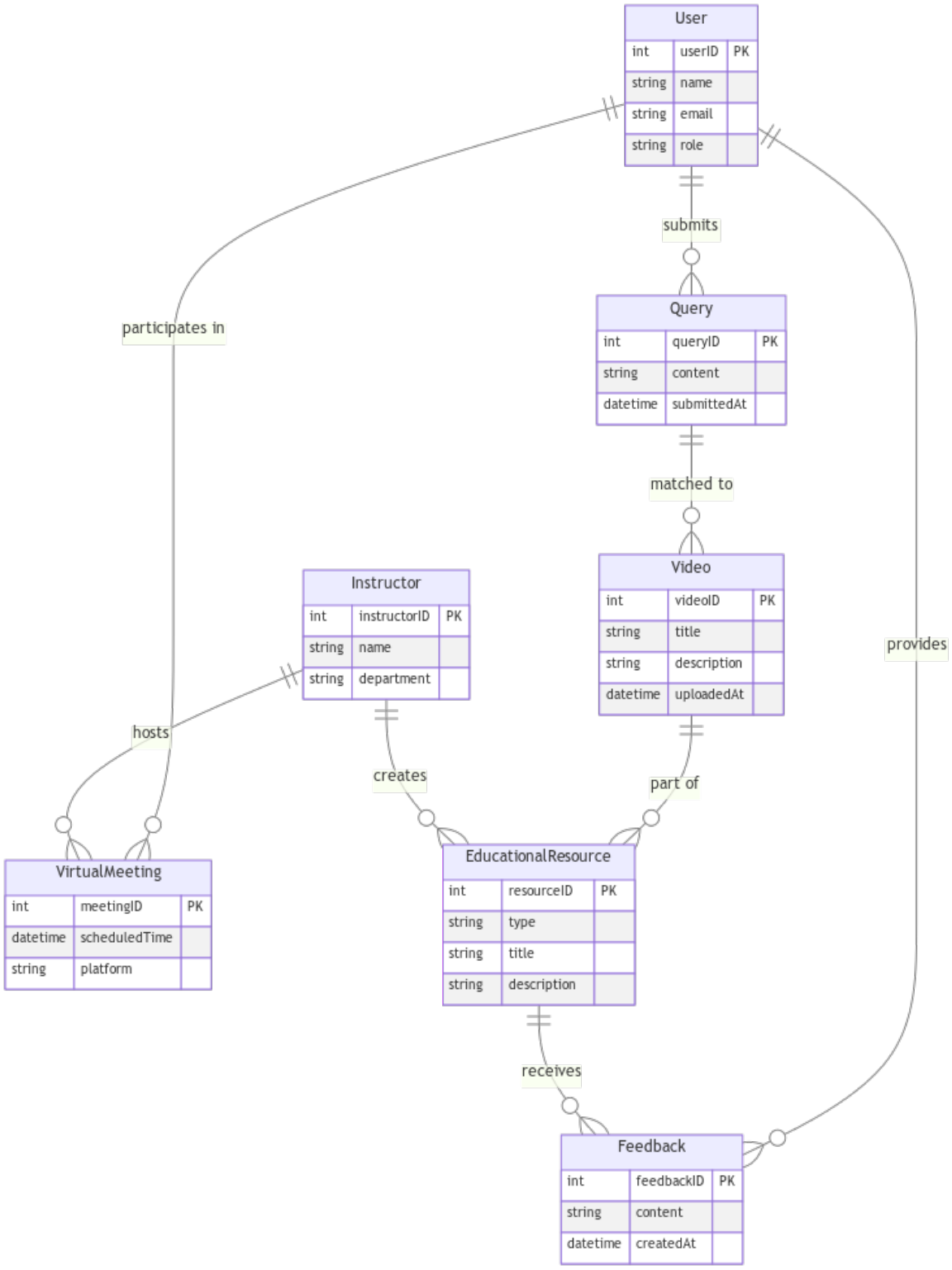

Figure 4.10: ER Diagram of MentorMe

4.9.2 Data Dictionary

Entity: User		
Attribute	**Data Type**	**Description**
userID	int (PK)	Unique identifier for each user. Not nullable.
name	string	Name of the user. Not nullable.
email	string	Email address of the user. Not nullable.
role	string	Role of the user (e.g., student, educator). Not nullable.

Entity: Video		
Attribute	**Data Type**	**Description**
videoID	int (PK)	Unique identifier for each video. Not nullable.
title	string	Title of the video. Not nullable.
description	string	Description of the video. Nullable.
uploadedAt	datetime	Upload date and time for the video. Not nullable.

Entity: EducationalResource		
Attribute	**Data Type**	**Description**
resourceID	int (PK)	Unique identifier for each resource. Not nullable.
type	string	Type of the resource (e.g., video, document). Not nullable.
title	string	Title of the resource. Not nullable.
description	string	Description of the resource. Nullable.

Entity: Instructor		
Attribute	**Data Type**	**Description**
instructorID	int (PK)	Unique identifier for each instructor. Not nullable.
name	string	Name of the instructor. Not nullable.
department	string	Department of the instructor. Not nullable.

Entity: VirtualMeeting		
Attribute	**Data Type**	**Description**
meetingID	int (PK)	Unique identifier for each virtual meeting. Not nullable.
scheduledTime	datetime	Scheduled time for the meeting. Not nullable.
platform	string	Platform used for the virtual meeting. Not nullable.

Entity: Feedback		
Attribute	**Data Type**	**Description**
feedbackID	int (PK)	Unique identifier for each piece of feedback. Not nullable.
content	string	Content of the feedback. Not nullable.
createdAt	datetime	Date and time when the feedback was created. Not nullable.

4.10 Risk Analysis

4.11 Project Risks

The development of the MentorMe Educational Platform for FAST University involves various risks that need to be identified and managed effectively. Here we outline the potential technical and business risks that may be encountered during the project.

4.11.1 Technical Risks

- **Integration Complexity:** Integrating advanced features such as the query-video matching algorithm and AI advisor could prove more complex than anticipated, leading to delays.
- **Scalability Issues:** The platform must be able to scale to accommodate an increasing number of users, and failure to do so could impact performance.
- **Security Vulnerabilities:** Handling sensitive user data requires stringent security measures. Any oversight could result in data breaches and loss of trust.
- **System Downtime:** Ensuring 24/7 availability of the platform is critical. Any significant downtime could severely disrupt the educational process.

4.11.2 Business Risks

- **Adoption Rate:** There is a risk that students or educators may be reluctant to transition to a new system, impacting the overall adoption rate.
- **User Resistance to AI:** Reliance on AI for advice and scheduling might meet with resistance from users who prefer human interaction.
- **Budget Overruns:** The project could exceed its budget due to unforeseen development costs, potentially requiring additional funding.

Chapter 5 Proposed Approach and Methodology

The proposed approach involves harnessing the capabilities of AI and machine learning, specifically utilizing Llama 13-B, to create a personalized, efficient, and user-friendly learning environment. The development process is structured into two main phases, each with its own set of tasks

5.1 Phase 0: Data Collection and Preparation

- Dataset Collection: A comprehensive dataset is gathered, encompassing a variety of educational resources such as text-based materials, video lectures, and code snippets. This diverse dataset serves as the foundation for training the AI models.
- Data Preprocessing: To ensure the quality and consistency of the dataset, a thorough data preprocessing step is performed. This involves cleaning and organizing the collected data, making it ready for subsequent model training.

5.2 Phase 1: Training the Mode

1. Query-Video Matching Algorithm: The query-video matching algorithm utilizes Llama 13B's natural language processing capabilities to analyze student queries and match them with the most relevant instructor videos from the platform's repository. The training process for this algorithm involves:

- Dataset Preparation: Gather a dataset of student queries and corresponding instructor videos.
- Feature Engineering: Extract relevant features from the student queries and instructor videos, such as keywords, topics, and concepts.
- Model Training: Train a machine learning model, such as a support vector machine or a neural network, to learn the relationship between the extracted features and the matching instructor videos.

2. AI Advisor/ChatBot:

The AI advisor powered by Llama 13B provides comprehensive and personalized assistance to students and instructors. The training process for this AI advisor involves:

- Dataset Preparation: Gather a dataset of questions and answers related to FAST University policies, course schedules, student support services, and academic topics.
- Model Training: Train Llama 13B on the prepared dataset, allowing it to learn the patterns and relationships between questions and answers.

- Fine-tuning: Fine-tune Llama 13B with additional data and feedback to improve its performance and accuracy in answering questions.

3. Scheduling System with Instructor Calendar Integration: The scheduling system utilizes machine learning techniques to predict instructor availability and seamlessly schedule virtual meetings between students and instructors based on their calendars. The training process for this scheduling system involves:

- Dataset Preparation: Gather a dataset of instructor schedules, meeting availability, and historical scheduling patterns.
- Model Training: Train a machine learning model, such as a recurrent neural network or a decision tree, to learn the patterns and relationships between instructor schedules and availability.
- Integration with Instructor Calendars: Implement a mechanism to connect the scheduling system with instructor calendars, enabling real-time availability updates and seamless scheduling.

By effectively training these AI models, the MentorMe Educational Platform will be equipped to provide a personalized, efficient, and user-friendly learning experience for students and instructors alike.

5.3 Phase 2: Implementation and Operationalization

The MentorMe Educational Platform utilizes a variety of trained AI models to power its core features. These models have been trained on datasets of relevant data and have undergone extensive testing to ensure their accuracy, effectiveness, and reliability.

1. Query-Video Matching Algorithm

The query-video matching algorithm utilizes the power of natural language processing (NLP) to analyze student queries and identify the most relevant instructor videos from the platform's repository. The algorithm's working procedure can be summarized as follows:

- Query Preprocessing: The student query is first preprocessed to remove stop words, punctuation, and other irrelevant elements. This step helps to clean the query and focus on its essential meaning.
- Feature Extraction: Relevant features are extracted from the preprocessed query. These features may include keywords, topics, concepts, and semantic relationships.
- Vector Representation: The extracted features are transformed into a numerical vector representation using techniques like word embedding or topic modeling. This vector representation captures the semantic meaning of the query in a quantifiable form.

- Similarity Calculation: The vector representation of the query is compared to the vector representations of all instructor video descriptions in the repository. This comparison is based on similarity measures like cosine similarity or Euclidean distance.
- Video Ranking: The instructor videos are ranked based on their similarity scores to the query vector. The top-ranked videos are recommended to the student.

The query-video matching algorithm continuously learns and improves based on user feedback and new data. It adapts to the evolving needs of students and instructors, ensuring that the recommended videos remain relevant and up-to-date.

2. AI Advisor/ ChatBot

The AI advisor powered by Llama 13B provides comprehensive and personalized assistance to students and instructors. It utilizes its vast knowledge base and natural language processing capabilities to answer a wide range of questions. The AI advisor's working procedure can be summarized as follows:

- Question Processing: The user's question is first processed to understand its intent, context, and relevant keywords.
- Information Retrieval: Llama 13B accesses its vast knowledge base, including text-based materials, instructor videos, and code snippets, to retrieve relevant information related to the user's question.
- Context Analysis: The retrieved information is analyzed in the context of the user's question to identify the most relevant and accurate response.
- Response Generation: Llama 13B generates a comprehensive and personalized response to the user's question. The response is tailored to the user's level of understanding, learning style, and specific needs.
- Continuous Learning: The AI advisor continuously learns and improves based on user interactions and new data. It adapts to the evolving needs of students and instructors, ensuring that the provided assistance remains relevant, accurate, and helpful.

The AI advisor plays a crucial role in supporting students and instructors throughout their academic journey, providing them with timely, personalized, and reliable guidance.

3. Scheduling System with Instructor Calendar Integration

The scheduling system utilizes machine learning techniques to predict instructor availability and seamlessly schedule virtual meetings between students and instructors. Its working procedure can be summarized as follows:

- Data Analysis: The system analyzes historical scheduling patterns, instructor schedules, and meeting availability data to identify patterns and relationships.
- Availability Prediction: Machine learning models, such as recurrent neural networks (RNNs) or decision trees, are trained to predict instructor availability based on their schedules, past meeting patterns, and other relevant factors.
- Real-time Updates: The system integrates with instructor calendars to receive real-time updates on availability changes and meeting conflicts.
- Conflict Resolution: The system utilizes its prediction capabilities and real-time updates to identify and resolve scheduling conflicts, ensuring that meetings are scheduled at times that are convenient for both students and instructors.
- Meeting Coordination: The system facilitates efficient communication and coordination between students and instructors for scheduling meetings, providing reminders and notifications to ensure that all parties are informed and prepared.

Chapter 6 High-Level and Low-Level Design

6.1 System Overview

The MentorMe Educational Platform is a comprehensive software system designed to enhance the educational experience at FAST University. It integrates various functionalities to support both students and educators in the digital learning environment. This section provides a high-level overview of the system, its functionalities, and design approach.

6.1.1 Functional Overview

The platform offers the following key functionalities:

- **Query-Video Matching Algorithm:** Utilizes artificial intelligence to analyze student queries and suggest relevant instructional videos.
- **AI Advisor:** A round-the-clock chatbot that provides answers to students' academic inquiries and navigational assistance within the platform.
- **Scheduling System:** Enables students to schedule virtual meetings with instructors, considering real-time availability.
- **User Feedback Integration:** Collects and incorporates feedback to improve the platform continuously.
- **Resource Repository:** A comprehensive database of educational materials accessible to students and educators.

6.1.2 System Design

The system is designed with a focus on user-friendliness, scalability, and robustness to accommodate the dynamic needs of an academic institution.

6.1.2.1 Architecture

The platform is built on a modular architecture that separates the user interface, business logic, and data storage layers. This separation allows for greater maintainability and scalability.

6.1.2.2 Design Approach

- **Microservices:** The platform adopts a microservices-based approach to ensure that each functionality, like video retrieval or scheduling, operates independently and scales as needed.

- **Responsive Design:** Ensuring a seamless user experience across various devices and screen sizes.
- **Security-First:** A strong emphasis on security with encrypted communications, regular audits, and compliance with data protection regulations.

6.1.3 Technical Stack

The platform utilizes a modern technology stack that supports rapid development, easy deployment, and efficient performance. Technologies include:

- **Frontend:** Frameworks like React or NextJS for an esponsive web-based user interface.
- **Backend:** Node.js or Python(FastAPI) for server-side logic, and Large Language Model implementation.
- **Database:** SQL(Supabase) for structured data storage and retrieval.
- **Cloud Services:** Railway.app for hosting and additional computational power.

6.1.3.1 User Interface Design

Carefully crafted UI/UX to ensure intuitive navigation and accessibility, adhering to the latest web standards.

6.1.4 Stakeholders

The primary stakeholders include students, educators, university administrative staff, and technical maintenance teams, each with a vested interest in the platform's success.

6.1.5 Expected Outcomes

The platform aims to provide a seamless integration of educational resources, real-time support, and personalized learning paths to enhance the quality of education at FAST University.

This system overview captures the essence of the MentorMe Educational Platform, reflecting the innovative spirit and dedication to providing a superior educational experience.

6.2 Design Considerations

This section delves into various issues that need to be addressed or resolved before finalizing the design solution for the MentorMe Educational Platform.

6.2.1 Assumptions and Dependencies

6.2.1.1 Related Software or Hardware

Assumes compatibility with modern web browsers and standard hardware capable of supporting them.

6.2.1.2 End-User Characteristics

Assumes users possess basic digital literacy and familiarity with web navigation.

6.2.1.3 Changes in Functionality

Flexible design to accommodate potential future enhancements or changes in functionality.

6.2.2 General Constraints

6.2.2.1 Hardware or Software Environment

Requires stable internet connection and browser support without the need for additional plug-ins.

6.2.2.2 Compliance and Interoperability

Must comply with educational standards and easily integrate with existing university systems.

6.2.2.3 Performance Requirements

Optimized for high performance, capable of handling multiple simultaneous user sessions.

6.2.3 Goals and Guidelines

6.2.3.1 Simplicity and Usability

Adheres to the KISS principle, ensuring the platform remains user-friendly and straightforward.

6.2.3.2 Scalability and Performance

Emphasizes scalability to handle a growing user base and performance to ensure a smooth user experience.

6.2.3.3 Consistency and Familiarity

Aims to provide an interface that is intuitive and familiar to users, drawing on established web design patterns.

6.2.4 Development Methods

Methodology The project adopts an Agile development methodology, allowing for iterative development and rapid response to feedback.

Design Patterns Following Design Patterns will be used:

- Model-View-Controller (MVC)
- Singleton
- Adapter
- State Management

Technology Selection The choice of technologies is based on current industry trends in web development.

Evaluation of Alternatives Two frameworks (AstroJS and ASP.Net) were evaluated and we selected React and NodeJS based on performance, community support, and scalability.

6.3 System Architecture

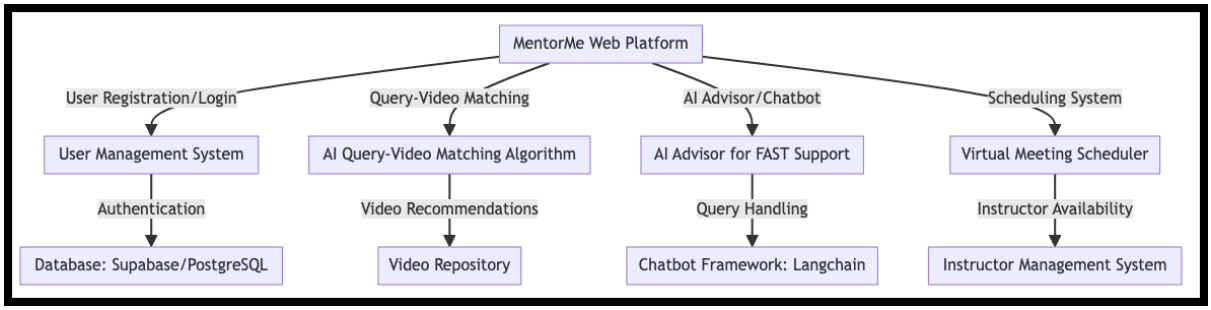

Figure 6.1: System Architecture

6.4 Architectural Strategies

In designing the architecture of the MentorMe Educational Platform, several key strategies were employed to ensure an effective and robust system. These strategies were chosen with careful consideration of the platform's goals and the requirements of FAST University's digital learning environment.

- **Modular Architecture:** The platform is built on a modular architecture, separating the user interface, business logic, and data storage layers for maintainability and scalability.

- **Use of Microservices:** We adopted a microservices-based approach to ensure that each functionality, such as video retrieval or scheduling, operates independently and can be scaled as needed.
- **Responsive Design:** To provide a seamless user experience across various devices and screen sizes.
- **Security-First Approach:** Focused on security with encrypted communications, regular audits, and compliance with data protection regulations.
- **Technology Stack:** Utilization of modern technologies like React or NextJS for the frontend, Node.js or Python (FastAPI) for the backend, and SQL (Supabase) for the database.
- **Cloud Services:** Use of Railway.app for hosting and additional computational power.

6.4.1 Strategy 1: Modular Architecture

This strategy involves the separation of the user interface, business logic, and data storage into different modules. This design provides flexibility and ease of maintenance, allowing for individual parts of the system to be updated or replaced without impacting the whole.

6.4.2 Strategy 2: Microservices

MentorMe employs a microservices architecture to handle distinct functionalities independently. This approach ensures that services like the Query-Video Matching Algorithm and the Scheduling System are scalable and maintainable.

6.4.3 Strategy 3: Responsive Design

Implementing a responsive design ensures that the platform is accessible and user-friendly across various devices and screen sizes, enhancing the overall user experience.

6.4.4 Strategy 4: Security-First Approach

Security is a top priority in the design of the MentorMe Educational Platform. This strategy includes encrypted communications, JWTs auth systems, and strict policies for database management.

6.4.5 Strategy 5: AI Integration

The platform integrates artificial intelligence in several key areas, notably in the Query-Video Matching Algorithm and the AI Advisor. This strategy not only enhances the user experience but also ensures efficient and accurate responses to user queries and needs.

6.4.6 Strategy 6: User Feedback Integration

Active incorporation of user feedback is a pivotal part of our strategy. This approach allows continuous improvement of the platform based on real user experiences and needs, ensuring the platform remains relevant and effective.

6.4.7 Strategy 7: Scalable Resource Management

The platform is designed to handle a comprehensive database of educational materials efficiently. Our strategy focuses on effective data storage management and persistence, facilitating quick access and high availability of resources for users.

6.4.8 Strategy 8: Concurrency and Synchronization

Given the platform's need to support multiple users simultaneously, we employ concurrency and synchronization mechanisms. This strategy ensures that the system can handle multiple user requests efficiently without data integrity issues.

6.4.9 Strategy 9: Comprehensive Communication Mechanisms

The platform utilizes advanced communication mechanisms, including real-time chat and video conferencing capabilities (using third-part APIs), to facilitate smooth and effective communication between students and educators.

6.4.10 Strategy 10: Advanced Error Detection and Recovery

Robust error detection and recovery mechanisms are in place to ensure platform stability. This strategy includes comprehensive logging, regular system checks, and automated recovery processes to minimize downtime and maintain system integrity.

6.5 Domain Model/Class Diagram

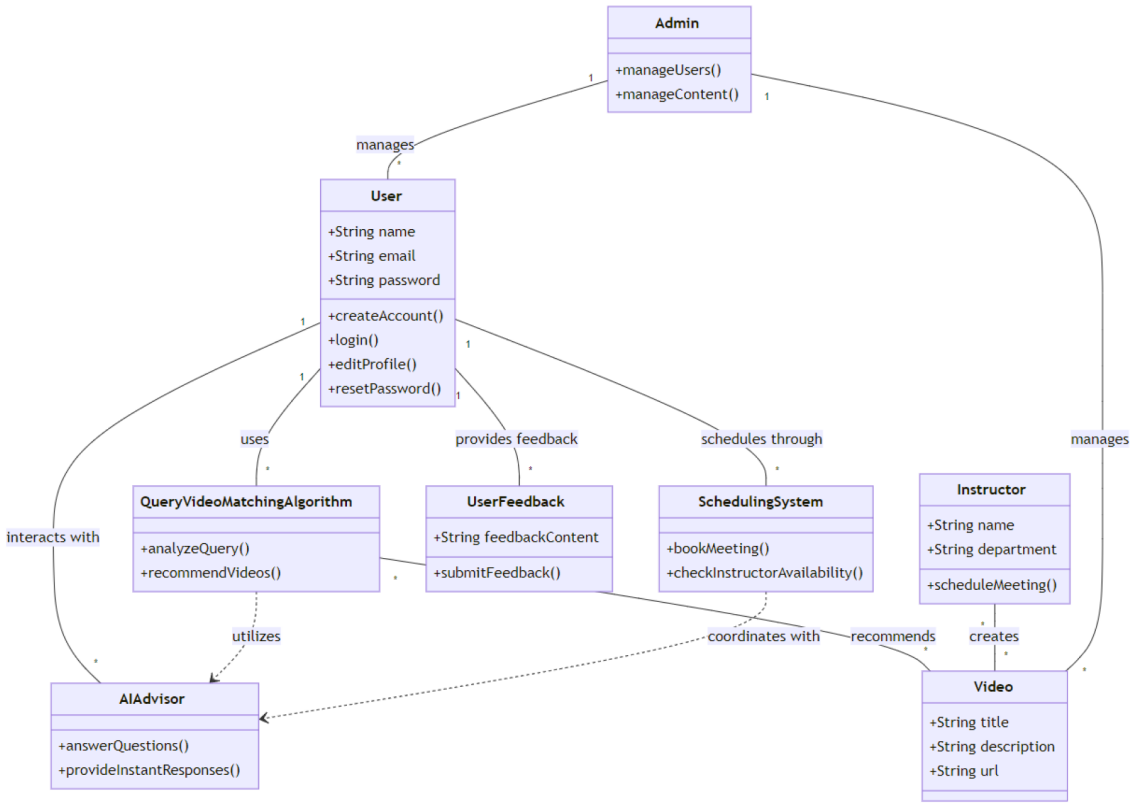

Figure 6.2: MentorMe Class Diagram

6.6 Sequence Diagrams

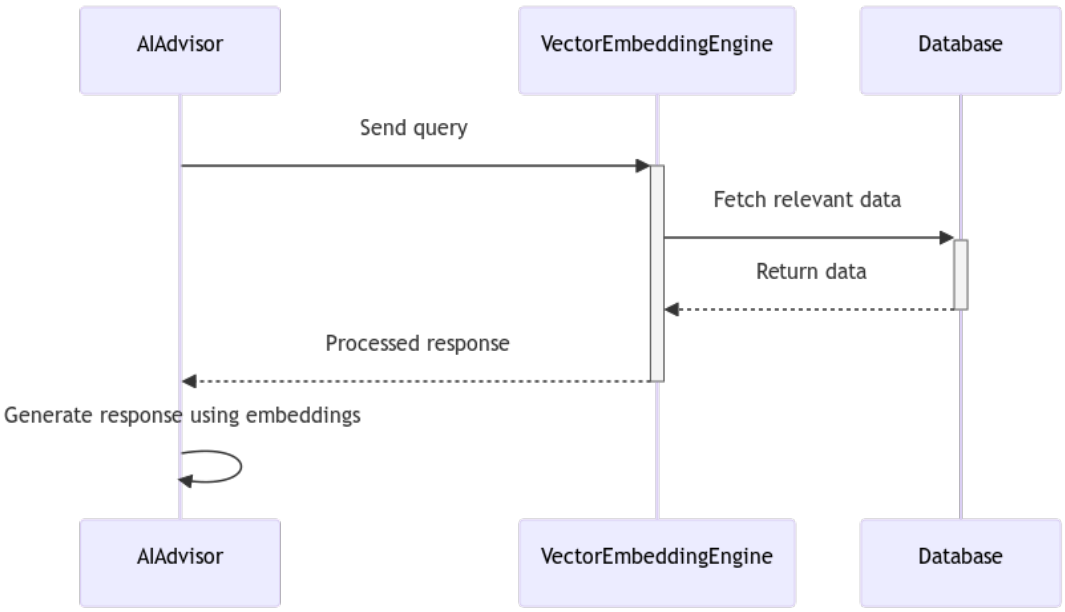

Figure 6.3: AI Advisor System

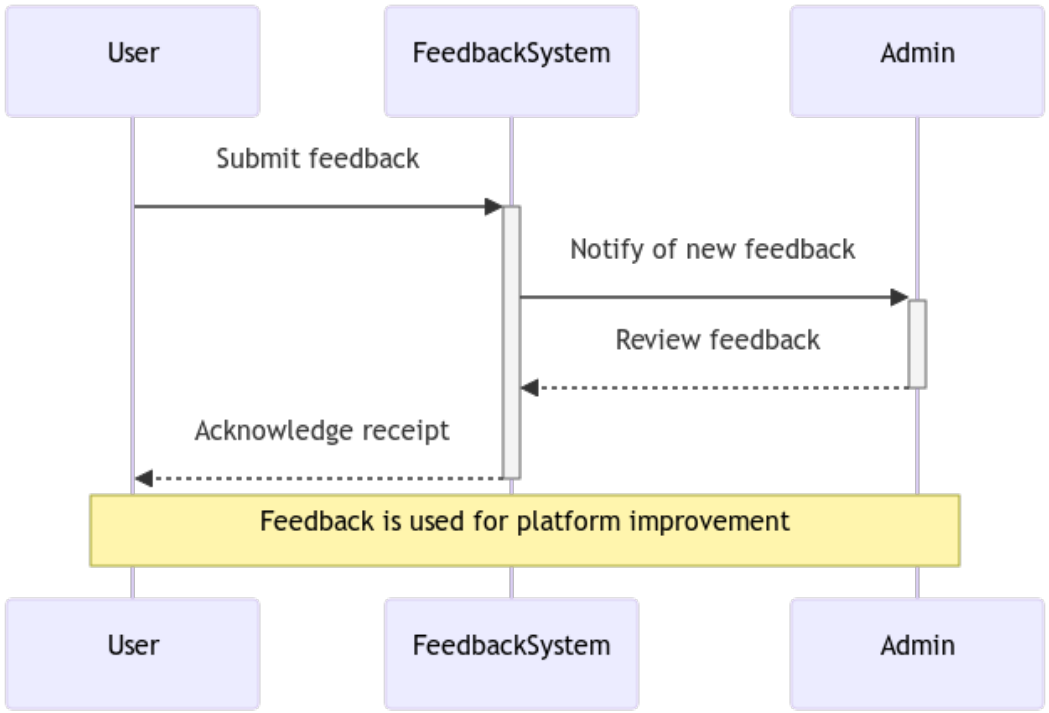

Figure 6.4: Feedback System

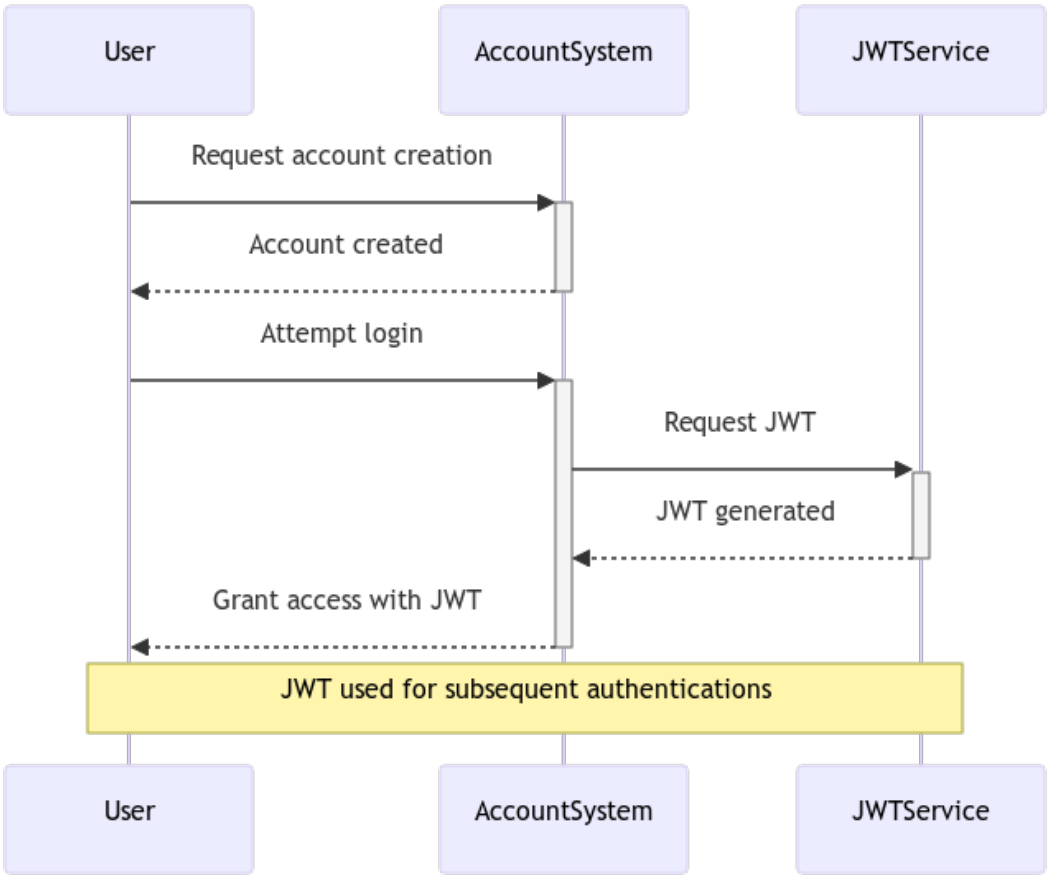

Figure 6.5: Login System

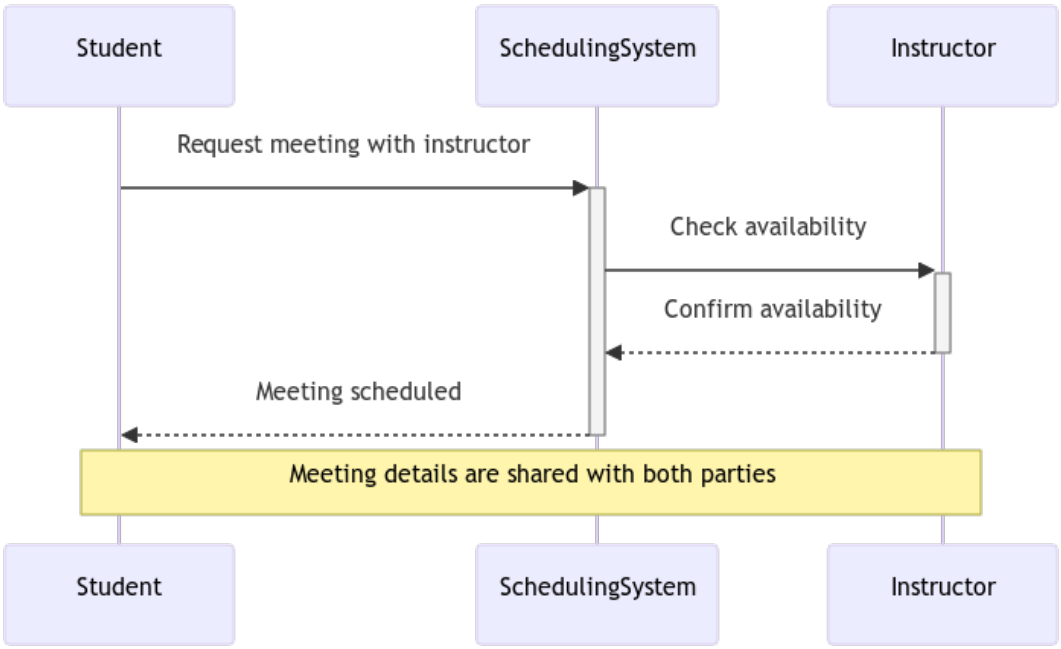

Figure 6.6: Meeting System

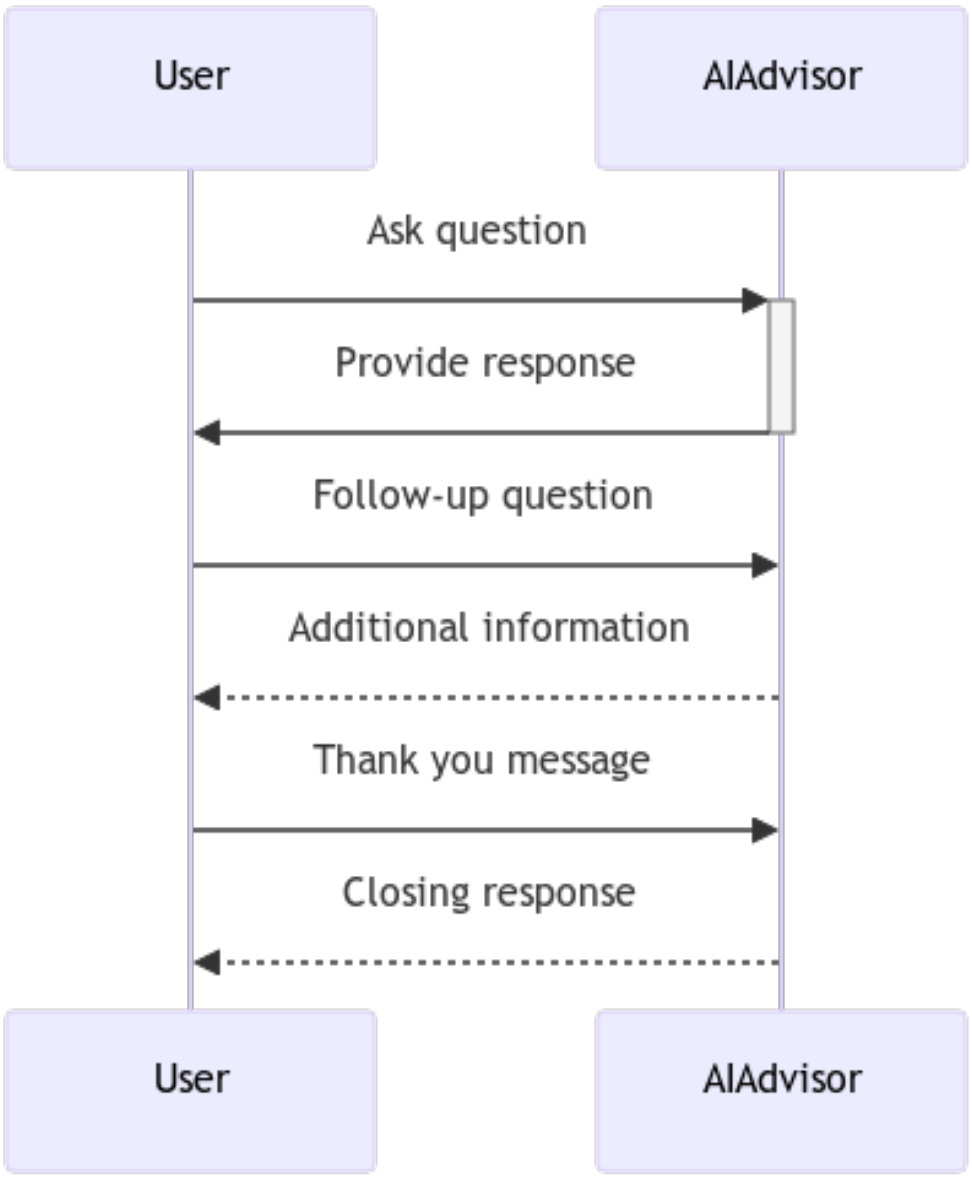

Figure 6.7: User interaction with AI advisor

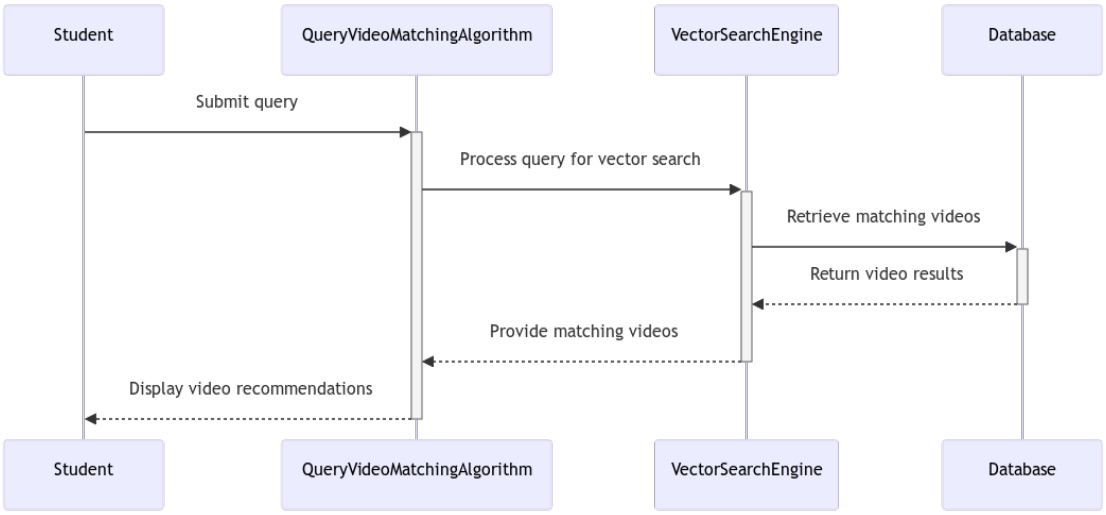

Figure 6.8: Video Query System

6.7 Policies and Tactics

This section outlines the design policies and tactics employed in the MentorMe Educational Platform. These policies and tactics are critical to the platform's functionality and user experience but do not significantly alter its high-level architecture.

- **Specific Product Choices:** Decisions on compilers, interpreters, databases, and libraries.
- **Engineering Trade-offs:** Balancing between performance, scalability, and development time.
- **Coding Guidelines and Conventions:** Standardized coding practices to maintain code quality and consistency.
- **Subsystem Protocols:** Communication and operational protocols for subsystems and modules.
- **Algorithm and Design Pattern Choices:** Selection of specific algorithms and design patterns for implementing system functionality.
- **Requirements Check:** Strategies to ensure that all requirements are accurately implemented and traceable.
- **Testing Plans:** Approaches and methodologies for testing the software.
- **Maintenance Plans:** Strategies for ongoing maintenance and updates of the platform.
- **User and System Interfaces:** Design of interfaces for end-users and system components using Chakra Library.
- **Source Code Organization:** Hierarchical organization of source code into files and directories

and Hosting on Github with Branches.

- **Build and Generation Processes:** Procedures for compiling, linking, and generating system deliverables.

6.7.1 Coding Standards and Conventions

We have established a comprehensive set of coding guidelines and conventions to ensure consistency and maintainability across the platform's codebase. This includes adherence to naming conventions, comment styles, and structured programming practices. Alternative approaches, such as more flexible coding standards, were considered but rejected to maintain a high level of code quality and readability.

6.7.2 Testing and Quality Assurance

A robust testing framework has been implemented, encompassing unit testing, integration testing, and user acceptance testing. This tactic ensures that all components of the platform are rigorously tested for functionality and performance. While other lighter testing methodologies were considered, they were deemed insufficient for the platform's complexity and criticality.

6.7.3 Choice of Technology Stack

The selection of our technology stack, including front-end frameworks (React or NextJS) and back-end technologies (Node.js or Python with FastAPI), was a critical decision. Alternatives like Angular for front-end or Ruby on Rails for back-end were considered, but were ultimately rejected due to our specific performance and scalability needs, as well as team expertise.

6.7.4 Data Handling and Storage

We employ a meticulous approach to data handling and storage, using SQL (Supabase) for structured data management. This choice was made considering the need for reliable and efficient data operations. NoSQL databases were considered but were not chosen due to the complex nature of our data relationships and the need for robust transaction support.

6.7.5 User Interface Design Principles

Our user interface is designed with a focus on accessibility and intuitive navigation, adhering to the latest web standards. We considered various design frameworks but opted for a custom approach to better align with our specific user experience goals and to provide a unique identity for the platform.

6.7.6 Build and Deployment Processes

The process for building and deploying the platform is streamlined using modern CI/CD pipelines. This includes automated testing, code reviews, and deployment strategies. We evaluated several CI/CD tools and chose the one that best fit our workflow and technical requirements.

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