MINDSCULPTOR: AN OBSESSIVE-COMPULSIVE DISORDER (OCD) EXPOSURE AND RESPONSE PREVENTION (ERP) THERAPY TOOL

24-25J-046

Project Proposal Report

Mallawaarachchi D.E.H

B.Sc. (Hons) Degree in Information Technology Specialized in Software Engineering

Department of Computer Science and Software Engineering

Sri Lanka Institute of Information Technology,
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DECLARATION

We declare that this is our own work and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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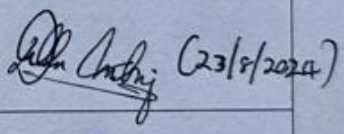
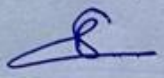
Supervisor	Dr.	Dilshan	De silva	
Co-Supervisor	Mr.	Samadhi	Rathnayaka	

ABSTRACT

AI-Enhanced Video Conferencing for ERP is a milestone in remote mental health interventions. The development of this system through the integration of cutting-edge AI technology within traditional video conferencing platforms will more effectively and easily make ERP therapy accessible as a frontline treatment for disorders such as OCD and anxiety disorders. By integration of AI, it shall be able to interact in real-time and improve usability features in the application so that therapy sessions are guided properly, allowing both therapists and patients to have a seamless and guided experience. This system will ensure better therapeutic experiences, by analysis of biometric data and emotional cues, so that therapists can change their approach at a moment's notice. As such, remote therapy sessions can be as effective as those in person since patients are treated the same, wherever they are. Another benefit is session analytics with predictive insights, whereby therapists know how to progress with treatment and in which areas it needs adjustment.

This paper, therefore, aims to design and test an AI algorithm that would extend the video conferencing abilities in creating a more interactive, engaging therapeutic setting. In doing so, this system would enable the convenient access to ERP therapy in order to improve patient outcomes while expanding mental health services.

Keywords: AI, Video Conferencing, ERP Therapy, Remote Intervention, Personalized Therapy.

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LIST OF ABBREVIATIONS

Abbreviations	Meaning
AI	Artificial Intelligence
ERP	Exposure and Response Prevention
OCD	Obsessive-compulsive disorder
DB	Data Base
SDLC	software development lifecycle
WBS	Work Breakdown Structure
SAP	System Applications and Products
AWS	Amazon Web Services
SSL	Secure Sockets Layer
TLS	Transport Layer Security
UI	User Interface

1 INTRODUCTION

1.1 BACKGROUND

The rapid growth in AI and video conferencing technologies opened new avenues for mental health care, especially in terms of the delivery of therapeutic interventions. One such intervention is Exposure and Response Prevention, a highly recognized treatment for conditions such as obsessive-compulsive disorder and a host of anxiety disorders. Conventionally, ERP depends on face-to-face sessions where a therapist guides patients through controlled exposure to feared stimuli. However, with increasing demands for accessible mental health care, ways of conducting distant therapy have only recently been developed.

AI-Enhanced Video Conferencing ERP Therapy is set to bridge the gap between conventional face-to-face therapy and the new emerging demands for interventions remotely. This system can provide real-time analysis, feedback, and adaptation during therapy sessions so that patients experience a more tailored form of care based on their unique requirements. AI infusion in the therapy experience not only enriches the therapeutic experience but also allows therapists to render much more effective interventions from a distance without losing quality in care.

This study is aimed at designing and implementing an AI-enhanced video conference system specialized in ERP therapy. It would further be teamed up with AI in a bid to automate the limited aspects of therapy, including monitoring patient responses, intervention techniques, and data analysis from sessions to improve treatment plans. Ultimately, it is expected that this study will be able to demonstrate how AI can help in increasing the effectiveness of remote ERP therapy to the level where it becomes a robust, viable alternative to traditional face-to-face sessions.

1.2 LITERATURE REVIEW

The increasing adoption of telehealth and remote therapy platforms reflects a significant shift in healthcare delivery, especially in mental health. Several platforms have emerged, each catering to specific aspects of remote healthcare, though many still lack comprehensive features that integrate advanced AI capabilities.

Zoom for Healthcare has gained widespread use due to its robust real-time video conferencing capabilities. It is particularly popular in clinical settings for consultations and follow-up sessions. A study by S. Domb et al. (2021) highlights its effectiveness in creating a virtual teaching clinic during the COVID-19 pandemic, emphasizing the platform's utility in real-time communication and collaboration [1]. However, Zoom for Healthcare lacks advanced features such as AI-based biometric analysis and emotion detection, which are essential for understanding and monitoring patient emotions during sessions.

Doxy.me is another telehealth platform focusing on video conferencing, specifically designed for healthcare settings. T. Newlin et al. (2018) discuss its role in clinical research for teleconsent, highlighting its ease of use and patient satisfaction [2]. However, like Zoom for Healthcare, Doxy.me does not incorporate AI-based biometric analysis or emotion detection, limiting its effectiveness in providing nuanced mental health care that requires deeper insights into patient emotions.

Talkspace is a platform tailored for mental health, offering text, video, and audio messaging with licensed therapists. D. Darnell et al. (2022) examined Talkspace's effectiveness and found that it aids in symptom management among adults with depression, showcasing its potential in remote mental health support [3]. However, despite its focus on mental health, Talkspace lacks advanced AI features such as biometric analysis and emotion detection, which could significantly enhance its ability to provide personalized care by understanding the emotional state of patients.

Lark Health is another platform that combines telehealth with AI-driven predictive analytics, primarily focusing on chronic disease management. K. G. Lockwood et al. (2024) conducted a study on Lark Health, emphasizing its feasibility and acceptability for managing heart health using predictive analytics [4]. While Lark Health includes predictive analytics and focuses on

mental health, it does not offer real-time video conferencing, AI-based biometric analysis, or emotion detection, which are crucial for comprehensive mental health support.

1.3 RESEARCH GAP

The review of existing platforms reveals significant gaps in the integration of advanced AI features, particularly in mental health applications. As summarized in the research gap table, while platforms like Zoom for Healthcare, Doxy.me, and Talkspace provide real-time video conferencing and focus on mental health, they lack AI-based biometric analysis and emotion detection. These features are crucial for understanding and monitoring patients' emotional states, which is vital for effective mental health care.

Moreover, none of the platforms fully integrate session analytics with real-time video conferencing and emotion detection, which could provide valuable insights for both patients and healthcare providers. Although Lark Health incorporates predictive analytics and focuses on chronic disease management, it lacks real-time video conferencing and emotion detection, making it less effective in real-time therapy scenarios.

The proposed system aims to address these gaps by offering a comprehensive platform that integrates real-time video conferencing, AI-based biometric analysis, emotion detection, session analytics, and predictive analytics, with a strong focus on mental health. This combination of features is currently not available in a single platform, making the proposed system a novel contribution to the field of telehealth and remote mental health care.

1.3.1 RESEARCH GAP TABLE

The table below summarizes the comparison of previous research efforts regarding the integration of AI in video conferencing platforms for ERP (Exposure and Response Prevention) therapy. It highlights the gaps in current studies and the potential advancements proposed in the new research.

Feature	Proposed System	Zoom for Healthcare [1]	Doxy.me [2]	Talkspace [3]	Lark Health[4]
Real-time Video Conferencing	✓	✓	✓	✓	✓
AI-based Biometric Analysis	✓	✗	✗	✗	✓
Emotion Detection	✓	✗	✗	✗	✗
Session Analytics	✓	✗	✗	✗	✗
Predictive Analytics	✓	✗	✗	✗	✗
Focus on Mental Health	✓	✓	✓	✓	✓

Table 1 Research Gap Table

The proposed system seeks to bridge the identified gaps by integrating AI capabilities within video conferencing platforms to enhance the effectiveness of ERP therapy through real-time adaptation, personalized feedback, and ERP-specific interventions. This approach aims to provide a more tailored and responsive therapeutic experience for remote patients, addressing the limitations of current research efforts.

1.4 RESEARCH PROBLEM

All the modern therapeutic techniques, ERP therapy proved to be one of the most effective treatments for patients with OCD and anxiety disorders. However, the traditional format of ERP therapy in a face-to-face delivery format raises barriers for those who, due to geographical, physical, or financial limitations, cannot participate in person in therapy. Videoconferencing has emerged as another medium through which ERP therapy is being made more accessible.

While video conferencing has already seen extensive use in telehealth, integrating AI-enhanced tools within these platforms for the optimization of ERP therapy remains relatively unexplored. Most of the teletherapy solutions are bereft of real-time adaptive feedback mechanisms and individualized intervention strategies that AI can drive into improving the effectiveness of ERP therapy. As a result, this limits the ability to offer any kind of personalized therapeutic experience that is dynamic in adjusting to the needs of the patient during remote sessions.

It is shown that the absence of AI integration within video conferencing for ERP therapy makes the therapeutic process less tailored and adaptive. This gap thus indicates a need for developing AI-enhanced video-conferencing platforms that, other than facilitating remote ERP therapy, also offer real-time adaptive interventions, personalized feedback, and ERP-specific AI tools. Such innovations will manifestly make remote therapy sessions much more effective, ensuring that patients receive the most efficient treatment anywhere.

Such a gap will be filled by the proposed research, developing an AI-enhanced video conferencing platform designed to support ERP therapy and allow therapists to provide highly customized and effective remote interventions, hence increasing access to quality mental health care and treatment outcomes for those patients who would otherwise not have been able to follow through consistently with ERP therapy.

2 OBJECTIVES

2.1 MAIN OBJECTIVES

The overall objective of the study is to develop an AI-enhanced video conferencing platform designed to support and extend ERP therapy for persons who have OCD or anxiety disorders. Such a platform will provide personalized, adaptive experiences for the improvement of the effectiveness of remote ERP sessions.

2.2 SPECIFIC OBJECTIVES

To achieve this, specific objectives to be addressed include:

1. **Real-time Biometric Detection**
   Implement AI models to capture and analyze facial features for anxiety and stress detection during therapy.

2. **Seamless Video Conferencing**
   Develop a platform for uninterrupted audio-video communication between patients and therapists.

3. **Session Analytics**
   Provide detailed session metrics and predictive analytics to monitor patient progress.

4. **Enhanced Feedback**
   Display critical facial expressions alongside live video for accurate therapist assessment.

To assist remote service delivery through designing, prescribing an effective treatment plan, several AI tools should be designed and incorporated (such as automated exposure tracking, response prevention decisions among others) for use within specific ERP methodologies.

3. METHODOLOGY

3.1 RESEARCH AREA

The scope of this study will be narrowed down to the effects of artificial intelligence on ERP systems, especially as applied for therapy via video conferencing. Post-pandemic, there is mounting demand for the ability to deliver mental health care remotely. From the perspective of this project, AI will be examined for the efficacy in which remote ERP therapy sessions are conducted. The focus will include:

1. Artificial Intelligence Use in Video Conferencing: Review the capacity of AI as included in video conferencing tools to assess factors of patient behaviour, emotion, and engagement in therapy sessions.

2. Utilising ERP Systems in Therapy: A review of how ERP systems used to manage patient data, schedule and record sessions can be utilised or adapted to therapy. Included will be the use of AI to enhance ERP systems for medicinal outcomes.

3. Efficacy of AI Tools in Remote Therapy: A measure of the comparative effectiveness of therapeutic interventions supported using AI-powered tools versus traditional therapy in terms of satisfaction for both patient and therapist, the effect of therapy, and practical limitations or challenges in remote therapy with all clients.

4. Ethical/Privacy Issues: One's critical review regarding moral implication concerning AI technology in therapy, i.e., from the patient's right to privacy and possible biases to securing the data.

It will provide another avenue to contribute to the field of therapy and mental health and will also confirm the correct methods for providing access to effective therapy for underserved and/or remote peoples through the use of technology.

3.2 OVERALL SYSTEM DESCRIPTION AND DIAGRAM

The proposed system is designed to enhance and streamline the process of diagnosing and treating obsessive-compulsive disorder (OCD) through a comprehensive, AI-enhanced platform that integrates video conferencing and virtual ERP (Exposure and Response Prevention) therapy. This system leverages AI technology to enable remote intervention, ensuring that patients receive timely and effective treatment regardless of their location.

System Workflow:

1. **User Interaction:** The process begins with the patient using a mobile application to report symptoms or concerns related to OCD. The app provides an interface for initial data input, allowing the patient to describe symptoms or upload relevant images and videos.

2. **Diagnosis of OCD:** The input data is analyzed to identify the presence of OCD. The system determines the severity, subtype (e.g., contamination, symmetry), and presence of OCD through advanced AI algorithms. This step is crucial for tailoring the subsequent therapeutic interventions.

3. **Data Storage:** The diagnosis results, including severity, subtype, and any related images or videos, are securely stored in a centralized database (DB). This allows healthcare providers to access and review patient information efficiently.

4. **AI-Enhanced Video Conferencing:** If the severity of OCD is high, the system facilitates a video conferencing session between the patient and a healthcare provider (doctor). This session is enhanced by AI to ensure that the therapist can effectively engage with the patient and make informed decisions during the session. The video conferencing module is integrated into both a web application and a mobile application, allowing flexibility in how the session is conducted.

5. **Virtual ERP Therapy (VERP):** For patients with mild to moderate severity, where the OCD subtype is related to contamination or symmetry, the system automatically initiates virtual ERP therapy. This therapy involves displaying relevant videos and images via the mobile or web app to help the patient gradually confront and manage their OCD symptoms.

6. **AI Voice Assistant:** For other OCD subtypes, such as checking and washing, the system deploys an AI voice assistant. This assistant guides the patient through tailored therapeutic exercises, helping them build resilience and manage their symptoms effectively. The assistant also uses conversational AI to maintain engagement and track the patient's progress.

7. **Session Analysis and Continuous Monitoring:** Post-session, the data from both the video conference and ERP therapy sessions are analyzed and stored in the database. This data is used for further analysis to track the patient's progress and adjust treatment plans as necessary.

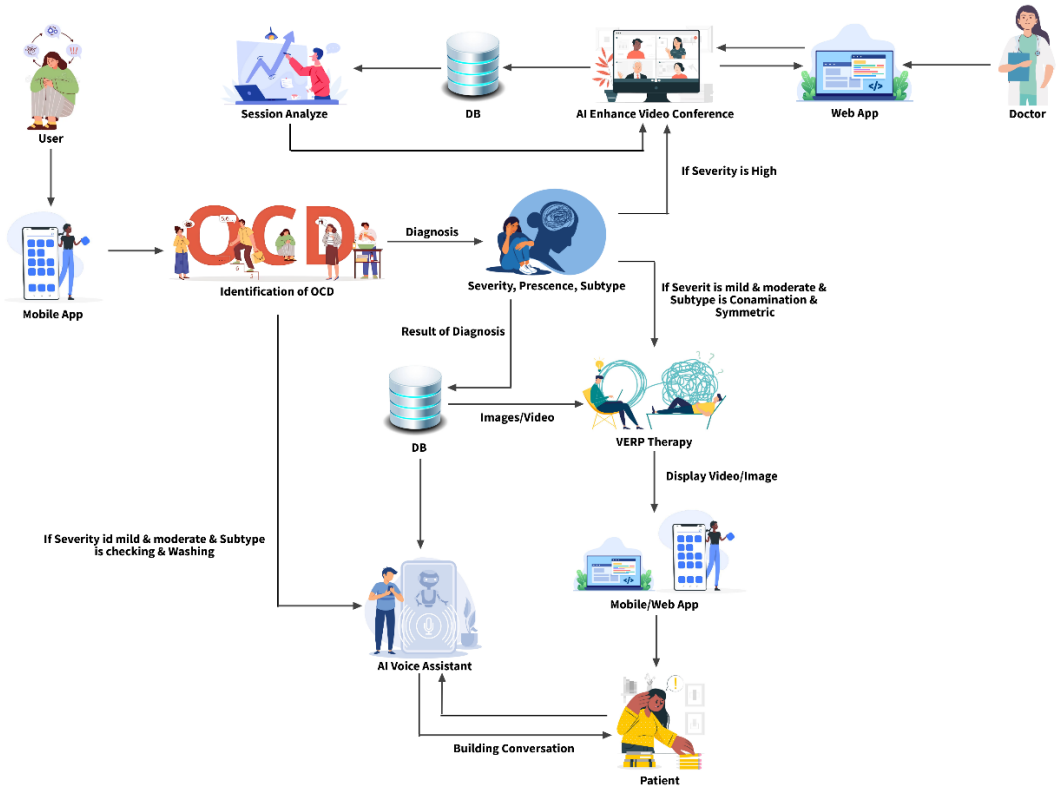

Figure 1 System workflow.

The diagram illustrates the flow of information and the interaction between various components of the system. It highlights the different pathways depending on the severity and subtype of OCD, ensuring that each patient receives a tailored and effective intervention. The integration of AI at various stages ensures that the system is responsive, adaptive, and capable of providing high-quality remote care.

This system represents a significant advancement in the remote treatment of OCD, utilizing AI-driven technologies to enhance accessibility, personalize care, and improve outcomes for patients.

3.3 INDIVIDUAL COMPONENT DESCRIPTION AND DIAGRAM

The depicted system focuses on assessing and managing patient stress and anxiety levels through real-time analysis using advanced AI technologies. The system integrates several components that work together to monitor, analyze, and provide actionable insights to healthcare providers, ensuring that patients receive timely and personalized care.

Component Workflow:

1. Patient Interaction: The process begins with the patient using a mobile or web application to engage with the system. This interaction involves capturing real-time video feeds, which are critical for the subsequent analysis stages.
2. Real-Time Facial Feature Analysis: As the patient interacts with the app, the system performs real-time facial feature analysis. This component utilizes AI algorithms to detect subtle facial expressions, micro-expressions, and other visual cues indicative of stress and anxiety. The analysis is crucial in determining the patient's emotional state during the session.
3. Stress and Anxiety Analysis: The data from the facial feature analysis is further processed to generate a comprehensive stress level report. This report provides insights into the patient's stress and anxiety levels, helping healthcare providers to understand the patient's current emotional and mental state. The system also has the capability to enhance the video feed, providing a clearer and more focused view for further analysis.
4. Session Analysis: Previous session data stored in the database (DB) is utilized to compare and analyze the patient's current stress levels against historical data. This comparison helps in identifying patterns or trends in the patient's mental health, which can be critical for long-term care and therapy adjustments.
5. Data Storage and Retrieval: All session data, including raw video feeds, stress level reports, and enhanced video feeds, are securely stored in a centralized database. This

ensures that healthcare providers have access to comprehensive records, enabling them to make informed decisions about the patient's treatment plan.

6. Doctor Interaction and Visualization: The healthcare provider or doctor can access the data and analytics through a web application. This component allows the doctor to visualize the patient's stress and anxiety levels, compare them with previous sessions, and make data-driven decisions regarding treatment. The doctor can also receive real-time updates during the session, ensuring that any critical changes in the patient's condition are addressed promptly.

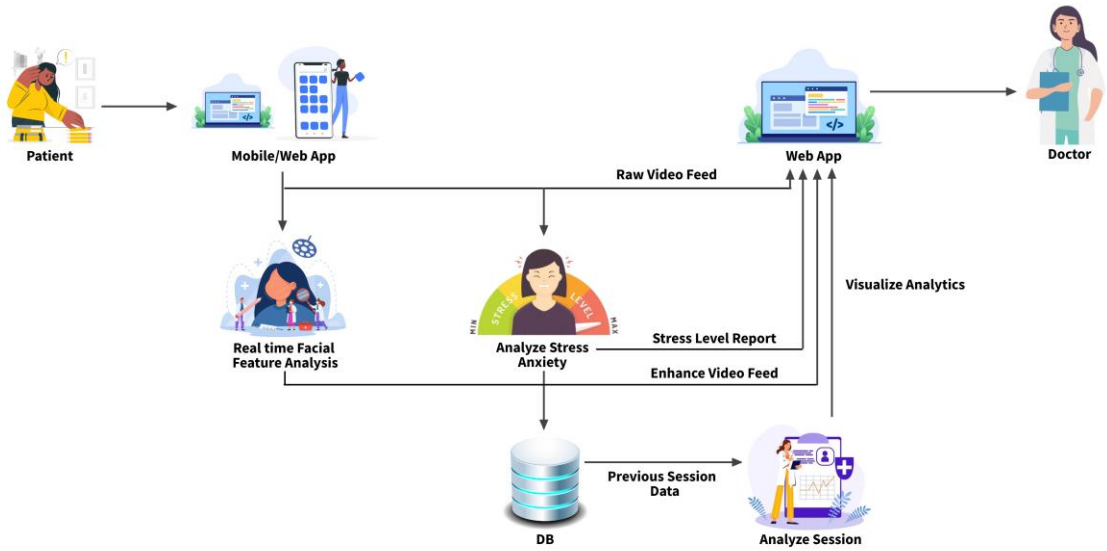

Figure 2 Individual Component Diagram

The diagram illustrates the flow of data between the patient, various analysis components, the database, and the healthcare provider. It highlights the system's capability to perform real-time facial analysis and stress detection, store and analyze historical data, and present this information to the doctor for further action. The system is designed to be responsive and adaptive, ensuring that patient care is both timely and personalized.

This innovative system enhances the ability of healthcare providers to monitor and manage patient stress and anxiety levels, making it a powerful tool in the treatment of mental health conditions.

3.4 SOFTWARE ARCHITECTURE

The software architecture for the proposed system is designed with a focus on delivering a robust, scalable, and efficient solution for managing and enhancing therapy sessions, specifically in the context of ERP (Exposure and Response Prevention) therapy. The architecture follows a structured approach, leveraging the principles of the Software Development Life Cycle (SDLC) to ensure that each phase of development is meticulously planned and executed, aligning with the overall objectives and user requirements.

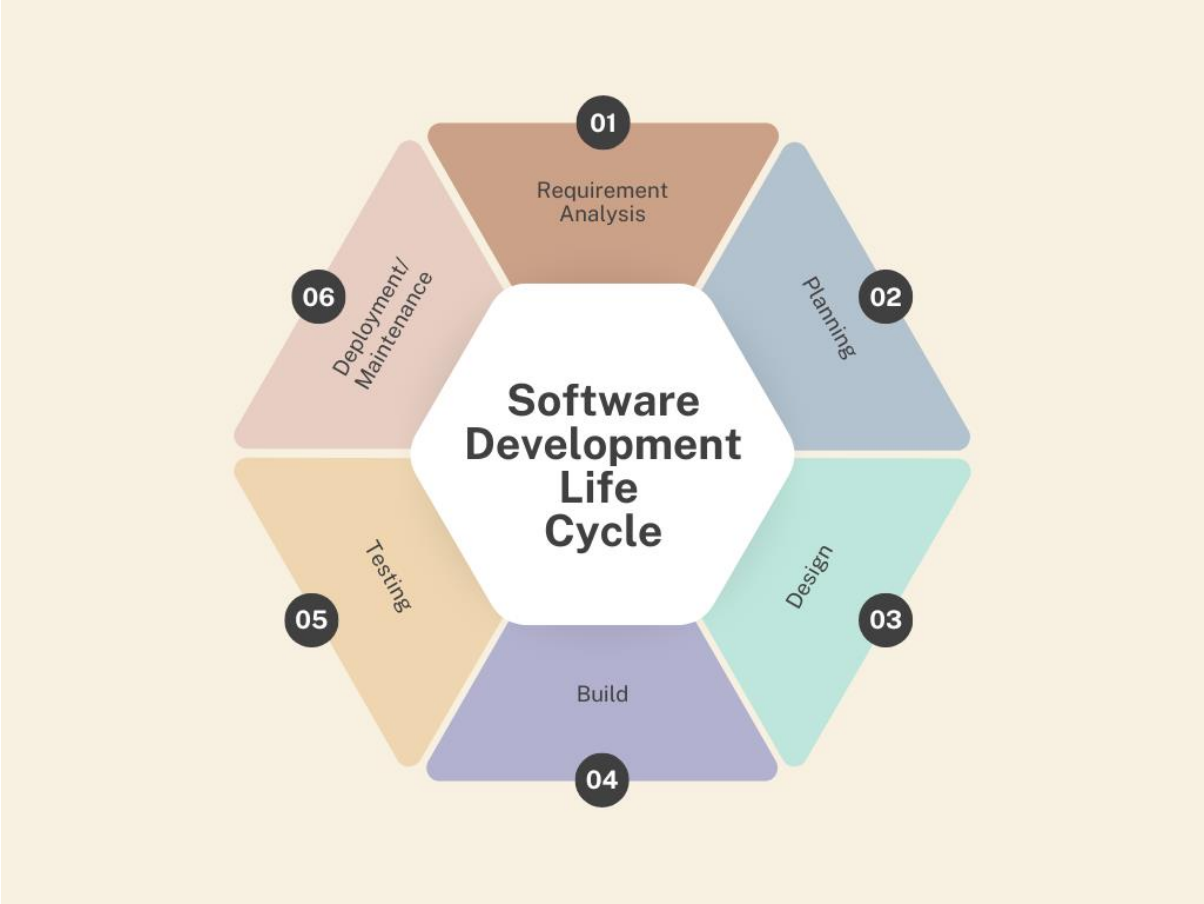

Figure 3 Software Development Life cycle

The SDLC process is broken down into five key phases, each of which plays a critical role in the development of the software:

- Project Planning
    - Define the project's scope, goals, and objectives.

    - Identify the necessary resources, including technology stacks, tools, and team members.
    - Develop a comprehensive project timeline, including milestones and deliverables.
- Analysis
    - Conduct a thorough analysis of existing therapy processes and tools, focusing on ERP therapy.
    - Identify specific challenges faced by therapists and patients, particularly in remote settings.
    - Gather data on user needs, regulatory requirements, and technological constraints.
    - Establish clear requirements for the software, ensuring alignment with therapeutic goals.
- Design
    - Develop a detailed design blueprint for the system, including both the backend architecture (e.g., database schema, AI algorithms) and frontend interfaces (e.g., mobile and web applications).
    - Integrate the analysis data into the design to ensure that the system meets the specific needs of therapists and patients.
    - Define the software architecture, including the choice of cloud services, databases, and AI tools that will be utilized.
    - Create a user-centered design for the interface, ensuring that it is intuitive, accessible, and tailored to the needs of both patients and therapists.
    - Design algorithms for real-time facial analysis, stress level detection, and adaptive feedback based on ERP responses.
    - Consider scalability, security, and performance in the architectural design to ensure the system can grow and evolve as needed.
- Implementation
    - Develop the software components according to the design specifications, including AI-driven tools for real-time analysis, personalized intervention, and remote therapy management.
    - Implement and integrate AI models for facial feature analysis and stress detection within the therapy sessions.

    - Conduct rigorous testing to ensure each component of the system functions correctly, addressing any bugs or issues that arise.
    - Prepare comprehensive documentation and user guides to facilitate easy adoption by therapists and patients.
    - Train users on how to effectively use the system, ensuring they are comfortable with its features and capabilities.
- Maintenance
    - Continuously monitor the system to ensure it remains functional and up-to-date.
    - Address any issues that arise post-deployment, providing timely updates and improvements.
    - Gather user feedback to inform future enhancements and updates.
    - Ensure the system remains compatible with new devices and technologies as they emerge.
    - Regularly review and update the AI models and algorithms to incorporate the latest advancements in the field and improve therapy outcomes.

3.5 REQUIREMENT GATHERING AND ANALYZING

Survey Results

A survey was carried out among therapists, patients, and healthcare administrators to ascertain the requirements and challenges posed by conducting remote ERP therapy sessions. The key requirements arising out of this survey were the need for real-time patient monitoring, seamless integration with existing ERP systems, and maintenance of patient engagement in the case of remote sessions. Feedback also identified common concerns related to data privacy and the effectiveness of AI-driven interventions.

Meetings and Interviews

Interviews and meetings with mental health professionals, AI specialists, and developers of ERP systems helped understand the technical and therapeutic requirements of the solution

proposed. Such discussions provided useful insights pertaining to the current limitations of remote therapy and pointed out areas in which AI enhancements could make significant improvements to the outcome of therapy. This was instrumental input for the definition of technical specifications and functional requirements of the system.

Observations

In-person and remote live therapy sessions were observed to understand the pragmatic challenges that a therapist and a patient go through. Observations brought out critical features that the AI-infused video-conferencing system should have apart from tracking and responding to non-verbal cues, it had to manage session interruptions and be friendly. Further, practicalities on the integration of the AI system with existing ERP tools have been evaluated to ensure solution effectiveness and feasibility of adoption.

3.6WORK BREAKDOWN STRUCTURE (WBS)

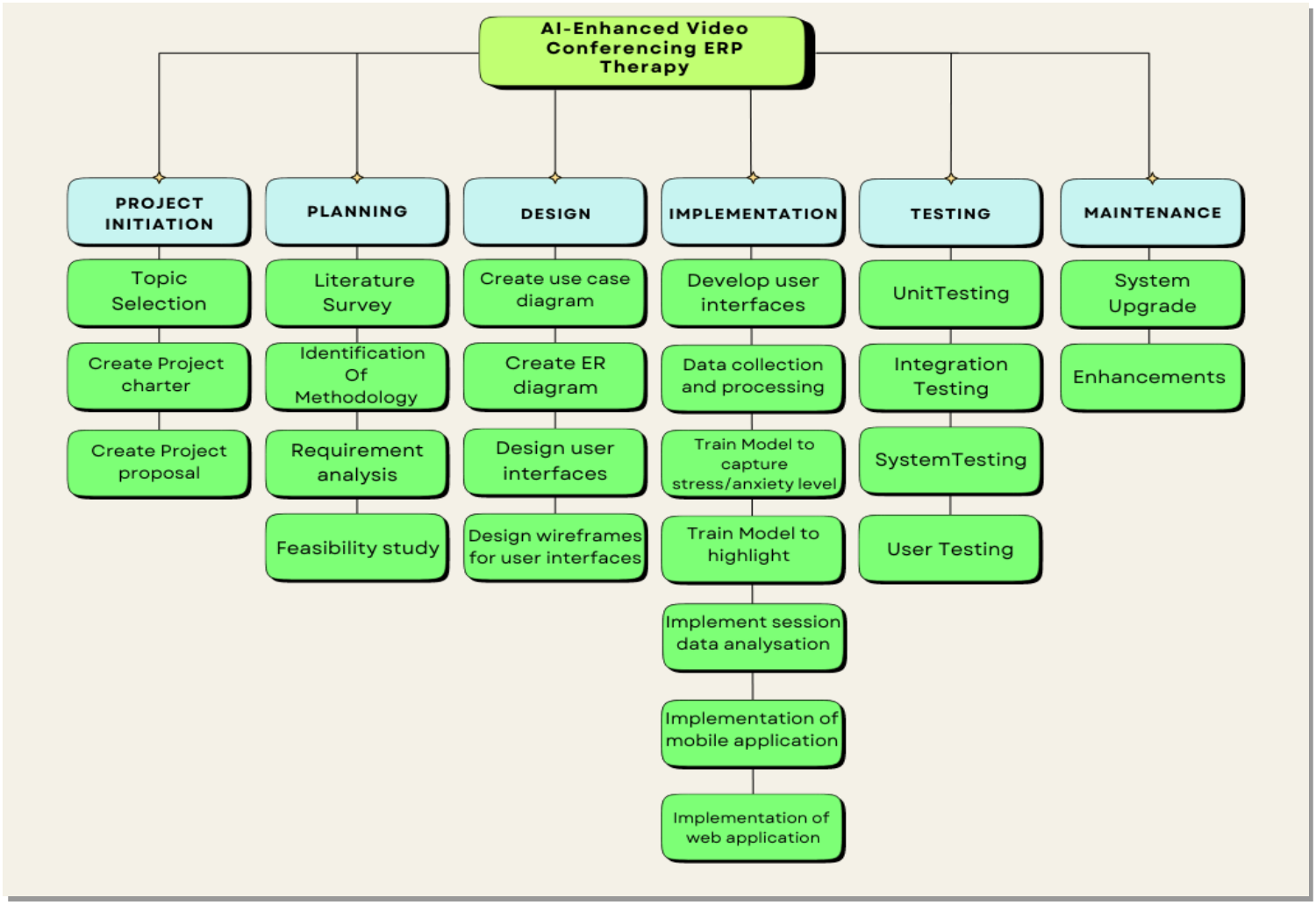

Figure 4 Work breakdown structure.

3.7 GANTT CHART

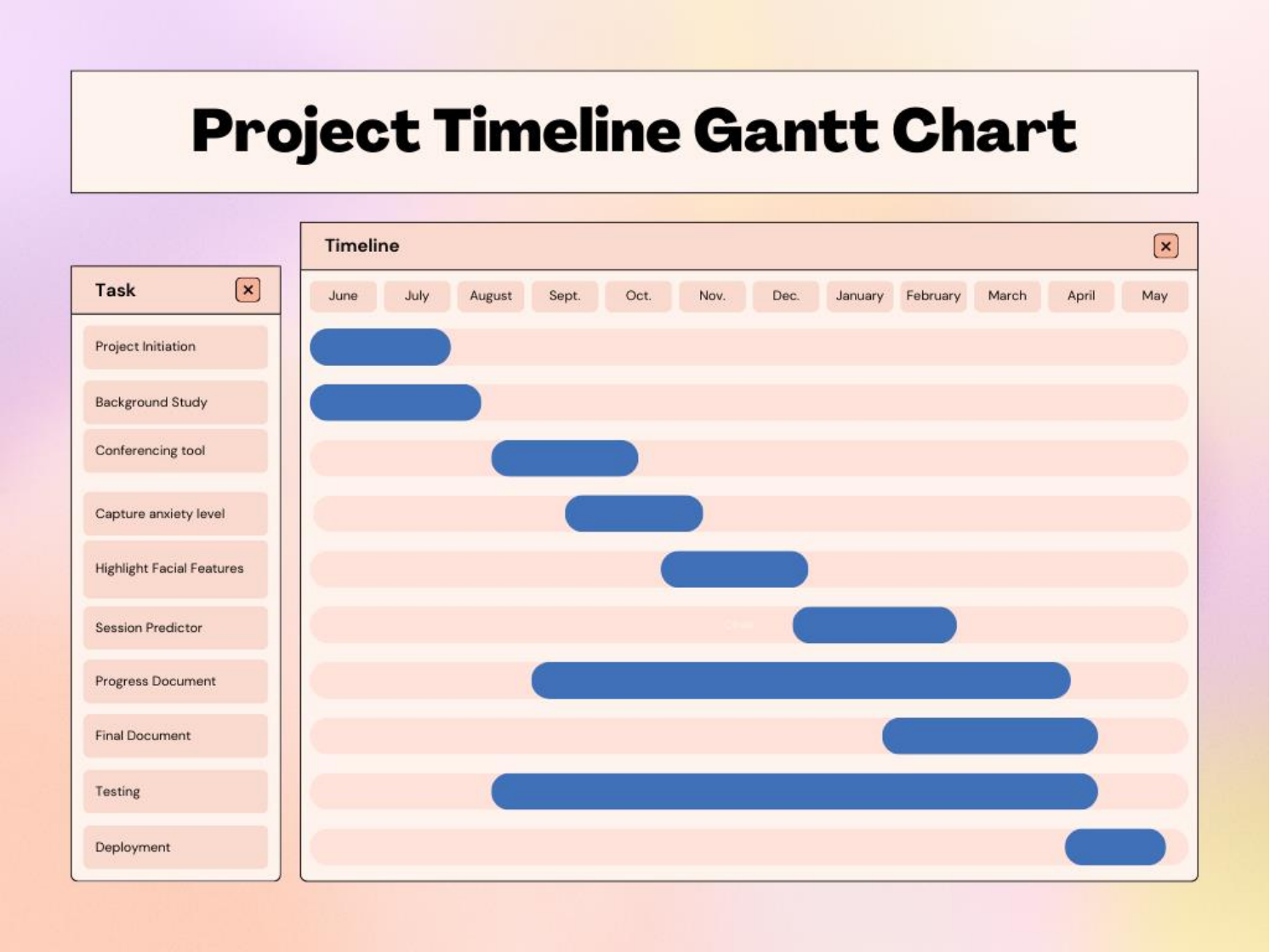

Figure 5 Project timeline Gantt Chart

4. PROJECT REQUIREMENTS

4.1 FUNCTIONAL REQUIREMENTS AND NON-FUNCTIONAL REQUIREMENTS

- **Functional Requirements**

    - The system should enable video conferencing capabilities for ERP therapy sessions, allowing therapists and patients to interact remotely in real-time.
    - Generate detailed metrics and predictive analytics reports based on patient interactions and behaviours during sessions. This will help in monitoring patient progress over time.
    - Display critical facial expressions and non-verbal cues alongside the live video feed, allowing therapists to make accurate assessments during the session.
    - The system should provide real-time feedback to therapists based on AI analysis, offering suggestions to improve the effectiveness of ongoing sessions.
    - Facilitate secure scheduling, notifications, and reminders for therapy sessions, ensuring both therapists and patients are consistently informed and engaged.
    - Ensure all patient data, including video streams and session analytics, is securely stored and complies with privacy regulations such as GDPR or HIPAA.

- Non-Functional Requirements
    - User-Friendliness: The system should offer an intuitive and easy-to-use interface that is accessible to users with varying levels of technical expertise. It should be compatible across different devices, including desktops, tablets, and smartphones.
    - Reliability: The system should be highly reliable, ensuring that video conferencing sessions run smoothly without interruptions. It should also safeguard against data loss, ensuring that all session information is securely stored and backed up.
    - Performance: The AI analysis and video conferencing features should operate with minimal latency, providing near-instant feedback and maintaining high video quality, even in conditions of varying network bandwidth.

- Security: The system must ensure the confidentiality and integrity of all patient data, employing robust encryption and access controls. It should comply with relevant healthcare data protection regulations, such as HIPAA.
- Scalability: The system should be designed to support a growing number of users, accommodating increased demand without compromising performance or reliability.
- Availability: The system should be available 24/7, allowing users to access therapy sessions and ERP tools at any time, with minimal downtime for maintenance or updates.

4.2 USER REQUIREMENTS

The three primary kinds of users within the AI-enhanced videoconferencing ERP therapy system will be as follows:

1. Therapist

- Conduct remote ERP therapy sessions with patients
- Access real-time AI-driven analysis of patient behavior and emotional states.
- Adjust therapeutic approaches during sessions based on AI feedback.
- Schedule therapy sessions.
- Utilize the video feed with highlighted facial features

2. Patients

- Log into the system remotely to attend therapy sessions from home or other locations.
- Use a user-friendly interface to easily join sessions, interact with therapists, and receive feedback.
- Benefit from AI features that enhance engagement through real-time cues and suggestions, ensuring effective and interactive therapy.

4.3 SYSTEM REQUIREMENTS

The system requirement describes those software and hardware resources the AI-Enhanced Video Conferencing ERP Therapy system would need for proper functioning. The requirements necessary for the system are outlined below.

Video Conferencing Platform: The video conferencing platform shall be a robust one like Zoom, WebRTC, or Microsoft Teams integrated right into the ERP system in order to conduct real-time therapy sessions.

It will make use of Artificial Intelligence and machine learning libraries like TensorFlow and Keras to undertake video stream analysis in order to determine the state of engagement and emotions of the patient during the therapy sessions.

Backend Server: Backend management for operations like handling AI model requests and data processing would be done using either Flask.

Database: A secure, scalable database is required to store session data, user information, and the results of the AI analysis.

User Interface: A responsive and intuitive user interface will be developed for therapists and patients React framework, ensuring both accessibility and ease of use on different hardware devices. Security protocols: System security, along with SSL/TLS encryption, OAuth for user authentication, and regular security audits, will be set up, and sensitive patient data will be protected.

- Cloud Infrastructure: The system should be hosted on the cloud - for example, AWS or Azure - to make the service highly available, automatically scalable, and resilient, especially in handling a great number of users concurrently.

4.4 USE CASE DIAGRAM

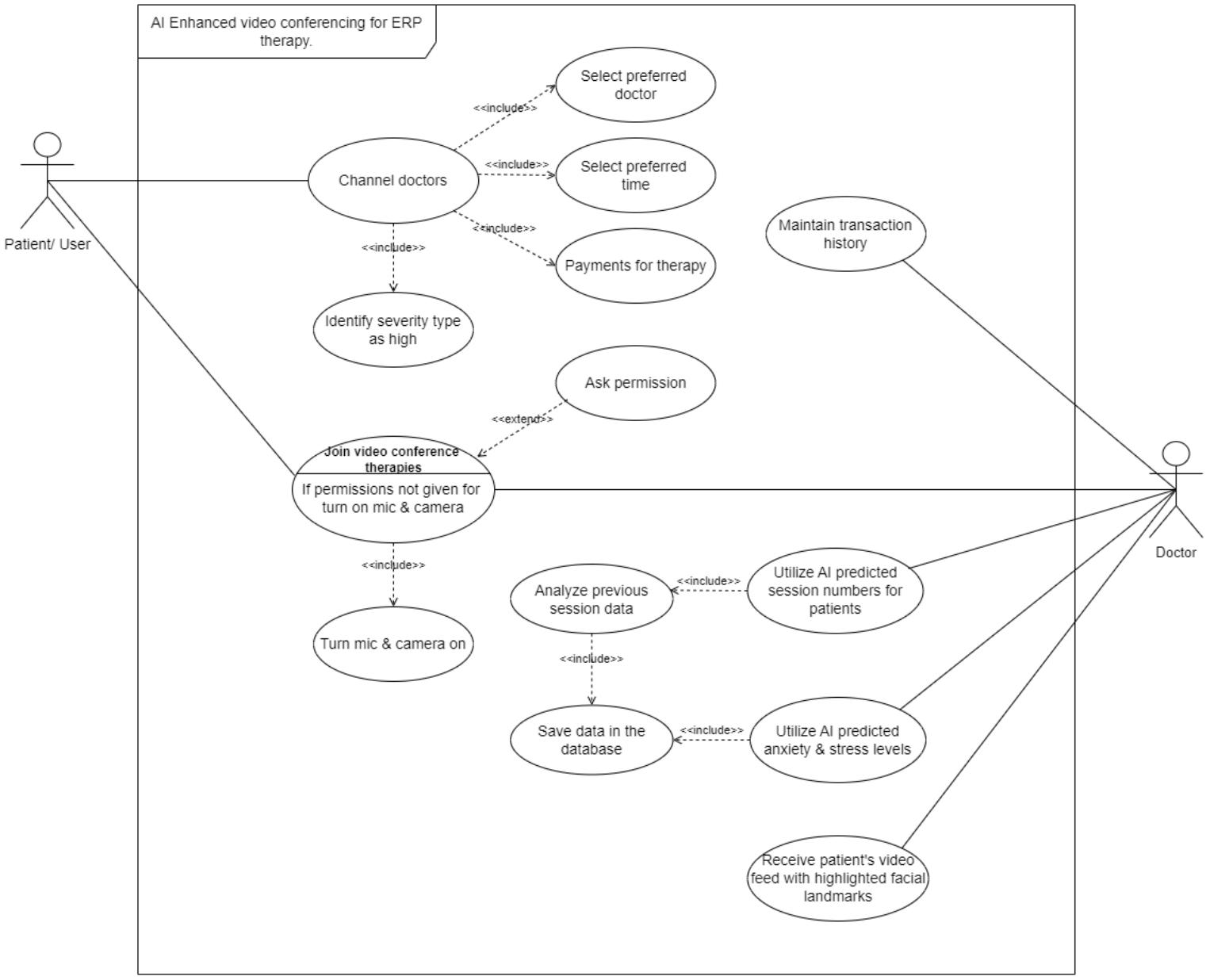

Figure 6 Use Case Diagram

4.5 TECHNOLOGY AND TOOL SELECTION

Selection of technologies and tools in AI-Enhanced Video Conferencing ERP Therapy system is critical for its effectiveness, scalability, and user accessibility. Based on compatibility, performances and meeting the requirements of the system, following technologies and tools have been chosen:

Video Conferencing Platform: WebRTC has been chosen for video conferencing since it is open source, supports real-time communication, and can be integrated with web-based applications easily. It provides low-latency video and audio streams, so it's perfectly suitable for interactive therapy sessions.

- AI and Machine Learning: TensorFlow and Keras are picked for building models that will be used in analysing real-time video streams. These frameworks have very rich support, extensive libraries, and are well-optimized both for performance and usability, fitting for the detection of patient engagement and emotional states during sessions.

Back-end Framework: Flask – Because of simplicity, flexibility, and the ability to perform a whole set of tasks—from handling AI model requests to data processing Flask is chosen for back-end development. Since this is lightweight, Flask allows fast development and is easy to integrate with other components of the system.

Database: MongoDB will be the database system in use here because of its emphasis on reliability, integrity of data, and scalability. Among the key powers it has is the handling of complex queries quickly, making it very suitable for managing all data pertaining to the system, such as patient information, session logs, and AI analysis results.

Frontend Development: The frontend will be done using React, which is able to provide a responsive and user-friendly interface. The component architecture of React makes it optimal for developing an interactive interface that can give seamless performance across desktops, tablets, and even smartphones.

Cloud Infrastructure: AWS, since it offers an integrated collection of services required in cloud computing, storing, and machine learning. Its infrastructure is spread across the globe, and its

scalability will sustain high loads on the system, reliably rendering service to users around the globe.

Security Tools: OAuth 2.0 and SSL/TLS encryption are chosen for secure authentication of users and transmission of their data. These technologies are the industry standard in securing sensitive information, from healthcare applications down to other applications.

4.6 TEST CASES

Preliminary identified test cases below ensure that the system is operable in AI-Enhanced Video Conferencing ERP Therapy, which may be refined throughout the project depending on further detailed requirements of the system.

1. Video Conferencing Initialization Test Case

a. Objective: Video Conferencing initialization to ensure that the system connects both the therapist and patient.

- Scenario: Initiate a video conference from the ends of the therapist and the patient. Ensure that each end shows no delay in the input and output.
- Expected Output: The streams of video and audio should be initialized in less than 5 seconds. There should be no detectable lag or sign of connection loss.

2. Test Condition 2: AI-Based Video Streams Analysis

Objective: Make sure that the AI gives a correct assessment of the video streams to the patient's engagement and emotional states. Procedure: Simulate different levels of patient engagement: attentive working, or emotionally distressed, across a session. Make sure that AI is giving proper, real-time feedback to the therapist.

- Desired outcome: It is expected that the AI correctly identifies and reports the patient's engagement level and emotional state, with 3 seconds of noticing a change.

3. Test Case 3: Integration with the ERP System

- Objective: Test that session data is logged properly and integrated into the ERP system.

- Procedure: Conduct a therapy session, record some notes, and save the session. Verify all data was appropriately stored and accessible through the ERP system.
Output: Session data, including notes and recordings, from all sessions are received by the ERP system within 2 minutes of completion.

4. Test Case: Security and Privacy Compliance

Objective: The system under test complies with the set regulations concerning data security and privacy.
Procedure: Allow unauthorized access to the system and view all patient data. Then, check whether the system allows this view or whether it has some security measures that prevent this. Simulate data breaches and check what response the system generates.

Expected Result: No possibility of unauthorized access; administrators warned in case of a potential breach of security. All patient data remains encrypted and secure.

5. Test Case: Cross-Platform Usability

The objective of the test is to prove that this system can work seamlessly across different devices and operating systems.

Procedure: The system shall be tested across various devices, including desktops, tablets, and smartphones, with different operating systems like Windows, macOS, Android, and iOS. All functions must be operable, and the UI responsive.

- Expected Result: The system shall work equally well with all devices and OS versions tested, and the interface shall be easy to use without any broken functionality.

6. Test Case : System load performance

- Objective: To determine the performance of the system during heavy user activity.

Procedure: Run several therapy sessions simultaneously, like 50-100 concurrent users, and track the response time of the system, video quality, and speed of AI processing.

Expected Result: The system shall keep up performance with minimal degradation; that means it can handle high user loads without significant delays or crashes.

4.7. WIREFRAMES

Figure 7 Wireframe 1

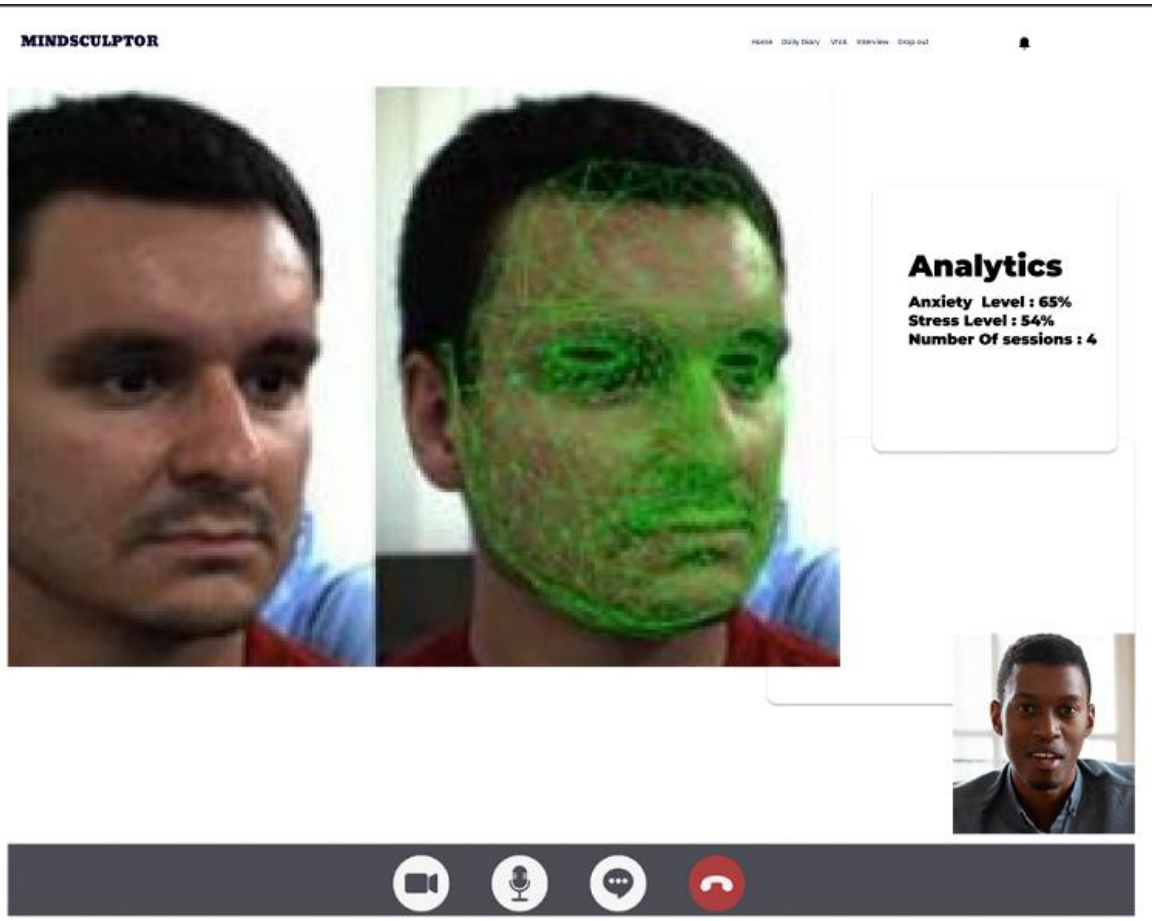

Figure 8 Wireframe 2

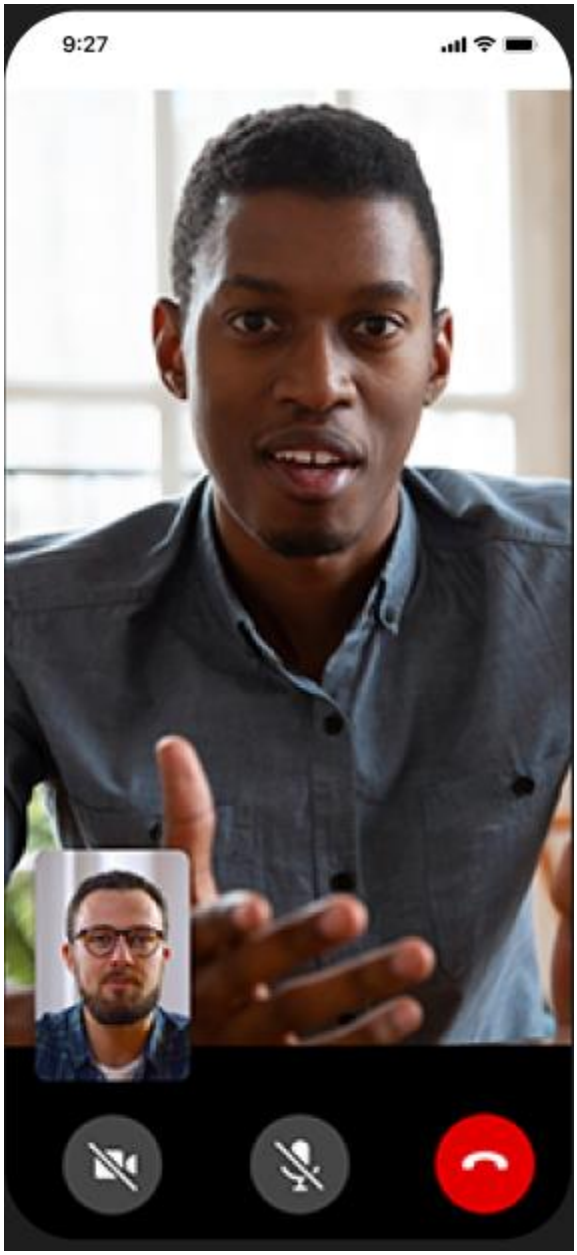

Figure 10 Wireframe 3

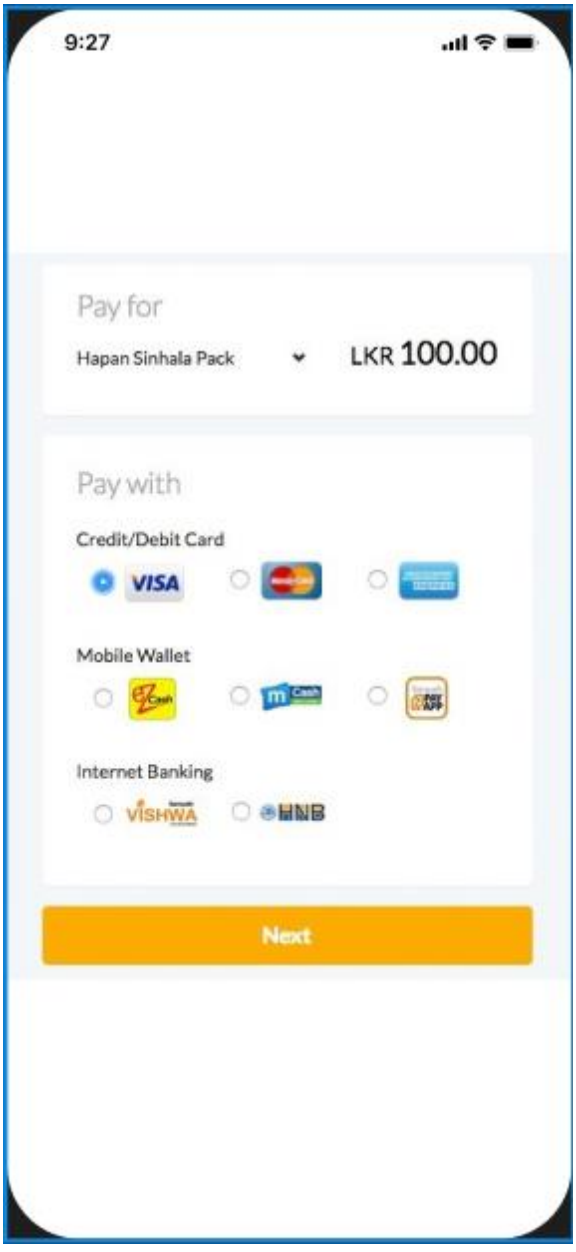

Figure 9 Wireframe 4

5. BUDGET AND BUDGET JUSTIFICATION

Component	Description	Price
Development Costs	Salaries for developers, designers, and managers	Rs. 300,000 (one-time)
AI & NLP Tools	Licenses/subscriptions for AI and NLP tools	Rs. 10,000 / year
Biometric Analysis Tools	Tools and libraries for biometric analysis	Rs. 5,000 (one-time)
Cloud Services	Cloud storage and computing power	Rs. 15,000 / year
App Maintenance	Ongoing maintenance and updates	Rs. 15,000 / year
Marketing & Promotion	Digital advertising and promotional events	Rs. 25,000 / year
Customer Support	Support staff salaries and tools	Rs. 20,000 / year
Compliance & Security	Data privacy and security compliance	Rs. 7,000 / year
Training & Documentation	Training materials and user guides	Rs. 4,000 (one-time)
Research & Development	Ongoing R&D for feature improvements	Rs. 12,000 / year

Table 2 Budget and Budget Justification

6. COMMERCIALIZATION

Target Audience

1)Individuals with OCD

- Demographics: Adults and adolescents diagnosed with OCD.
- Needs: Access to effective therapy, personalized treatment plans, and flexible therapy options.
- Pain Points: Stigma, geographical barriers, cost, and infrequent therapist availability.

2)Mental Health Professionals

- Demographhics :Therapists, psychologists, and psychiatrists specializing in OCD and related disorders.
- Needs: Tools for effective patient management, enhanced treatment delivery, and remote therapy capabilities.
- Pain Points: Limited time for each patient, difficulty in tracking progress, and need for scalable solutions.

3)Healthcare Institutions

- Demographics :Clinics, hospitals, and mental health facilities.
- Needs: Integrated solutions for patient care, data management, and evidence-based treatment.
- Pain Points: Managing large patient volumes, integrating new technologies, and ensuring data privacy.

Marketplace

- Mental Health Apps Market
- Digital Therapy Solutions

7. REFERENCES

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[3] D. Darnell, M. D. Pullmann, T. D. Hull, S. Chen, and P. Areán, “Predictors of Disengagement and Symptom Improvement Among Adults With Depression Enrolled in Talkspace, a Technology-Mediated Psychotherapy Platform: Naturalistic Observational Study,” *JMIR Formative Research*, vol. 6, no. 6, p. e36521, Jun. 2022, doi: https://doi.org/10.2196/36521.

[4]K. G. Lockwood *et al.*, “Evaluating a New Digital App–Based Program for Heart Health: Feasibility and Acceptability Pilot Study,” *JMIR Formative Research*, vol. 8, pp. e50446–e50446, May 2024, doi: https://doi.org/10.2196/50446.

7. Appendices

Meeting with Dr. Roshan Fernando (Psychiatrist): Our team had the privilege of meeting with Dr. Roshan Fernando, a psychiatrist, to deepen our understanding of the clinical aspects of our research. During this meeting, we discussed the project's objectives and benefited from his expert advice on the psychiatric evaluation of OCD. A photograph from the meeting is included, along with the hospital appointment letter confirming our consultation.

RECEIPT

REFERENCE NO.	:	41499002
APPOINTMENT DATE	:	**July 2, 2024**
APPOINTMENT TIME	:	Tue 08:40 PM (Time may vary according to doctor's arrival time)
APPOINTMENT NO.	:	**021 (Active)**
HOSPITAL	:	LEESONS HOSPITAL
PATIENT'S NAME	:	Mr. PASINDU JAYASINGHE (Local)
PHONE NUMBER	:	714006675
NIC	:	200016000147
EMAIL	:	pasindujayasinghe@gmail.com
ROOM	:	131
DOCTOR NAME	:	**Dr. W. K. T. ROSHAN FERNANDO** (Psychiatrist)
PAYMENT DATE	:	2024-07-01 11:45 PM
SOURCE	:	Doc990 (Web)
DOCTOR CHARGES	:	2600.00 LKR
HOSPITAL CHARGES	:	700.00 LKR
BOOKING CHARGES	:	195.00 LKR
TOTAL CHARGES	:	**3395.00 LKR**
HOSPITAL REFERENCE	:	LHR0001931781
HOSPITAL ADDRESS	:	No. 33, Thewatta Road, Ragama, Sri Lanka
HOSPITAL CONTACT NUMBER	:	011 296 1300
HOSPITAL EMAIL	:	leesons@sltnet.lk

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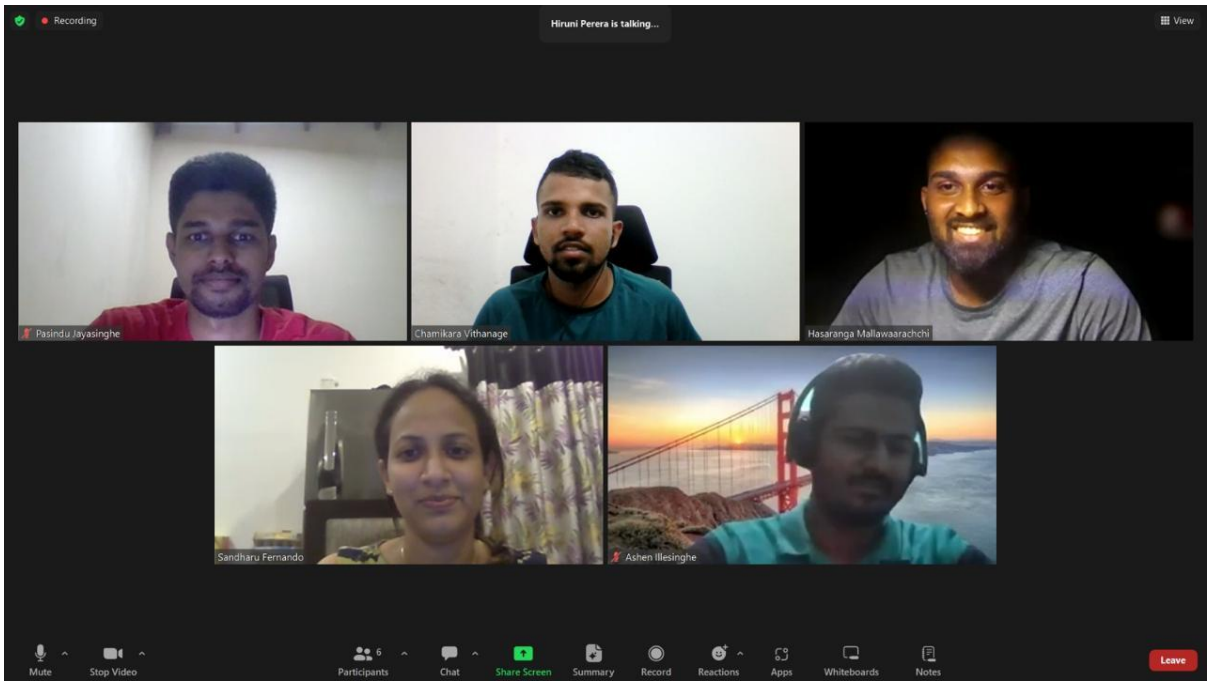
Online Meeting with Miss Sandaru Fernando (Psychologist): We also held an online meeting with our external supervisor, Miss Sandaru Fernando, a psychologist, who provided us with valuable psychological insights pertinent to our research. Her expertise was crucial in refining our approach to the psychological assessment and intervention methods for OCD.



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