CS 492

Senior Design Project

Detailed Design Report

T2315

SummarEyes

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1. Introduction

In the past decade, video conferencing has become an indispensable tool for real-time communication, spanning various domains from corporate meetings with remote teams and multiple office locations to educational settings like workshops, training sessions, and university lectures. The shift toward online education, accelerated by recent global events and extraordinary circumstances, has underscored the versatility and necessity of this technology. While video conferencing reduces travel expenses, enhances productivity, and fosters collaboration, it is not without its challenges, particularly in maintaining participant engagement and personal interaction, which are crucial for effective communication.

Recognizing these challenges, SummarEyes aims to refine the online meeting experience by addressing key areas where video conferencing can fall short. SummarEyes takes a comprehensive approach by offering intelligent meeting summaries and detailed attention analysis. This not only aids presenters in understanding audience engagement but also provides participants with a comprehensive recap of the meeting, ensuring that key points are retained and understood.

SummarEyes leverages advanced algorithms to analyze engagement levels, identifying moments of high or low attention based on participants' visual cues. This information can be invaluable for presenters, offering insights into which aspects of their presentation resonate most and where attention may wane. Additionally, SummarEyes incorporates sophisticated summarization techniques, distilling the essence of meetings into concise, actionable insights that can be reviewed at a glance.

By integrating these features, SummarEyes aspires to elevate the effectiveness of video conferencing, making it a more interactive and productive tool. The goal is not just to enhance the experience for presenters but to also enrich the learning and collaborative environment for all participants. In embracing the potential of video conferencing, SummarEyes is committed to developing a solution that balances the convenience of digital communication with the nuanced dynamics of personal interaction, striving to create a more engaging and insightful virtual meeting space for everyone involved.

1.1 Purpose of the System

The SummarEyes system is developed with the aim of enhancing the utility and effectiveness of online meetings, recognizing the inherent challenges that come with virtual communication. Its primary function is to generate summaries of meetings, aiming to offer users a concise overview of discussions without requiring them to revisit the entire meeting. The system also endeavors to analyze participants' attention and engagement, providing insights that might help in understanding and potentially improving meeting dynamics. Data security and privacy are central to the system's design, with efforts focused on protecting user information, acknowledging the critical importance of trust and compliance in the digital space.

The interface of SummarEyes aims to be user-friendly, striving to accommodate users of varying technical proficiency, yet user experience may differ. The system also seeks to support collaboration

and knowledge sharing, although the impact of these features can be subjective and dependent on individual and organizational usage patterns.

Continuous improvement is a guiding principle for SummarEyes, with the system open to evolving through user feedback and technological advancements. However, the pace and direction of innovation will likely be influenced by a range of factors, including user engagement and industry trends.

In essence, SummarEyes is an ambitious project aimed at adding value to virtual meetings, yet its effectiveness and reception will ultimately be determined by its real-world application and the experiences of its users.

1.2 Design Goals

1.2.1 Data Security and Privacy

Security and privacy for users is a priority for SummarEyes. Data protection measures, including encryption and secure data handling protocols to safeguard sensitive meeting information and user data, as well as consent systems for video recording are implemented.

1.2.2 User-Centric Design

An intuitive and accessible user interface, regardless of technical proficiency and familiarity, is designed to enhance overall user experience.

1.2.3 Scalability and Performance

SummarEyes system is designed to be scalable and responsive so that it maintains high performance and reliability through growing number of users and levels of meeting complexity.

1.2.4 Continuous Improvement and Adaptability

A dynamic feedback mechanism is also integrated in the system to ensure the gathering of user insights for the purpose of continuously evolving the system, integrating new technologies, and adapting to changing user needs and industry trends.

1.2.5 Economic Accessibility

SummarEyes works on a pricing model that balances accessibility with sustainability, offering tiered services to cater to different needs while also ensuring its competitiveness in the market.

1.3 Definitions, Acronyms, and Abbreviations

RBAC: Role-Based Access Control - A method to regulate access to computer and network resources based on the roles of users within an organization.
URL: Uniform Resource Locator - The address used to access a website.
HTTP: Hypertext Transfer Protocol - The foundation of data communication for the World Wide Web (WWW).

TCP/IP: Transmission Control Protocol/Internet Protocol - Communication protocols used to interconnect network devices on the internet.

S3 Bucket: A storage resource in Amazon S3 (Simple Storage Service) where data can be stored in buckets.

Heroku Server: A cloud platform where applications can be deployed.

API: Application Programming Interface

API Gateway: A service that provides an API endpoint to access microservices and handle request routing.

SQL: Structured Query Language - A language where users can store, manipulate and retrieve data in databases.

AI: Artificial Intelligence

ML: Machine Learning

UI: User Interface - The platform that allows human and machine interactions.

1.4 Overview

The SummarEyes project is developed with the objective of enhancing the online meeting experience, targeting common challenges in virtual communication environments. This system seeks to improve engagement, focus, and productivity during meetings by offering features that analyze participants' attention and generate summaries of the discussions.

Central to SummarEyes is its functionality to process video feed data to monitor participant engagement and attention. The system utilizes algorithms to detect interaction levels, note engagement fluctuations, and identify moments of peak interest. This feature aims to provide presenters and meeting organizers with insights into audience engagement, although the accuracy and depth of these insights can vary based on numerous factors including video quality and participant behavior.

SummarEyes also incorporates a feature to create summaries of meetings. Leveraging natural language processing and machine learning, it strives to produce concise summaries that encapsulate key discussion points, decisions, and action items. These summaries are intended to offer participants a quick recap of meetings, potentially reducing the need to review full recordings.

User experience is a key consideration for SummarEyes, with a design focused on simplicity and accessibility. The interface is designed to be intuitive, facilitating easy access to its various features, from joining meetings to accessing summaries and engagement insights.

Security and privacy are crucial aspects of SummarEyes' design. The system employs measures like encryption and secure data storage to protect user data and meeting content. However, the effectiveness of these measures can be influenced by evolving cybersecurity threats and user compliance with security protocols.

In summary, SummarEyes aspires to provide a more interactive and productive virtual meeting environment by offering attention analysis and summarization features within a user-friendly and secure framework. The actual impact of these features on meeting dynamics and user productivity will likely be determined through practical application and user feedback.

2. Current Software Architecture

After Covid, the usage of online meeting platforms has increased dramatically and a diverse range of applications offered. Since the users might attend these meetings from a place that they can't possibly give their full attention, an application like SummarEyes, which offers to give users a chance to review the parts that they couldn't give enough attention to, was needed. In the current market, there are a couple of different products that are similar to SummarEyes which can be listed as Zoom, Google Meet, Microsoft Teams, Cisco Webex, Skype etc. Here is the comparison between SummarEyes and the most used three online meeting products in the current market:

- Zoom is generally known for its user-friendly interface and its ease of use. However it only offers attention detection analysis with its third-party apps such as "MorphCast for Zoom" whereas in SummarEyes attention detection comes as a built-in feature and doesn't have the need of the additional steps of the user downloading the third-party app and integrating it to their online meeting environment. Furthermore, addition of a third-party app might raise some privacy concerns and possible integration problems might occur.
- Even though Microsoft Teams has experimented with a number of AI-powered functions to boost user productivity, these features are not part of the platform's core functionality. Although these features can be integrated with third-party apps and Microsoft Cognitive Services, doing so takes extra setup and management, which could make the user experience more challenging. Teams also has advanced its AI-powered meeting analytics and provides transcribing services. Nevertheless, the platform does not offer a combined approach that smoothly incorporates inside its system both good meeting summaries and in-depth attention analysis. As it might be seen in Zoom, these integration of third-party apps might cause data privacy concerns and integration issues.
- Cisco Webex has been on the lead when it comes to using AI to improve meeting experience like voice commands and noise cancellation. It does not, however, come with built-in emotion or attention detection; instead, these features may be integrated through the use of external APIs or third-party apps. Although Webex has capabilities to increase the efficiency of meetings and provides transcribing services, it does not have a function that combines attention analysis with thorough meeting summaries, so users will need to look for other tools to get a more in-depth analysis.

Overall, all these applications provide solid platforms with a selection of features and tools for collaboration that make it easier to conduct online meetings and work processes. But neither platform has a native, integrated solution that can do both efficient meeting summary and attention detection, which gives SummarEyes, a chance to stand out. SummarEyes simplifies the user experience by providing these functions as built-in capabilities, doing away with the requirement for third-party programs and potentially resolving privacy and integration concerns. In addition to increasing efficiency and user engagement, this integrated strategy establishes SummarEyes as a more complete and approachable option in the crowded field of online meeting platforms.

3. Proposed Software Architecture

3.1 Overview

This section fully explains the suggested software architecture. Software architecture is a foundational framework essential to comprehending software systems and offering a path for their advancement. The main elements of the software architecture, such as subsystem decomposition, hardware/software mapping, persistent data management, access control, and security, are briefly reviewed in this section.

3.2 Subsystem Decomposition

Subsystem decomposition, which divides complicated systems into more manageable, coherent pieces, is essential to organizing a software application's design. This method makes testing and development easier while also making it clearer who is responsible for what in the system. The diagram's breakdown illustrates how the system is divided into three main subsystems, each responsible for certain functions that combine to offer the whole range of the application's capabilities.

Along with the Meeting interface, the Interface Subsystem provides the front end of user interaction. It has features like Login/Sign Up, Dashboard/Profile, Summaries/Feedbacks, and Organization/Subscription administration. This subsystem, which aims to offer a smooth and simple user experience, acts as the user's entry point to the program.

The Server Subsystem, which serves as the system's operational hub, is at its heart. It may be accessible via an API Gateway, which guarantees effective and safe communication between services. The Meeting Service manages the practicalities of running sessions, the Authentication Service confirms user credentials, and the Summary Service compiles and produces meeting summaries.

Last but not least, the Data Subsystem is fundamental, providing strong data management capabilities to support the application. This subsystem offers an organized method for organizing, saving, and retrieving data through the Database Manager, which is essential for the application's performance and integrity.

The figure illustrates the modular structure of the program by isolating distinct subsystems, which allow each subsystem to be built, scaled, and maintained separately while still maintaining the overall coherent function of the system.
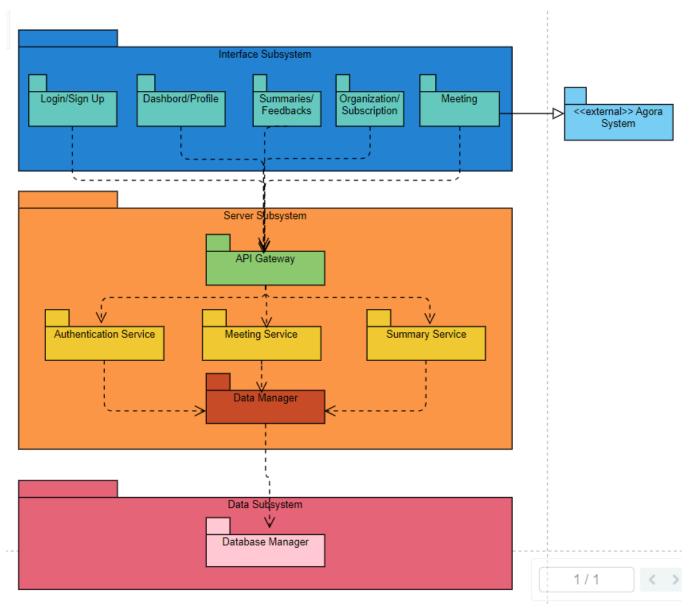
Figure 1: Subsystem Decomposition

3.3 Hardware/Software Mapping

The hardware/software mapping in the SummarEyes project's architecture is carefully thought out to guarantee logical interactions between different system components. The architectural diagram makes it evident how software services are deployed and linked to their appropriate hardware settings. The Authentication Service, Meeting Service, and Summary Service—which together comprise the core of the application's server-side logic—are supported by the Heroku Server, which is at the center of the infrastructure. The program uses a scalable and dependable S3 Bucket hosted by Amazon Cloud to store meeting recordings, which are necessary for the summarizing functionalities. On the client side, users connect to the Web Server, which supports the Frontend Client, and engage with the system using a web browser and devices with cameras.

Through the processing of HTTP requests by an API layer, this client interfaces with server-side components to provide a smooth user experience and data flow. Agora Server integration is another feature of the design that highlights the system's resilience to real-time media interactions. Every connection—whether via the TCP/IP or HTTP protocols—is meticulously set up to enable effective data flow. Software settings and, eventually, the software components' deployment are influenced by the underlying hardware. The SummarEyes platform's best performance and scalability depend on this strategic alignment between hardware and software.
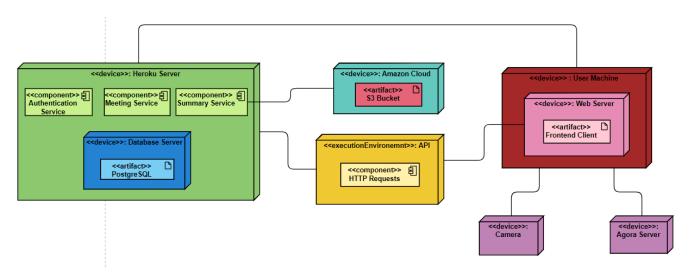

Figure 2: Hardware&Software Mapping

3.4 Persistent Data Management

Strategic choices were taken throughout the SummarEyes application's development lifecycle to guarantee effective and safe persistent data storage, according to our application's needs for processing video data for emotion analysis.

First, we realized that to make emotion analysis easier, user video recordings need to be temporarily stored. We used Amazon S3 cloud storage to manage massive amounts of video footage while navigating privacy concerns. With this approach, we can prioritize user privacy and effective data management while maintaining high speed and accessibility. Videos are erased soon after processing.

We chose a robust database system that could effectively manage the varied and large amounts of data related to video analysis to accommodate the large amount of data produced by our application, including the results of emotion analysis. This makes the SummarEyes application reliable and scalable.

In addition, keeping meeting summaries is a crucial component of our data strategy. These summaries, which highlight significant ideas and feelings from the discussions, are produced after emotion analysis. We improve the usability and user experience of the program by giving users valuable context and actionable information by preserving these summaries.

We have a separate data manager layer in our system architecture that abstracts the complexity of working with the database and cloud storage, making it possible to perform simple tasks like storing meeting summaries and temporarily storing videos, retrieving them for emotion analysis, and then deleting them. This layer enhances the flexibility and effectiveness of our data-handling strategy by separating application logic from data management responsibilities.

3.5 Access Control and Security

SummarEyes places a high priority on protecting user data privacy and security, especially in light of the sensitive nature of meeting summaries and recordings. SummarEyes uses a strong access control and security approach that includes role-based access control (RBAC), data encryption, and authentication to reduce any possible security risks.

To begin with, SummarEyes uses a safe authentication system to confirm users' identities. During the login procedure, each user's role—administrator, team member, or ordinary user—is authenticated. Users may access just the features and information relevant to their rights within the system thanks to role-based authentication. An administrator may, for example, be able to see the entire system, but individual users would only be able to view their own meeting summaries.

Secondly, SummarEyes uses strong encryption techniques to protect data while it's in motion and at rest. Advanced encryption standards are used to secure meeting recordings kept in S3 buckets, and encryption is also used to protect analytical data sent to the servers from interception and illegal access. This method guarantees that the data is safe and unreadable even in the improbable case of data interception.

And last, the SummarEyes platform carefully applies RBAC. The system restricts user access to various areas of the program according to their responsibilities by using fine-grained permissions. To make sure that every user interaction with the system is compared to the user's authorized activities, access control lists and, where needed, custom decorators are used in the application's codebase to enforce this. Ensuring that sensitive data, such as summarized meeting insights, is only accessible to authorized users through extensive access control is crucial for preserving the integrity and security of data inside the SummarEyes ecosystem.

4. Subsystem Services

In the SummarEyes architecture, a three-tier structural pattern is employed, following the client-server model. This arrangement encompasses three computational tiers: the Interface Tier, Application Logic Tier, and Server Tier. The Interface Tier acts as the user interface, managing client requests and disseminating information to users. The Application Logic Tier serves as the operational layer of the application, handling data received from clients, processing and storing it by interacting with the Server Tier, and subsequently returning it to the Interface Tier. The Server Tier, housing the database servers, is tasked with data storage [1]. Within the SummarEyes system, the Interface Layer assumes the role of

the client, engaging with the Application Layer, which acts as the server in client-server interactions, to solicit resources or services.

4.1 Client-side Subsystem

SummarEyes, embodying the interface tier in a three-tier architectural pattern, facilitates direct interaction with its users. This tier plays a pivotal role in requesting and displaying data from the application logic tier, ensuring a seamless user experience. Additionally, it is responsible for sending user input back to the application logic layer for further processing and storage. As depicted in the accompanying diagram (See Figure 3), the SummarEyes interface is subdivided into seven distinct subsystems, each specializing in specific aspects of user interaction and data management, thereby contributing to the overall functionality and efficiency of the system.
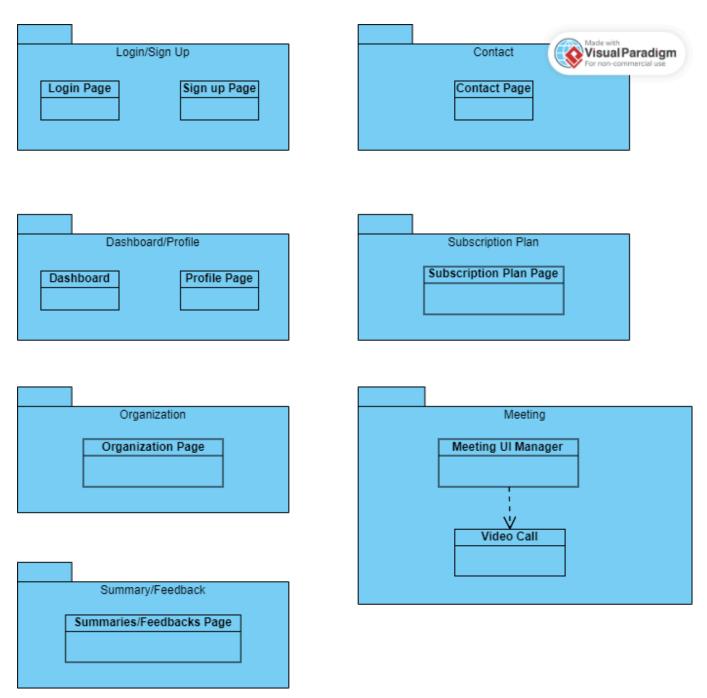
Figure 3: Client-side Subsystem Diagram

4.1.1 Login/Sign Up

When users enter the SummarEyes website, they are first directed to the 'Login Page,' where existing users can enter their credentials to access their accounts. For new users who don't have an account, there is an option available, labeled 'Don't have an account? Sign Up,' located below the login fields. Selecting this option takes them to the 'Sign Up' page, where they can register by providing the necessary information. Both the 'Login' and 'Sign Up' pages are integral for user interactions, capturing essential details like login credentials and registration information. Most of this data is subsequently sent

to the application logic tier for processing, ensuring a seamless integration of user management within the system.

4.1.2 Dashboard/Profile

Upon successfully logging in, users are directed to their 'Dashboard Page', which serves as the central hub for navigation within the system. From here, users can access various features, including their profile. By clicking the profile button, users are taken to the 'Profile Page' where they can view and edit their personal information. This page interacts with the Application logic tier to retrieve and update user profile details. Additionally, if a user wishes to adjust their settings or review other account-related information, the Profile Page continues to facilitate these requests by interacting with the application logic tier for data retrieval and update submissions.

4.1.3 Organization

The 'My Organization' page is a significant feature designed for users who are either owners or members of an organization. Accessible from the user's Profile Page, this section provides a centralized platform for managing and participating in organizational activities. When a user navigates to the 'My Organization' page, the Application Logic Tier plays a crucial role in presenting the relevant information based on the user's role within the organization. For owners, it displays options for managing the organization, such as adding members, assigning roles, and overseeing organizational settings. For members, it provides access to organization-specific information and activities. The Application Logic Tier ensures that each user's interaction is processed accurately, reflecting their privileges and responsibilities within the organization.

4.1.4 Subscription Plan

Users can go to the "Subscription Plans" page from their "Dashboard". The Subscription Plan feature within our project allows users to choose different levels of service according to their needs. This functionality is managed by the Application Logic Tier, which handles the processing of subscription selections, changes, and renewals. It ensures that the user's choices are correctly applied and that any changes to subscription status are promptly reflected in their access to features and services. The Server Tier plays a vital role in the Subscription Plan feature by securely storing all subscription-related data. It maintains records of user subscription types, payment information, and historical data regarding subscription changes. When a user makes a choice or changes their subscription plan, this tier updates the records accordingly, ensuring data consistency and reliability. The Server Tier is also responsible for integrating with payment gateways and managing the secure processing of subscription fees

4.1.5 Meeting

The Meeting subsystem, managed by the 'Meeting UI Manager', facilitates essential video conferencing features accessible from the 'Dashboard Page' to the 'Meeting Page'. In the Meeting subsystem, the Application Logic Tier plays a pivotal role. It handles the operational logic for starting and managing

video conferences, including the camera and microphone controls, and processing the leave meeting requests. This tier also controls the recording of meetings and orchestrates the initial processing of these recordings, preparing them for further analysis. The Server Tier is responsible for securely storing these video recordings and managing the data flow between the Meeting UI and the data storage solutions, ensuring data integrity and security

4.1.6 Summaries/Feedbacks

In the 'Dashboard', users will find a dedicated button leading to the 'Summaries/Feedbacks' page. This section significantly enhances the user experience by offering detailed insights into past meetings. Upon navigating to this page, users are presented with a layout where each previous meeting is displayed as a clickable card. Clicking on a card opens up its specific summary, providing a concise and personalized recap based on the emotional responses captured during the meeting. For the Summaries/Feedbacks feature, the Application Logic Tier takes the recorded data from the Server Tier and performs advanced analysis to generate personalized summaries and emotion-based feedback. It processes user interactions on the Summaries/Feedbacks page, retrieving specific meeting data upon request. The Server Tier plays a critical role here by storing all the analyzed data, including the transcripts, summaries, and feedback metrics. It ensures that when a user selects a meeting card on the Summaries/Feedbacks page, the corresponding data is efficiently retrieved and displayed

4.1.7 Contact

When the user is navigating within the dashboard, they can access the 'Contact Page' by clicking the contact form button. This page is specifically designed to capture user queries, feedback, or requests. It actively monitors all user interactions within this page, ensuring a responsive and user-friendly experience. Upon submission of the form, the information provided by the user is forwarded to the application logic tier for appropriate handling and response.

4.2 Server-side Subsystem

Within the SummarEyes framework, the Application Tier functions as the core component in a three-tier architectural model. This tier operates on the server side, facilitating interaction between the Interface Tier and the Server Tier. It plays a pivotal role in the exchange of data: retrieving information from the Server Tier to fulfill requests from the Interface Tier, and conversely, receiving requests from the Interface Tier and transmitting data to the Server Tier for storage purposes. As in Figure 4, the client-side subsystem has 3 subsystems.
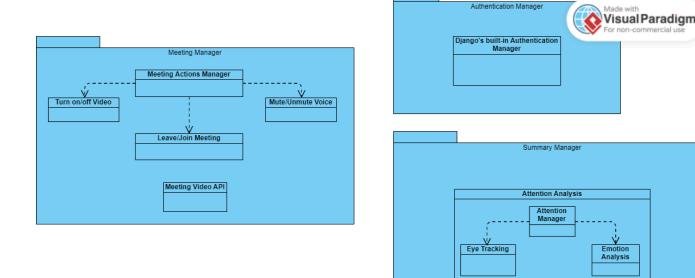
Figure 4: Server-side Subsystem Diagram

4.2.1 Authentication Manager

The Authentication Manager is the security gatekeeper of our system. It utilizes Django's built-in authentication system to manage user sign-ins, sign-ups, and maintain session security. This manager is tasked with verifying user credentials, providing appropriate access control, and protecting user data through robust authentication protocols. It is an essential component in maintaining the integrity and privacy of our user-centric platform.

4.2.2 Summary Manager

The Summary Manager handles the compilation and delivery of meeting summaries and feedback. It consists of two primary subsystems: the Attention Analysis and the Emotion Analysis. The Attention Analysis subsystem, guided by the Attention Manager, utilizes eye-tracking data to gauge user attention during meetings. It assesses engagement levels, providing valuable metrics for feedback. Concurrently, the Emotion Analysis subsystem processes emotional cues to enrich the meeting summaries, giving insights into the participant's emotional engagement, using valence and arousal as key indicators.

4.2.3 Meeting Manager

The Meeting Manager oversees all aspects related to the virtual meetings. This includes the Meeting Actions Manager, which allows participants to turn on/off their video, mute/unmute their microphones, and manage their presence in the meeting by joining or leaving. Furthermore, the Meeting Video API interfaces with the presentation tier to handle real-time video data, ensuring a seamless video conferencing experience. This manager ensures the reliable execution of meeting-related actions and the integrity of video data management.

5. Test Cases

5.1 Functional Test Cases

Test ID	LR1	Category	Functionality	Severity	Critical
Objective	Validate that users can successfully log in with valid credentials.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid login credentials. 3. Click the 'Login' button.				
Expected	User is redirected to the Dashboard Page.				
Date-Result					

Test ID	LR2	Category	Functionality	Severity	Critical
Objective	Ensure that the system denies access with invalid login credentials.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid login credentials. 3. Click the 'Login' button.				
Expected	User receives an error message and remains on the login page.				
Date-Result					

Test ID	LR3	Category	Usability	Severity	Medium
Objective	Validate the registration process for new users.				
Steps	1. Navigate to the SummarEyes login page. 2. Click on 'Don't have an account? Sign Up'. 3. Fill in the required registration details and submit.				

Expected	User is successfully registered and redirected to the login page or dashboard.
Date-Result	

Test ID	LR4	Category	Functionality	Severity	High
Objective	Ensure that the password reset functionality works correctly.				
Steps	1. Navigate to the SummarEyes login page. 2. Click on the 'Forgot Password' link. 3. Enter the registered email address and submit. 4. Check the email for a reset link and use it to set a new password.				
Expected	User can reset their password and log in with the new one.				
Date-Result					

Test ID	LR5	Category	Usability	Severity	High
Objective	Validate that a new user cannot register with existing credentials.				
Steps	1. Navigate to the SummarEyes login page. 2. Click on 'Don't have an account? Sign Up'. 3. Fill in the required registration details and submit.				
Expected	User gets an error message that the user exists.				
Date-Result					

Test ID	LR6	Category	Usability	Severity	Medium
Objective	Ensure that the password is at least 6 characters.				
Steps	1. Navigate to the SummarEyes login page. 2. Click on 'Don't have an account? Sign Up'. 3. Fill in the required registration details and submit.				
Expected	User gets an error message that the password cannot be less than 6 characters.				
Date-Result					

Test ID	LR7	Category	Functionality	Severity	Medium
Objective	Verifying new email address.				
Steps	1. Navigate to the SummarEyes login page. 2. Click on 'Don't have an account? Sign Up'. 3. Fill in the required registration details and submit.				

	4. Verify the email address through the confirmation link sent to the provided email.
Expected	User receives a confirmation email and is able to verify their email address successfully, gaining full access to the site's features.
Date-Result	

Test ID	MS1	Category	Functionality	Severity	Critical
Objective	Validate that a user can create a new meeting.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Dashboard Page. 4. Click the 'Create Meeting' button.				
Expected	User is directed to the Meeting Page with a new meeting session created.				
Date-Result					

Test ID	MS2	Category	Functionality	Severity	High
Objective	Ensure participants can join the meeting using the meeting ID.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Dashboard Page. 4. Click 'Join Meeting' and enter a valid meeting ID.				
Expected	User joins the specified meeting session.				
Date-Result					

Test ID	MS4	Category	Usability	Severity	Medium
Objective	Verify that meeting participants can mute and unmute their microphones.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Dashboard Page. 4. Join an ongoing meeting. 5. Click the 'Mute' button. 6. Click the 'Unmute' button.				
Expected	User's microphone status toggles between muted and unmuted accordingly.				
Date-Result					

Test ID	MS5	Category	Usability	Severity	Medium
Objective	Ensure the host can end the meeting for everyone.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Dashboard Page. 4. Click 'Create Meeting'. 5. Click the 'End Meeting for All' button.				
Expected	The meeting ends for all participants, and they are redirected or notified.				
Date-Result					

Test ID	MS6	Category	Usability	Severity	Medium
Objective	Ensure the meeting interface is user-friendly and intuitive.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Dashboard Page. 4. Click 'Join Meeting' and join a meeting. 5. Navigate through various meeting controls and features.				
Expected	All controls are accessible and easy to use.				
Date-Result					

Test ID	MS7	Category	Functionality	Severity	High
Objective	Ensure that participants can turn their video on/off.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Dashboard Page. 4. Click 'Join Meeting' and join a meeting. 5. Click the 'Turn Video Off' and 'Turn Video On' buttons.				
Expected	Video toggles on and off as per the user's actions.				
Date-Result					

Test ID	MS8	Category	Functionality	Severity	High
Objective	Ensure that users can end their participation in a meeting without affecting others.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login.				

	3. Navigate to the Dashboard Page. 4. Click 'Join Meeting' and join a meeting. 5. Leave the meeting using the 'Leave Meeting' option.
Expected	The user exits the meeting while it continues for others.
Date-Result	

Test ID	MS9	Category	Functionality	Severity	High
Objective	Ensure that when the host ends the meeting for everyone, the meeting token becomes invalid.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Dashboard Page. 4. Click 'Create Meeting'. 5. Click the 'End Meeting for All' button. 6. Click 'Join Meeting' and enter the meeting id.				
Expected	User cannot re-enter the meeting as it doesn't exist.				
Date-Result					

Test ID	DBO1	Category	Usability	Severity	Medium
Objective	Verify that users can navigate to different sections from the Dashboard.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Dashboard Page. 4. Click on different sections like Profile, Settings, etc.				
Expected	Each section loads successfully without errors.				
Date-Result					

Test ID	PR1	Category	Functionality	Severity	Medium
Objective	Verify that user profiles display accurate information.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Profile Page.				
Expected	User should view their own credentials.				
Date-Result					

Test ID	ST1	Category	Functionality	Severity	Medium
Objective	Ensure users can update their profile information.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Settings Page. 4. Update various fields like name, email, etc., and save changes.				
Expected	Changes are saved and reflected immediately.				
Date-Result					

Test ID	OR1	Category	Functionality	Severity	High
Objective	Verify that organization owners can add members.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. As an owner, navigate to the My Organization page. 4. Add a new member by entering their credentials.				
Expected	The new member is added successfully to the organization.				
Date-Result					

Test ID	OR2	Category	Functionality	Severity	High
Objective	Ensure organizations can change their subscription plan.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Subscriptions Plan Page. 4. Select a different plan and complete the necessary steps to change it.				
Expected	The new subscription plan is activated for the user.				
Date-Result					

Test ID	DAT1	Category	Functionality	Severity	High
Objective	Ensure that all sensitive data stored in the database is encrypted.				
Steps	1. Access the server where SummarEyes database is hosted. 2. Extract a sample of the data stored. 3. Analyze the extracted data to check for encryption.				

Expected	All sensitive data extracted should be encrypted, demonstrating that the system's persistent data management adheres to encryption standards for data at rest.
Date-Result	

Test ID	SES1	Category	Functionality	Severity	Medium
Objective	Verify that the system automatically logs out users after a period of inactivity, enhancing security.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Remain inactive for the duration specified in the system's security policy (time not yet determined). 4. Attempt to perform an action without re-authenticating.				
Expected	The system should automatically log the user out after the specified period of inactivity, requiring re-authentication to continue, thereby validating the session management security.				
Date-Result					

Test ID	VR1	Category	Functionality	Severity	Medium
Objective	Meeting attendants shouldn't be able to record.				
Steps	1. Open SummarEyes webpage 2. Login to SummarEyes 3. Click the Join Meeting button 4. Enter a meeting ID and join a meeting				
Expected	The Recording button does not exist				
Date-Result					

Test ID	VR2	Category	Functionality	Severity	High
Objective	The meeting host should be able to start recording.				
Steps	1. Open SummarEyes webpage 2. Login to SummarEyes 3. Click the Create Meeting button 4. Click the Start Recording button				
Expected	The recording started pop-up appeared.				
Date-Result					

Test ID	VR3	Category	Functionality	Severity	High
Objective	The consent of the meeting attendant needs to be taken after the host starts recording.				
Steps	1. Open SummarEyes webpage 2. Login to SummarEyes 3. Click the Join Meeting button 4. The host started recording				
Expected	The recording consent pop-up appeared and if the attendant does not accept, his/her video will not be recorded.				
Date-Result					

Test ID	VR4	Category	Functionality	Severity	High
Objective	The meeting record should be saved to the cloud when the recording ends by the host.				
Steps	1. Open SummarEyes webpage 2. Login to SummarEyes 3. Click the Create Meeting button 4. Click the Start Recording button 5. Click the End Recording button				
Expected	The host is informed with a pop-up about recording saved to the cloud, and meeting summaries will be sent to users. The audio and video recordings should be saved to the cloud.				
Date-Result					

Test ID	VR5	Category	Functionality	Severity	Medium
Objective	The meeting record should be saved to the cloud when the meeting ends without ending the recording.				
Steps	1. Open SummarEyes webpage 2. Login to SummarEyes 3. Click the Create Meeting button 4. Click the Start Recording button 5. Click the End Meeting button				
Expected	The host is informed with a pop-up about recording saved to the cloud, and meeting summaries will be sent to users. The audio and video recordings should be saved to the cloud.				
Date-Result					

Test ID	SUM1	Category	Functionality	Severity	Critical
Objective	Validate that the Language Model accurately generates summaries from the transcript of the meeting.				
Steps	1. Input a recorded segment of the host's meeting. 2. Command the Language Model to generate a summary of the provided segment.				
Expected	The AI tool successfully creates a summary that captures the key points of the presentation segment accurately and concisely.				
Date-Result					

5.2 Non-Functional Test Cases

Test ID	MS3	Category	Security	Severity	Critical
Objective	Confirm that a user cannot join a meeting without the correct meeting ID.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Dashboard Page. 4. Click 'Join Meeting' and enter an incorrect or non-existent meeting ID.				
Expected	User receives an error and cannot join the meeting.				
Date-Result					

Test ID	FB1	Category	Usability	Severity	High
Objective	Ensure that the feedback provided to the host is relevant and constructive regarding their presentation's engagement levels.				
Steps	1. Collate the attention and emotion data from a sample video conference. 2. Utilize the Language Model to generate feedback for the host based on the collated data.				
Expected	The Language Model produces feedback that is relevant to the specific segments where engagement dropped and offers constructive suggestions for improvement.				
Date-Result					

Test ID	ET1	Category	Accuracy	Severity	Medium
Objective	Assess the precision of the eye-tracking feature to accurately determine whether guests are looking at the screen or not during the presentation.				

Steps	1. Play a video recording to the test subjects while recording their eye movements. 2. Analyze the recorded data using the eye-tracking feature to determine focus points.
Expected	The eye-tracking feature accurately reflects the test subjects' points of focus in comparison to control data.
Date-Result	

Test ID	ET2	Category	Accuracy	Severity	Low
Objective	Test the eye-tracking feature's accuracy in low-light conditions to simulate different user environments.				
Steps	1. Set up a test environment with low-light conditions. 2. Perform eye-tracking calibration and tracking on subjects within this environment. 3. Compare the tracking data with a control set collected in standard lighting conditions.				
Expected	The eye-tracking feature maintains a high level of accuracy, comparable to the control set, even in low-light conditions.				
Date-Result					

Test ID	FB2	Category	Usability	Severity	Low
Objective	Ensure that the feedback provided to the host is presented in a user-friendly manner, allowing for easy interpretation and action.				
Steps	1. Generate feedback using the Language Model based on a set of sample emotion and attention data. 2. Review the feedback to assess clarity, actionability, and presentation quality.				
Expected	The feedback should be clearly structured, easy to understand, and presented in a format that is actionable for the host to make improvements.				
Date-Result					

Test ID	LR8	Category	Security	Severity	High
Objective	Check the system's response to a SQL injection attempt during login.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter credentials with SQL injection code.				

	3. Click the 'Login' button.
Expected	System prevents login and may log the attempt for security monitoring.
Date-Result	

Test ID	LR9	Category	Performance	Severity	Medium
Objective	Assess the response time of the login process.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and click 'Login'.				
Expected	The login process completes within an acceptable time frame.				
Date-Result					

Test ID	MS10	Category	Performance	Severity	Medium
Objective	Assess the video and audio quality during a meeting.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Dashboard Page. 4. Click 'Join Meeting' and join a meeting. 5. Observe the video and audio quality.				
Expected	Both video and audio are of good quality without significant lag or distortion.				
Date-Result					

Test ID	MS11	Category	Performance	Severity	Medium
Objective	Evaluate the system's handling of large meetings with many participants.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Dashboard Page. 4. Click 'Create Meeting' and host a meeting with a large number of participants. 5. Monitor system performance and user experience.				
Expected	The system remains stable and provides a good user experience, even with many participants.				
Date-Result					

Test ID	MS12	Category	Security/	Severity	High

			Usability		
Objective	Ensure user consent is obtained before video recording in a meeting.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Navigate to the Dashboard Page. 4. Click 'Join Meeting'. 5. When the host attempts to start recording, a consent prompt should appear for all participants. 6. Participants choose to give or deny consent for recording.				
Expected	No video recording of a participant should commence without their explicit consent. If a participant denies consent, their video should not be recorded and they won't receive a summary of the meeting, ensuring compliance with privacy and data protection standards.				
Date-Result					

Test ID	SES2	Category	Security/ Usability	Severity	High
Objective	Verify that the system uses cookies appropriately to manage user sessions and that these cookies are secure.				
Steps	1. Navigate to the SummarEyes login page. 2. Enter valid credentials and login. 3. Check the browser's developer tools to view the cookies set by the system. 4. Verify that a session cookie is created and is secure.				
Expected	The system sets a secure session cookie upon login, which is used for managing user sessions without exposing the session ID or sensitive information.				
Date-Result					

Test ID	DAT2	Category	Security	Severity	High
Objective	Confirm that data transmitted between the client and server is encrypted and secure.				
Steps	1. Initiate a session and perform a task that involves data transmission. 2. Capture the network traffic using a network monitoring tool. 3. Analyze the captured data for encryption.				
Expected	The network traffic analysis should show that the data transmitted is encrypted, indicating that the system uses secure protocols (like HTTPS) for data in transit.				
Date-Result					

Test ID	EA1	Category	Performance	Severity	High
Objective	Check if the Emotion Analysis script can detect low concentration correctly with one user in the meeting with the host.				
Steps	1. Save a video recording from the SummarEyes web page with one user 2. Get the video of the user from the cloud 2. Apply emotional analysis script				
Expected	The script should detect minutes that the user has a low concentration correctly				
Date-Result					

Test ID	EA2	Category	Performance	Severity	Low
Objective	Check if the Emotion Analysis script can detect low concentration correctly in the low-light condition with one user in the meeting with the host.				
Steps	1. Save a low-light condition video recording from the SummarEyes web page with one user 2. Get the video of the user from the cloud 2. Apply emotional analysis script				
Expected	The script should detect minutes that the user has a low concentration correctly				
Date-Result					

Test ID	EA3	Category	Performance	Severity	High
Objective	Check if the Emotion Analysis script can detect low concentration correctly with more than one user in the meeting with the host.				
Steps	1. Save a video recording from the SummarEyes web page with more than one user 2. Get the videos of the users from the cloud 3. Apply emotional analysis script to all videos separately				
Expected	The script should correctly detect the minutes in which the users have a low concentration for each user.				
Date-Result					

Test ID	AS1	Category	Security	Severity	Critical
Objective	The application redirects the user to the login screen when the URL is copied and pasted to a different browser.				

Steps	1. Copy the URL when logged in and paste it to a different browser or window.
Expected	When logged in, copying and pasting the URL to a different browser or window should redirect the user to the login screen.
Date-Result	

Test ID	GT6	Category	Security	Severity	High
Objective	The video recordings of the meeting participants shouldn't be stored for any purpose after the job is done.				
Steps	1. Check the database whether there is any table storing users' video recordings.				
Expected	The video recordings of participants are not present in the database. Instead, the required processing is done directly on the upcoming data without keeping them permanently.				
Date-Result					

Test ID	HB1	Category	Usability	Severity	Medium
Objective	Whisper AI should filter out background noise and focus on speech during transcription.				
Steps	1. Play an audio clip with background noise present. 2. Verify that the AI tool prioritizes speech over background noise in the transcription.				
Expected	The Whisper AI accurately transcribes speech while minimizing the impact of background noise.				
Date-Result					

Test ID	HB2	Category	Performance	Severity	High
Objective	Evaluate the Whisper AI's performance when processing and transcribing meetings of varying lengths and complexities.				
Steps	1. Provide the Whisper AI with audio clips of meetings with different durations and with varying levels of complexity. 2. Measure the tool's performance in terms of transcription accuracy, across different complexity levels and processing speed for each clip.				
Expected	The Whisper AI's performance may vary depending on factors such as speech length and complexity. It should demonstrate flexibility in handling these variations while maintaining acceptable levels of accuracy and efficiency.				

Date-Result	

Test ID	HB3	Category	Usability	Severity	High
Objective	Validate that the AI tool accurately transcribes English speech into text.				
Steps	1. Provide the AI tool with an audio clip containing English speech. 2. Verify that the transcription accurately reflects the English language.				
Expected	The Whisper AI successfully transcribes English speech into text without significant errors.				
Date-Result					

Test ID	HB4	Category	Usability	Severity	Medium
Objective	Validate that the AI tool accurately transcribes Turkish speech into text.				
Steps	1. Provide the AI tool with an audio clip containing Turkish speech. 2. Verify that the transcription accurately reflects the Turkish language.				
Expected	The Whisper AI successfully transcribes Turkish speech into text without significant errors.				
Date-Result					

Test ID	HB5	Category	Usability	Severity	High
Objective	The accuracy rate of the transcript extracted from a meeting should be within the acceptable range.				
Steps	1. Generate the transcript from the meeting recording using the SummarEyes system. 2. Calculate the accuracy rate by identifying and dividing the number of correct words by the total words. 3. Confirm the accuracy rate meets the acceptable threshold.				
Expected	The transcript extracted from what is spoken in a meeting using artificial intelligence tool Whisper AI should be consistent and coherent with what the speaker actually said.				
Date-Result					

6. Factors in Engineering Design

6.1 Public Health

Growing worries about "Zoom fatigue," or physical and psychological exhaustion, have arisen from the increased use of virtual meetings. This phenomena, which was thoroughly investigated during the COVID-19 epidemic, emphasizes the mental strain that results from using digital interfaces for extended periods of time as well as the difficulty of deciphering nonverbal signs in a virtual setting [2]. By offering brief meeting summaries based on participant attention and emotion detection, SummarEyes seeks to reduce this stress. This feature enables users to participate in meetings with less intensity, which may lessen exhaustion. SummarEyes might also include user interface modifications, including the ability to see just the presenter's video, which would simplify the visual field and reduce mental stress.

6.2 Public Safety

In the realm of video conferencing, safeguarding sensitive information is paramount. SummarEyes will protect privacy by not keeping meeting recordings on file permanently. Only feedback and summaries will be kept instead, and users will have the option to download and then remove this data. In order to enhance safety even more, hosts will be able to monitor participant interactions, such as adding or removing attendees, in order to preserve meeting integrity and security. Access to meetings will also be restricted through authentication procedures.

6.3 Public Welfare

Since SummarEyes is a web program that people will use for personal purpose, there is no impact on public welfare.

6.4 Global Factors

While no immediate global factors impact the design of SummarEyes, lessons learned from the COVID-19 pandemic underscore the importance of adaptability in communication tools. Therefore, SummarEyes will be designed with scalability and flexibility in mind, ready to adapt to changing global conditions and emerging user needs.

6.5 Cultural Factors

Diversity in communication styles between cultures is an important factor. These differences will be taken into consideration by SummarEyes's mood and attention analysis algorithms. For example, gesture expressiveness differs between communication cultures with high and low context. The model for emotion detection and the dataset for eye tracking will comprise a wide variety of cultural expressions to enable correct analysis and improve the app's cross-cultural usability.

6.6 Social Factors

Reducing social biases is an essential part of developing AI. SummarEyes will take extra care to make sure that biases pertaining to age, gender, or race are not present in its attention and emotion analysis algorithms. In order to do this, inclusive datasets will be used, and universal measures of attention and emotion, like eye contact and facial expressions, that are free from bias will be the main focus.

6.7 Economic Factors

A wide range of users, including companies and academic organizations, are the focus of SummarEyes. The software will be available for free at first to promote user input and wide adoption. Later, tier-based subscription models will be implemented. These models will serve a variety of user needs, including business customers with access to more sophisticated features and support available in premium packages, and educators with easily accessible solutions. This approach seeks to strike a compromise between wide accessibility and financial viability.

Factor	Effect Level	Effect
Public Health	7	Stress during the online meetings should be reduced
Public Safety	8	User's privacy must be secured.
Public Welfare	0	None
Global Factors	2	Scalability and flexibility must be a concern in our development
Cultural Factors	5	Datasets and models should be inclusive
Social Factors	6	No biases should be included
Economic Factors	2	Initially free, then tier-based subscription

Figure X: Factor and Effect Table

7. Teamwork Details

7.1 Contributing and Functioning on the Team

Throughout the project, all the tasks are distributed as equally as possible among all team members. We divided up the work on our team methodically so that each person could contribute as much as they could.

- Deniz and Burcu took on the task of creating our project's backend logic. Their proficiency with management of databases and server-side components was essential to laying a solid basis for our application.

- Gökhan and Hazal committed their talents to creating the frontend experience in the meantime. Their contributions to the user interface and user experience design were essential to ensuring that our product was both user-friendly and accessible.

- Kürşad managed the ML logic and implemented algorithms that improved the functioning and intelligence of our application thanks to his expertise in machine learning.

Each team member was able to make a substantial contribution to their area of expertise through the assignment allocation, and by working together, they were also able to obtain insights into other project issues.

Furthermore, the strategic use of Jira, WhatsApp, and GitHub, which enabled clear communication, effective work management, and seamless cooperation, greatly increased our team's effectiveness.

- Jira played a crucial role in helping us arrange our assignments and divide the tasks fairly among the team members. We were able to keep an open overview of everyone's responsibilities and progress by using Jira to create and manage tasks. We were able to distribute tasks to team members according to their skill sets and availability thanks to this approach.

- Our main method of communication was WhatsApp, which allowed team members to stay in touch, discuss information, and offer assistance to one another quickly and easily. This made it possible for us to keep a strong sense of unity within the team and quickly handle any problems or inquiries that came up.

- GitHub was essential to the development of our project because it allowed us to easily manage version control, create code together, and assess each other's contributions. We were able to easily connect the many components of our project—from the front end to the back end and machine learning logic—through GitHub, making sure that every component functioned well with the others. We were also able to emphasize the contributions made by each team member, highlighting the just and equal involvement of all members thanks to the platform.

7.2 Helping to Create a Collaborative and Inclusive Environment

Establishing a cooperative, inclusive workplace where each person's voice was respected was our team's top priority. All team members could exchange ideas, offer criticism, and ask for assistance as

necessary thanks to frequent team meetings and open lines of communication. We were able to solve problems more skillfully and come up with new ideas as a team since this strategy promoted a feeling of respect and belonging among the team members. We acknowledged and appreciated the differences in our backgrounds and skill sets, realizing that each person added a special touch to the project and enriched its progress.

7.3 Taking Lead Role and Sharing Leadership on the Team

Leadership within our team was fluid and shared, with members stepping up to lead in their areas of expertise while supporting others in their roles. Deniz and Burcu, for instance, not only led the development of the backend logic but also facilitated knowledge sharing sessions on backend technologies for the rest of the team. Similarly, Gökhan and Hazal, besides leading the frontend development, contributed to creating design guidelines that helped unify our project's visual and functional aspects. Kürşad took the initiative to introduce machine learning concepts to the team, enhancing our collective understanding of how AI could be leveraged in our project. This shared leadership model ensured that each member could develop leadership skills and contribute to the project's success in multiple ways.

8. References

[1] "Three-tier client server architecture in Distributed System," GeeksforGeeks, 24-Feb-2022.
[Online]. Available:
https://www.geeksforgeeks.org/three-tier-client-server-architecture-in-distributed-system/.
[Accessed: 7-Mar-2024].

[2] "Zoom Fatigue – Why video calls are so exhausting," allianzcare.com. [Online]. Available: https://www.allianzcare.com/en/about-us/blog/2021/03/zoom-fatigue.html. [Accessed: 6-Dec-2023].