

Mind Sculptor

An Obsessive-Compulsive
Disorder(OCD) Exposure and Response
Prevention(ERP) Therapy Tool

24-25J-046



Our Team



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INTRODUCTION

- Obsessive-Compulsive Disorder(OCD) is a chronic psychiatric condition characterized by persistent intrusive thoughts (obsessions) and repetitive behaviors (compulsions).
- It affects approximately 2-3% of the population and significantly impairs daily functioning and quality of life.
- Traditional ERP therapy is effective but limited by accessibility and engagement challenges.
- A comprehensive OCD ERP tool with advanced biometric monitoring and AI-driven therapeutic interventions has been identified as a valuable resource for enhancing the accessibility and effectiveness of obsessive-compulsive disorder treatment



Research Problem

- ❖ How can AI and voice analysis improve the identification of OCD presence, subtypes and severity levels?
- ❖ In what ways can biometric data and machine learning algorithms be used to create tailored ERP therapy plans for individual patients?
- ❖ How can AI-supported Interactive Voice Assistant(IVA) increase patient engagement and accessibility to ERP therapy, particularly for those with logistical or psychological barriers?



Research Objectives

Main Objective

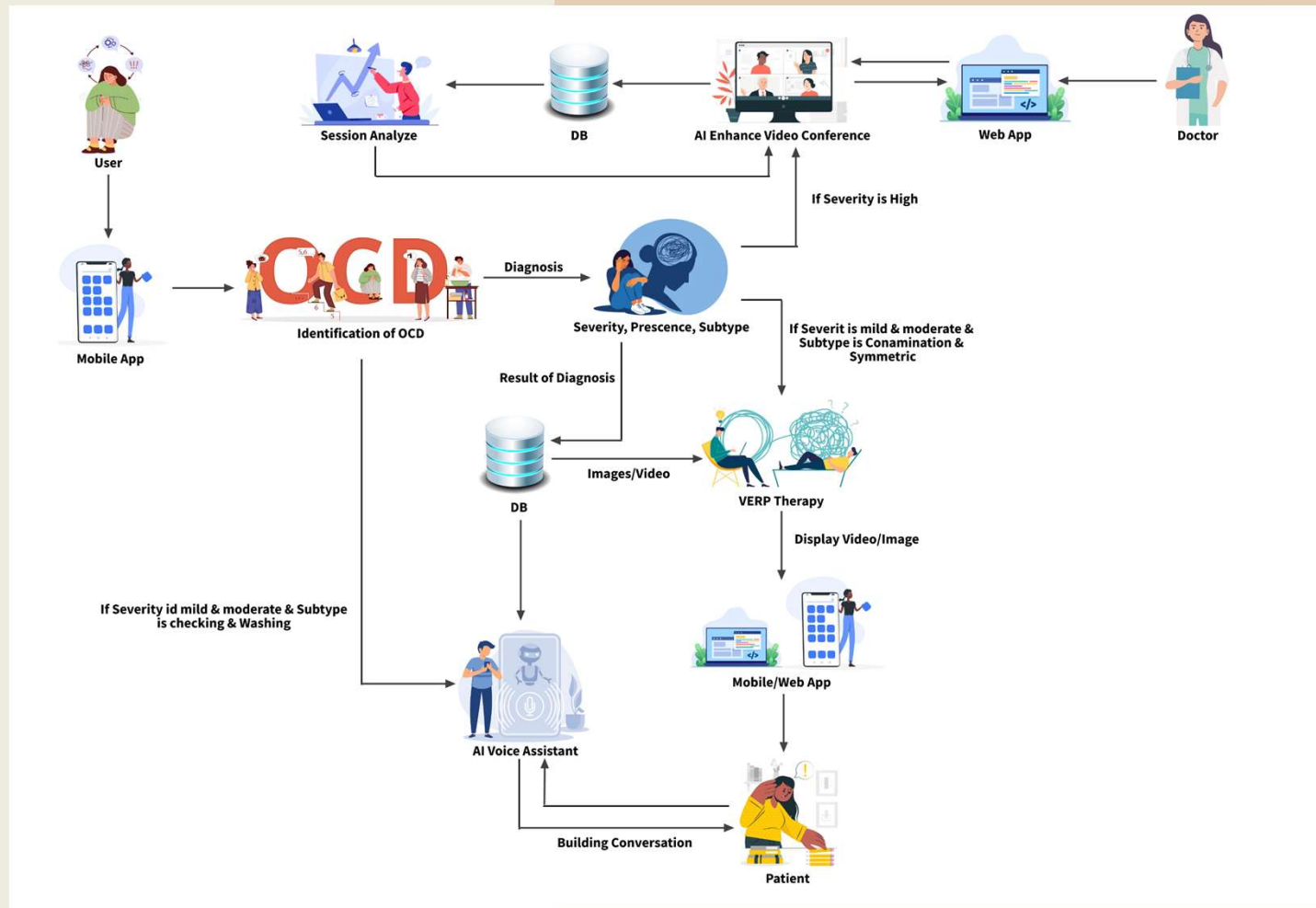
- ❖ Develop an Exposure and Response Prevention(ERP) Therapy tool for patients suffering from OCD.



Sub Objectives

- ❖ To enhance the diagnosis and understanding of OCD subtypes
- ❖ To develop personalized and adaptive ERP therapy plans
- ❖ To create AI-supported Interactive Voice Assistant(IVA)
- ❖ To enable remote and real-time monitoring of therapy sessions

System Diagram



Psychology Experts

Dr. Roshan Fernando:

- ❖ Psychiatrist guiding the overall research project, providing insights into OCD diagnosis and treatment

Ms. Sandaru Fernando:

- ❖ Psychologist assisting in the development of the dataset and providing expertise in psychological assessment.

Data Collection



KEY MOMENTS WITH PSYCHOLOGY EXPERTS

Feedback for PP1 comments from supervisors



A screenshot of a receipt from Doc990, a service powered by Dialog. The receipt is titled 'RECEIPT' and contains the following information:

Doc990
www.doc.lk
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RECEIPT

REFERENCE NO. : 45339277

APPOINTMENT DATE : March 13, 2025

APPOINTMENT TIME : Thu 03:19 PM (Time may vary according to doctor's arrival time)

APPOINTMENT NO. : 008 (Active)

HOSPITAL : NAWALOKA HOSPITAL - NEGOMBO

PATIENT'S NAME : Mr. PASINDU JAYASINGHE (Local)

PHONE NUMBER : 714300675

NIC : 200016000147

EMAIL : pasindujayasinghe@gmail.com

DOCTOR NAME : Dr. W. K. T. ROSHAN FERNANDO (Psychiatrist)

PAYMENT DATE : 2025-03-09 04:38 PM

SOURCE : Doc990 (Web)

DOCTOR CHARGES : 2500.00 LKR

HOSPITAL CHARGES : 1250.00 LKR

BOOKING CHARGES : 299.00 LKR

TOTAL CHARGES : 4049.00 LKR

HOSPITAL REFERENCE : NN0002760717

HOSPITAL ADDRESS : No. 169, Colombo Road, Negombo, Sri Lanka.

HOSPITAL CONTACT NUMBER : 031 577 7777

HOSPITAL EMAIL : info.neg@nawaloka.com

TERMS & CONDITIONS

Please refer www.doc.lk/terms-and-conditions?appSite=0

Identification of presence, severity and subtype of OCD:

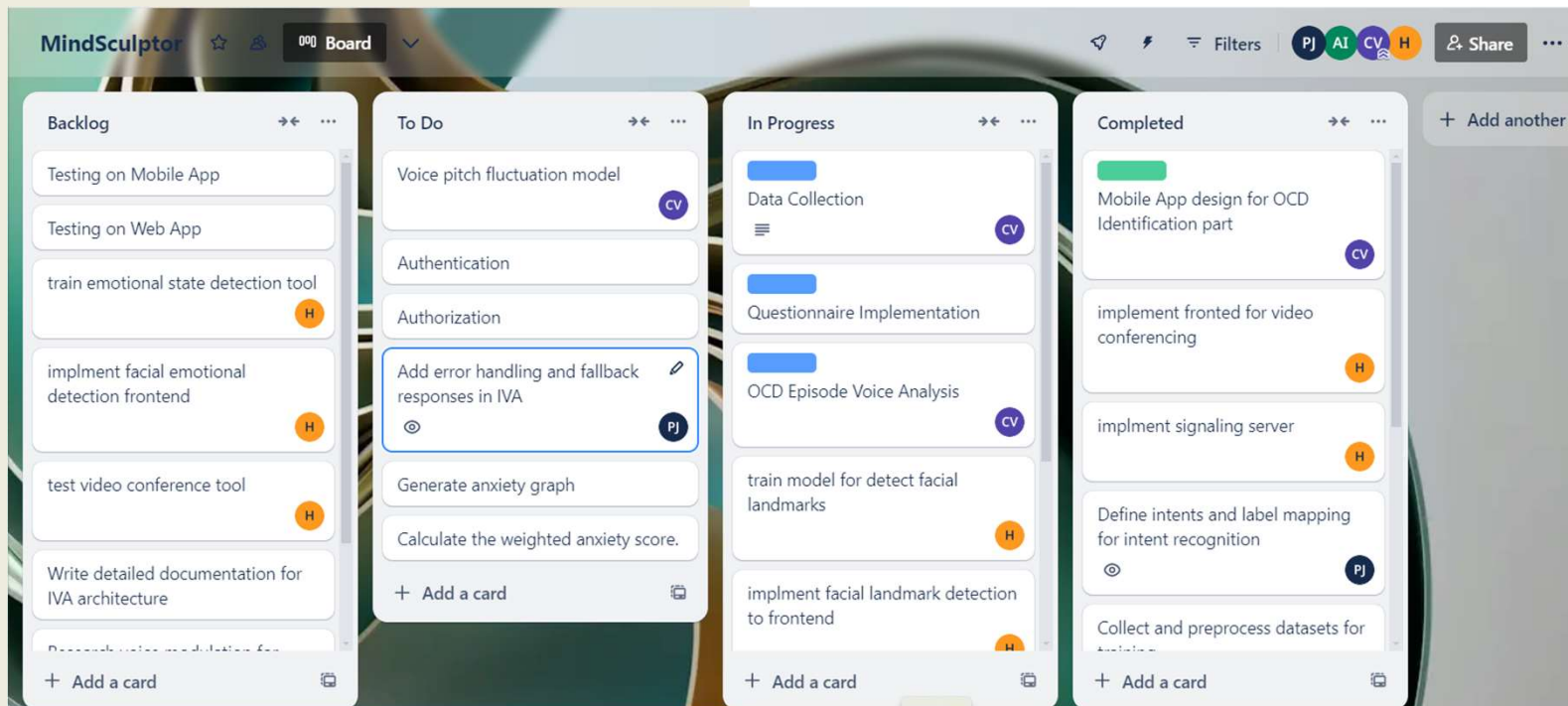
- ❖ Refined the dynamic questionnaire to enhance accuracy by incorporating feedback. Validated that the questions align with established standards for OCD assessment.

Video Conferencing ERP Therapy Tool:

- ❖ To ensure real-world applicability, anonymized anxiety related data from patients were analyzed to validate the system's predictive accuracy.

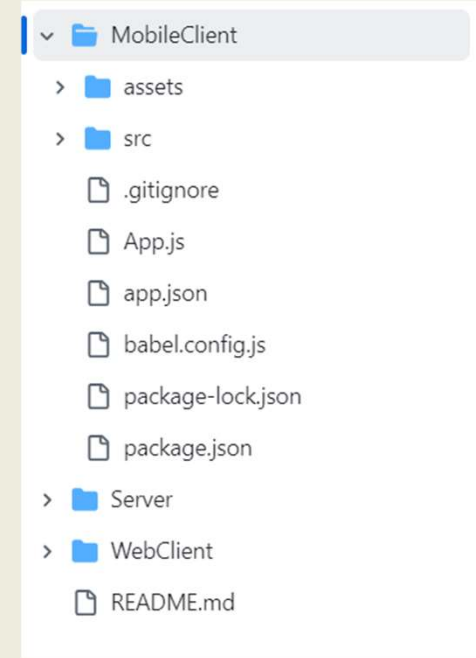
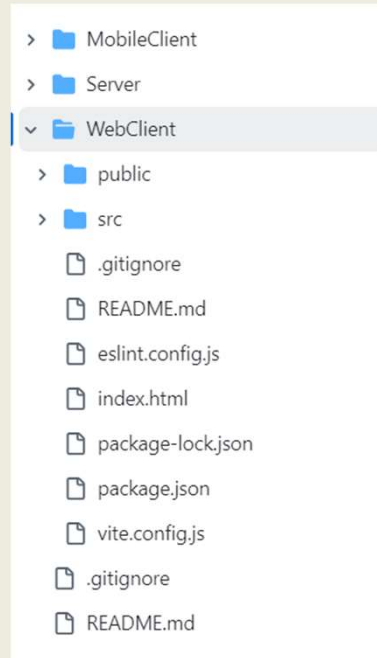
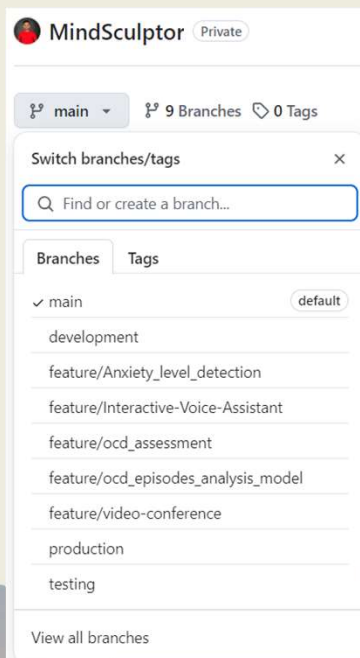
Best Practices Followed

- ❖ Proper usage of Comments.
- ❖ Project Management performed using Trello.

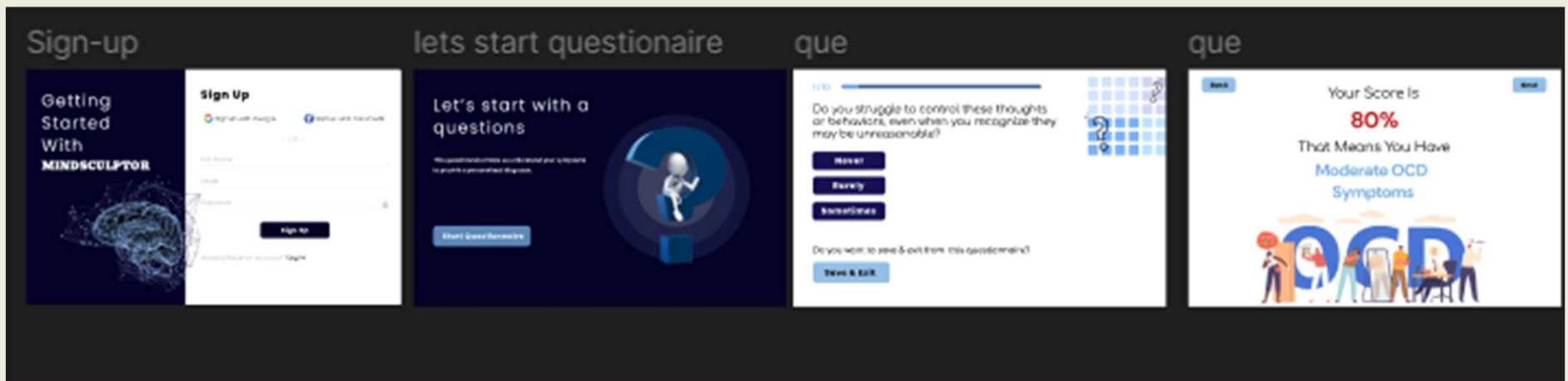


Best Practices Followed

❖ Optimized Feature-wise and Environment-wise branching



UI Design



UI Design



Identify the presence, severity, and sub types of OCD in patients



IT21219498 | Vithanage C.S.

Specialization: Software Engineering

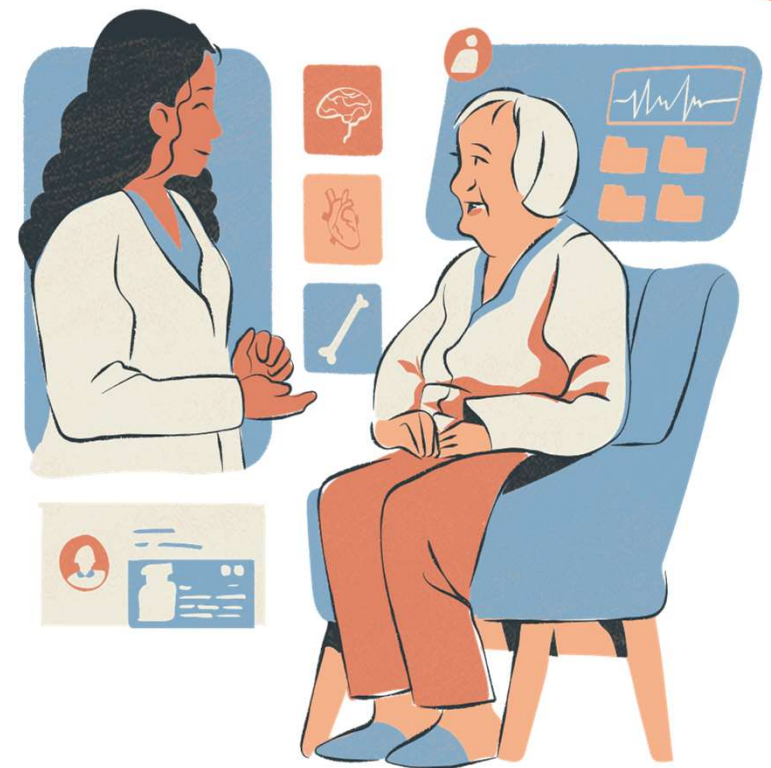
Introduction

Background on OCD

- ❖ Obsessive-Compulsive Disorder (OCD) is a mental health condition characterized by unwanted and intrusive thoughts (obsessions) and repetitive behaviors (compulsions).
- ❖ It affects individuals' daily functioning and quality of life.

Importance of the Study

- ❖ Identifying the presence, severity, and sub-types of OCD can lead to better diagnosis, treatment, and understanding of the disorder.
- ❖ Accurate assessment helps in providing tailored interventions and improving patient outcomes.



Research Questions

Primary Questions

- ❖ How can the presence of OCD be accurately identified in patients using modern technological methods?
- ❖ What are the most effective techniques to determine the severity of OCD symptoms?
- ❖ How can different sub-types of OCD be classified and differentiated in patients?

Secondary Questions

- ❖ Can voice recordings and speech analysis provide additional insights into OCD symptoms?
- ❖ What algorithms and techniques are most suitable for these assessments?



Objectives

Main Objective

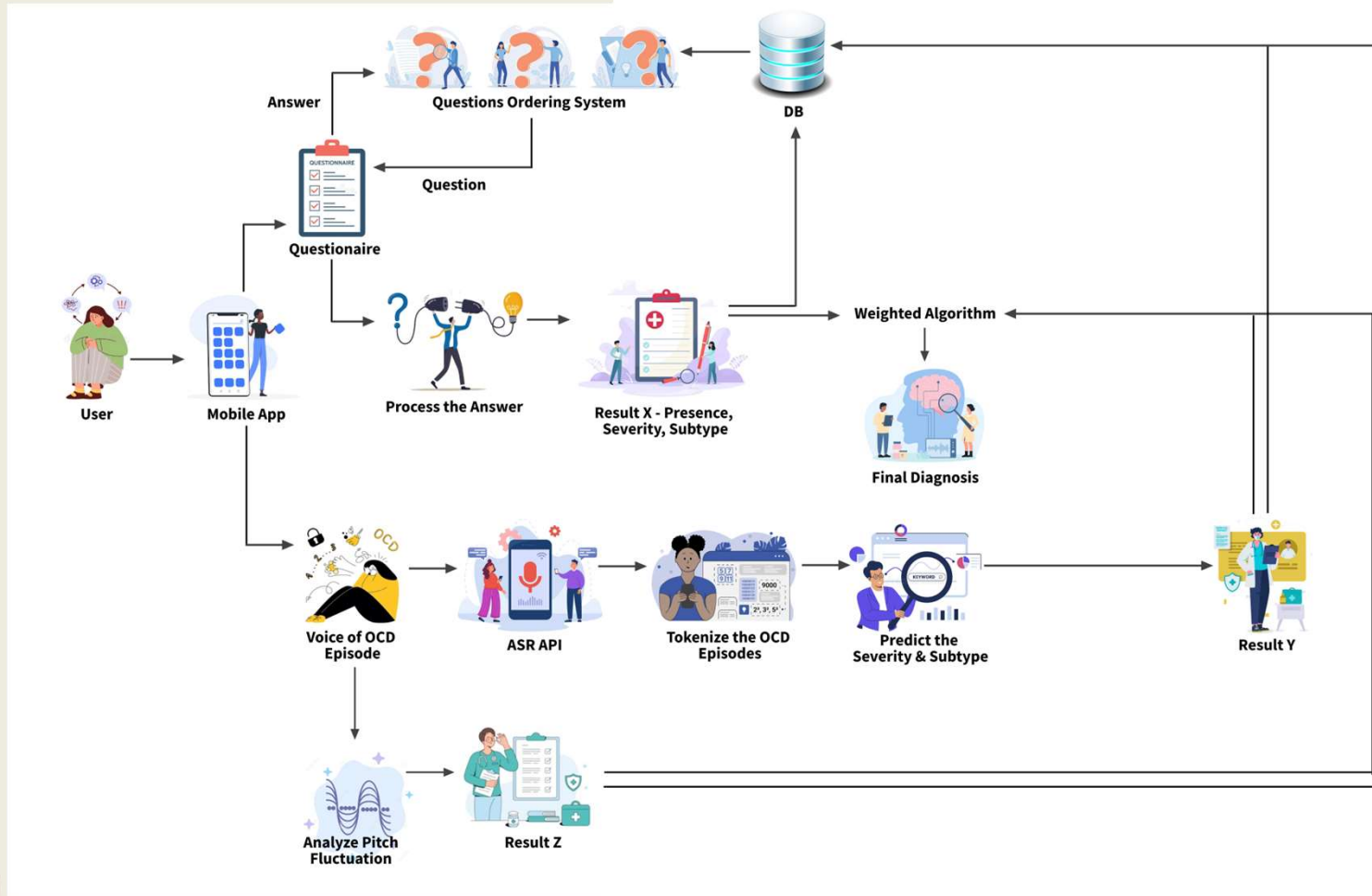
- ❖ **Develop a comprehensive assessment method for identifying the presence, severity, and sub-types of OCD in patients.**



Sub Objectives

- ❖ **Questionnaire-Based Assessment:**
Implement a dynamic questionnaire to provide a preliminary diagnosis based on user responses.
- ❖ **OCD Episodes Analysis:**
Leverages **BERT** for fine-tuned multi-class classification to identify OCD subtypes and severity levels from episode descriptions
- ❖ **Final Diagnosis:**
Combine results from all sub-components to produce a comprehensive OCD diagnosis.

Methodology – System Diagram



Methodology – Technologies, Techniques, Algorithms

Technologies

- React
- Python
- Flask
- MongoDB
- Matplotlib & Seaborn
- Jupyter
- Librosa
- NLTK
- Scikit-learn
- Hugging Face Transformers
- WordCloud

Techniques

- Speech recognition
- Fine-Tuning BERT
- Text Preprocessing

Algorithms

- BERT
- Weighted scoring algorithm

Methodology – Completion and Future Works

90% Completion of the component

- Created a Comprehensive Dataset
- Developed **BERT-based models** for predicting
- Implemented **dynamic questionnaire** based on Y-BOCS and OCI-R standards.
- Integrated Flask APIs for real-time predictions of subtype and severity.
- Integrated the dynamic questionnaire with Web App.
- Implement the Speech to Text Conversion of OCD episodes using ASR Api.
- Combined the results of Questionnaire, OCD Episode analysis and Voice Pitch Analysis.
- Implemented the UI Design and API Integrations.
- Integrate the sub components

10% Future Enhancements

- Test the application.
- Enhance the UI Design.
- Enhance the data privacy

Enhanced Exposure and Response Prevention Therapy



IT21286278 | Illesinghe A.T.
Specialization: Software Engineering

Introduction

Background

- ❖ Exposure and Response Prevention(ERP) therapy is commonly used treatment by psychiatrists for patients diagnosed with Obsessive-Compulsive Disorder(OCD).
- ❖ Exposure and Response Prevention(ERP) therapy, have proven effective in reducing symptoms and improving outcomes for OCD patients.
- ❖ Enhanced Exposure and Response Prevention(VERP) is an innovative approach to treating OCD patients.
- ❖ VERP uses advanced technology to simulate OCD-inducing scenarios and integrates biometric data to enhance the effectiveness of traditional exposure therapy.
- ❖ VERP can be used to treat patients with symmetric OCD, contamination OCD.



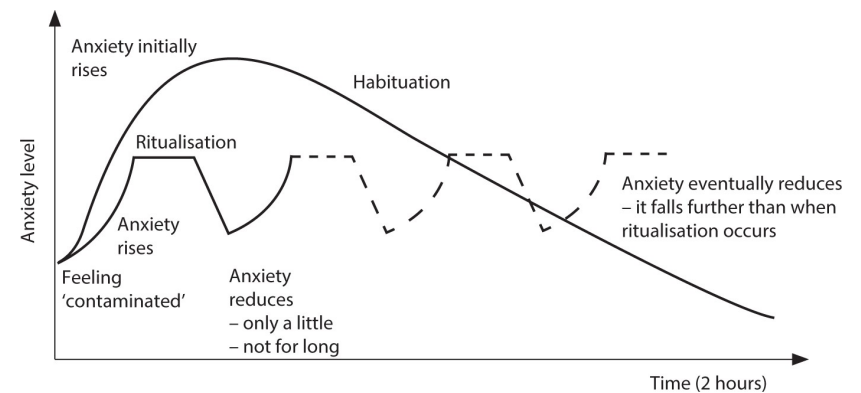
Introduction

Importance of the Study

- ❖ First, the patient is exposed to an OCD-inducing scenario using images/videos.
- ❖ Then the anxiety graph is generated using patient self-reported data and bio metric data.
- ❖ Patients can seek the therapy on their own without consulting a doctor and reduce the symptoms of the OCD.
- ❖ Patients can monitor the effectiveness of treatment by analyzing anxiety charts.



Contamination OCD



Anxiety graph

Research Questions

- ❖ How can we virtually expose patients to OCD inducing scenarios?
- ❖ How can response prevention therapy be implemented using modern technology?
- ❖ How can the accuracy of response prevention therapy be increased using modern technology?



Objectives

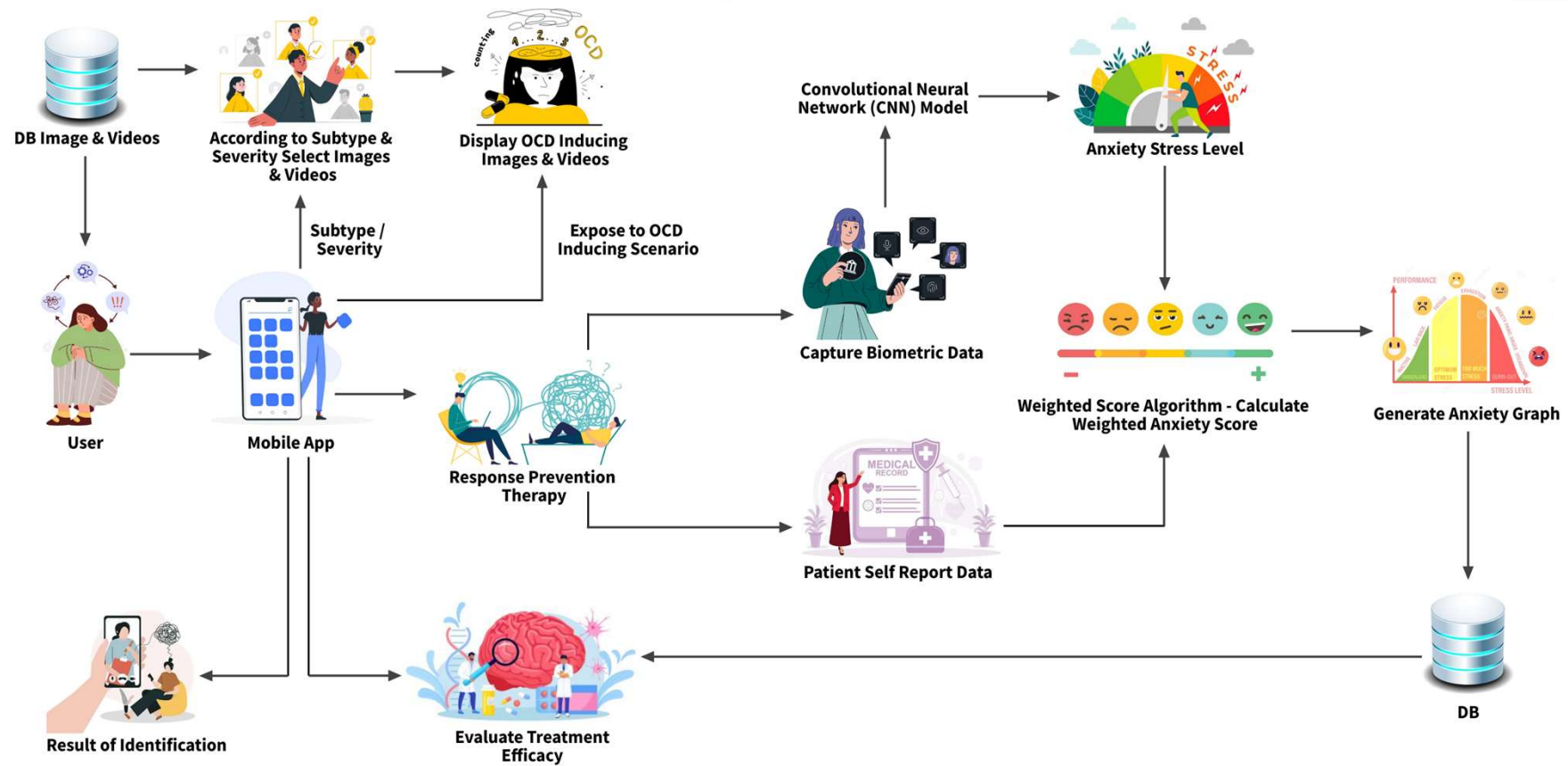
Main Objective

To develop a therapy system that utilizes virtual simulations and biometric data to effectively treat Obsessive-Compulsive Disorder (OCD).

Sub Objectives

1. Simulate real-life scenarios using tailored videos and images to expose the patient to OCD triggering scenario.
2. Capture biometric data and patient self-reported data during therapy session.
3. Generate the anxiety graph using captured biometric data and self-reported data.
4. Analyze anxiety graphs to predict the patient's treatment efficacy.

Methodology – System Diagram



Methodology – Technologies, Techniques, Algorithms

Technologies

- React Native
- TensorFlow
- Python Flask
- NodeJs
- MongoDB/Mysql
- Vscod
- Google Colab
- Keras

Techniques

- Facial recognition
- Emotion detection
- Machine learning
- Deep learning
- Graph visualization.

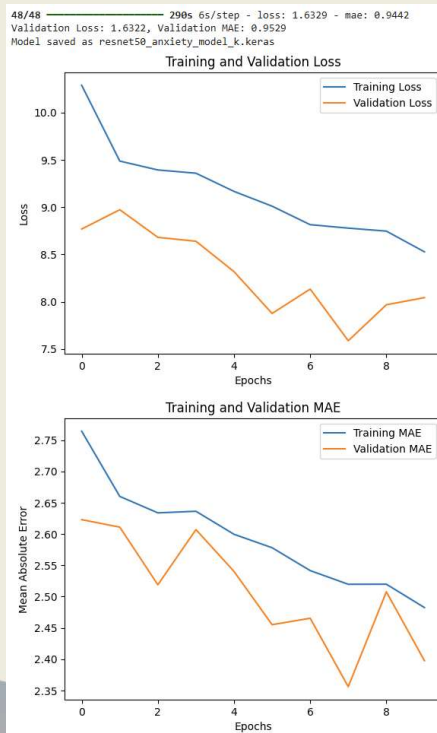
Algorithms

- Convolutional Neural Network (CNN)
- Decision Tree algorithm
- Weighted scoring algorithm

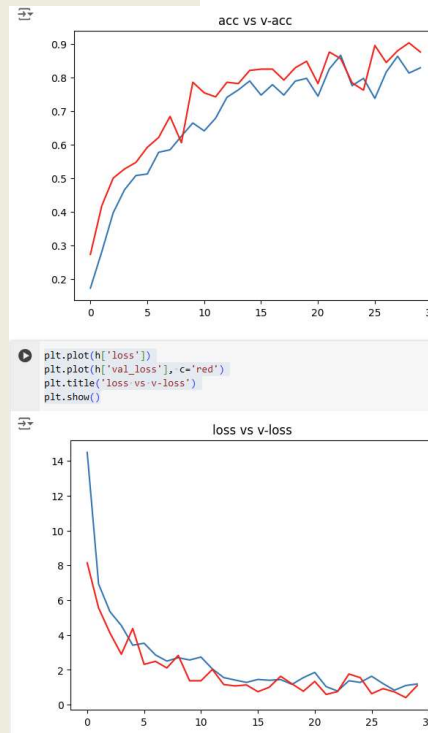
- CNN architectures
- MobileNetV2

CNN Architectures

ResNet50

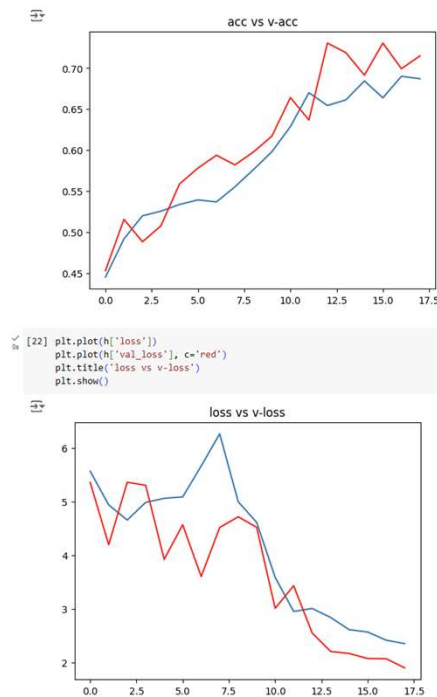


MobileNetV2



Accuracy = 90.45

VGG16



Methodology – System, Personal, and Software Specification Requirement

Functional Requirements

- Display appropriate image/video based on the OCD sub type and severity of the patient.
- Capture accurate anxiety/stress level using emotion detection during the therapy.
- Capture the patient self-reported data.
- Calculate the weighted anxiety score accurately using facial expression data and user input data.
- Generate the anxiety graph using the weighted anxiety score.
- Analyze anxiety graphs of the patient.

Non-Functional Requirements

- The application should be reliable and efficient.
- Interfaces should be user-friendly.
- The application should be compatible with different devices.
- Patient data must be secure.
- The results of VERP therapy must be accurate.

Software requirements

- Python
- Node
- React
- Vscode
- MongoDB
- Google Colab

Personal requirements

- Guidance of external supervisors to acquire knowledge of healthcare domain.
- Data set to train the CNN model.

Completion and Future work

90% Completion of the component

- Collect data and pre-process the data.
- Train the CNN model to capture the anxiety level of the patient.
- Train several models using different CNN architectures to identify the most suitable model.
- Develop the functionality of display visual elements based on OCD subtype and severity.
- Implement the functionality to capture anxiety levels by using the CNN model and by collecting self-reported values during the therapy session.
- Calculate the weighted anxiety score.
- Generate the anxiety graph at the end of the therapy session.

10% Future enhancements

- Display the overview of all therapy session to see the progress.
- Implement download option for the anxiety graph.

AI Supported Interactive Voice Assistant



IT21234484 | Jayasinghe P.T.
Specialization: Software Engineering

Introduction

Stigma in Society

- Mental health disorders are often stigmatized, leading to fear of judgment or discrimination.
- This stigma prevents many from openly discussing their struggles or seeking help, worsening their condition over time.

Reluctance to Seek Help

- Concerns about being labeled or misunderstood result in a hesitation to pursue traditional therapy.
- Cultural pressures and misconceptions around mental health reinforce the idea that seeking help is a sign of weakness.

Geographical Barriers

- Access to mental health services is severely limited in rural and remote areas, where traveling to see a therapist can be impractical or impossible.
- These geographical challenges create a significant gap in mental health care for those living in underserved regions.



Research Questions

How can AI supported Interactive Voice Assistant enhance accessibility and personalization of ERP therapy for OCD patients?



Objectives

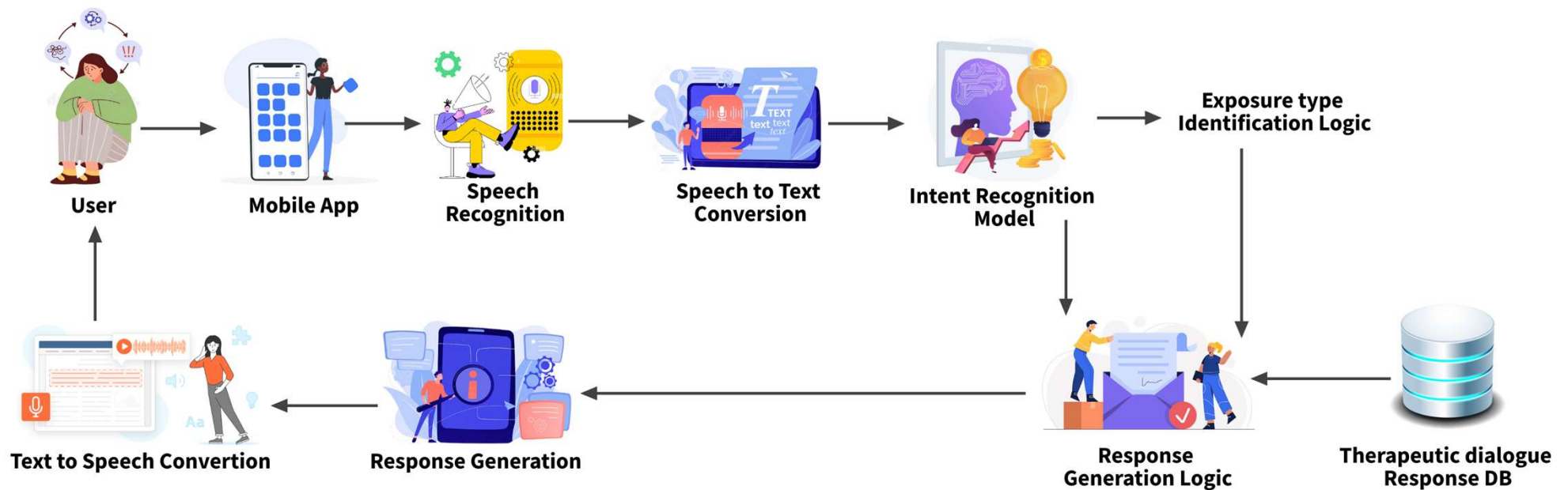
Main Objective

- ❖ Implementation of an AI-Supported Interactive Voice Assistant for ERP Therapy in OCD

Sub Objectives

- ❖ Conduct ERP Therapy Sessions for Contamination OCD Subtype.
- ❖ Identification of Exposure Type and Severity Level of patients.
- ❖ Generate Appropriate Therapeutic Responses
 - Utilize patient input to dynamically generate and provide personalized therapeutic responses during the therapy session.
- ❖ Evaluate Patient Progress and Emotional Response

Methodology – System Diagram



Methodology – Technologies, Techniques, Algorithms

Technologies

- Expo
- Flask
- NodeJs
- MongoDB
- Python
- Vscode
- Google Colab
- Transformers
- TensorFlow
- Matplotlib

Techniques

- Natural Language Processing
- Speech recognition
- Keyword detection
- Machine learning
- Rule-based Logic
- Comparative Anxiety Graph Generation.

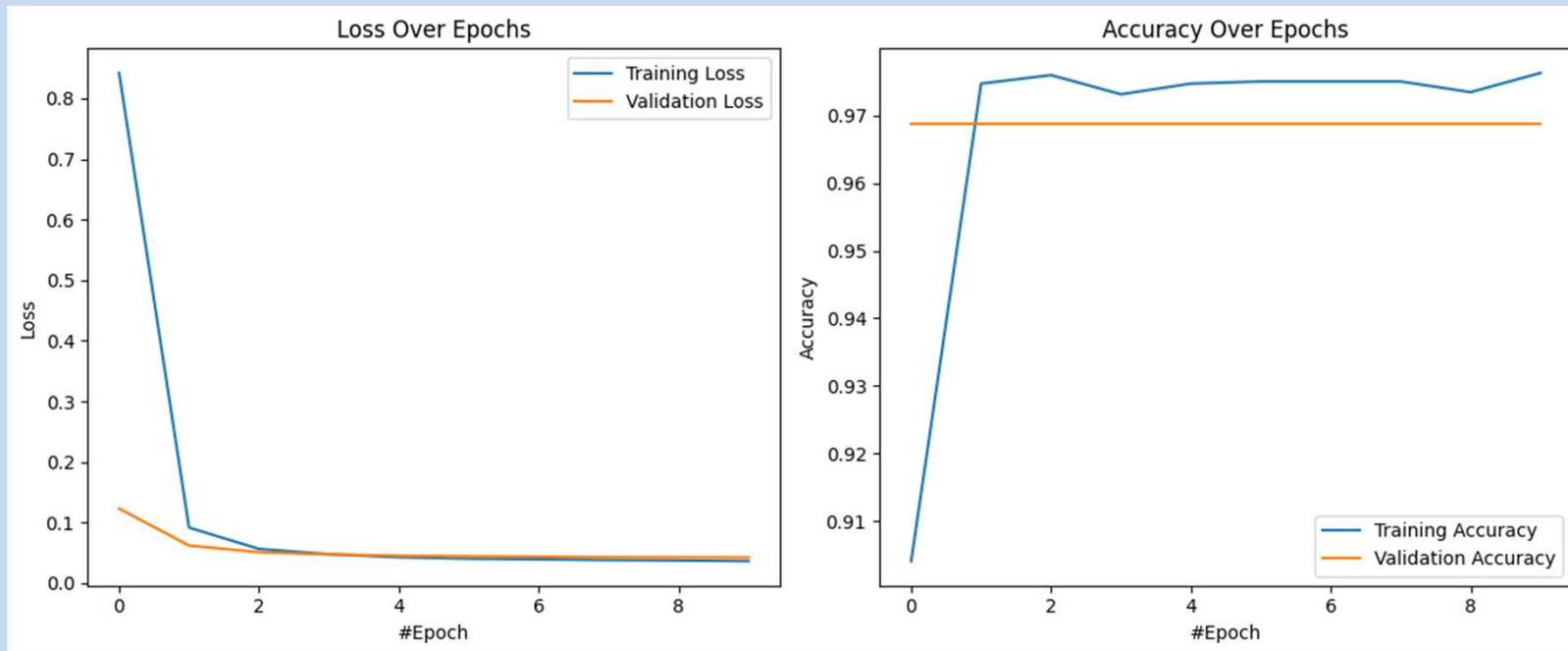
Algorithms

- Matching Algorithm for Keyword-Based Exposure Type Detection.
- State-Based Rule Logic for Conversational Flow
- Metrics: Confusion Matrix, Classification Report.
- Loss and Accuracy Tracking Across Epochs.

Intent Recognition DistilBERT Model

Loss – 0.0425

Accuracy – 0.9688



Completion and Future Works

90% Completion of the components

- Fine-tuned a DistilBERT-based model for accurate intent classification.
- Enhanced the keyword-based extraction system to accurately identify exposure types from user inputs.
- Developed and tested a robust rule-based conversational flow tailored to OCD treatment.
- for seamless voice-based interaction. Integrated Speech-To-Text and Text-To-Speech functionalities
- Implemented anxiety graph generation to visualize anxiety fluctuations during therapy sessions.

10% Future Enhancements

- Enable anxiety graph comparison across multiple sessions to track patient progress over time.
- Optimize response generation.

AI-Enhanced Video Conferencing ERP Therapy



IT21209420 | Mallawaarachchi D.E.H.

Specialization: Software Engineering

IT21209420 Mallawaarachchi D.E.H | 24 – 25J – 046

Introduction

Background on OCD

- ❖ Traditional ERP therapy for OCD needs a lot of time and specialized care, making it hard for many people to access.
- ❖ Stigma around mental health makes people hesitant to seek help, which worsens their symptoms.

Importance of the Study

- ❖ AI-enhanced video conferencing can make ERP therapy more accessible and offer personalized, real-time care.
- ❖ Using biometric analysis, this method can better monitor anxiety and stress levels, improving treatment results.



Research Questions

Primary Questions

- ❖ How does AI video therapy help OCD patients access treatment better than in-person therapy?
- ❖ How effective is AI video therapy in reducing OCD symptoms?
- ❖ How do patients feel about using AI video therapy? Is it easy and acceptable?

Secondary Questions

- ❖ How does biometric analysis help track and improve outcomes in AI video therapy?
- ❖ What are the cost differences between AI video therapy and traditional methods for patients and providers?



Objectives

Main Objective

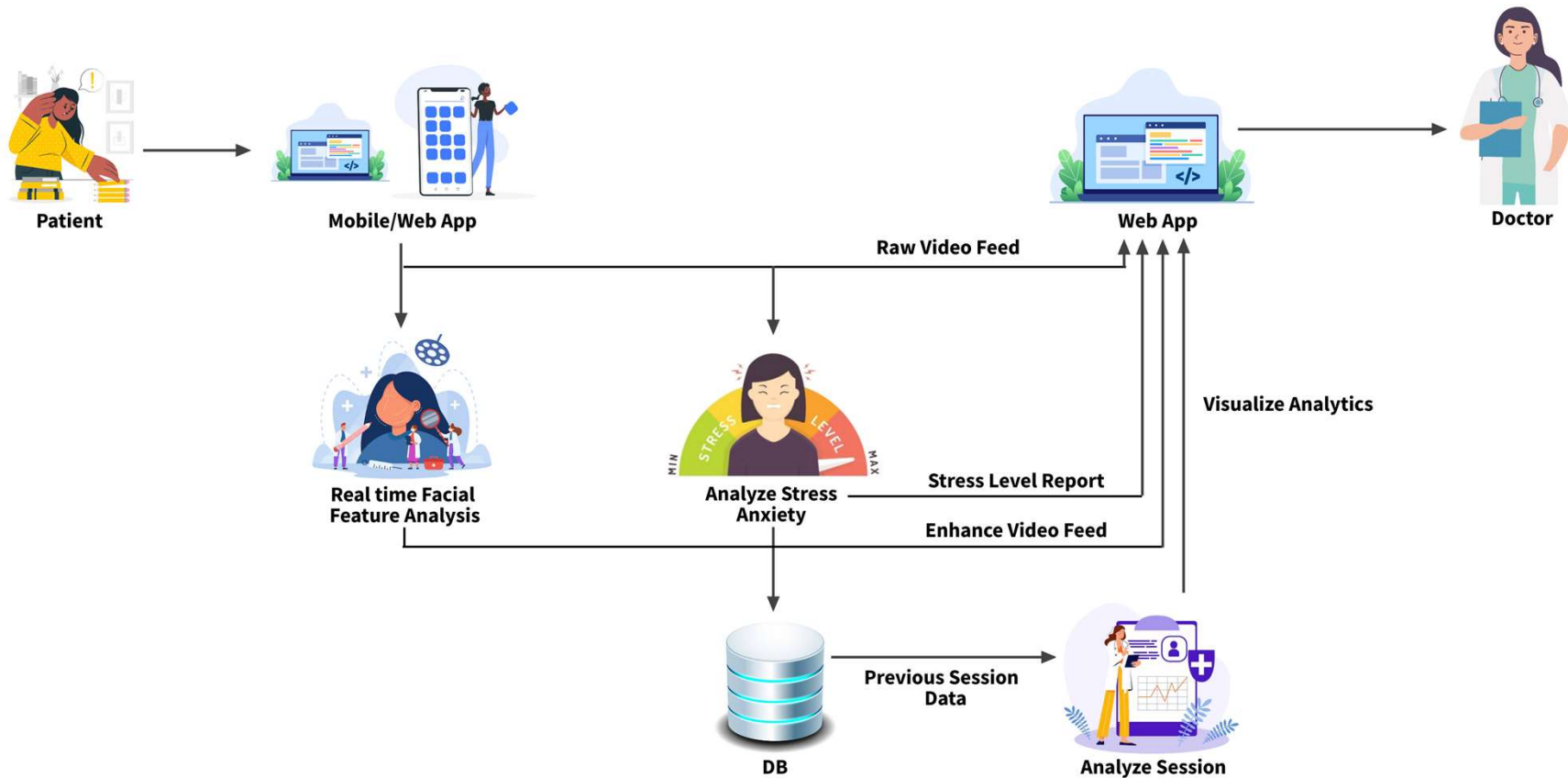
- ❖ **Develop an AI-Enhanced Video Conferencing ERP Therapy tool to facilitate more accessible, personalized, and effective OCD treatment.**



Sub Objectives

- ❖ **Seamless Video Conferencing:** Develop a platform for uninterrupted audio-video communication between patients and therapists.
- ❖ **Session Analytics:** Provide detailed session metrics and predictive analytics to monitor patient progress.
- ❖ **Enhanced Feedback:** Display critical facial expressions alongside live video for accurate therapist assessment.

Methodology – System Diagram



Methodology – Technologies, Techniques, Algorithms

Technologies

- WebRTC
- Node.js
- Firebase
- React
- Python Flask
- MongoDB
- Google Colab

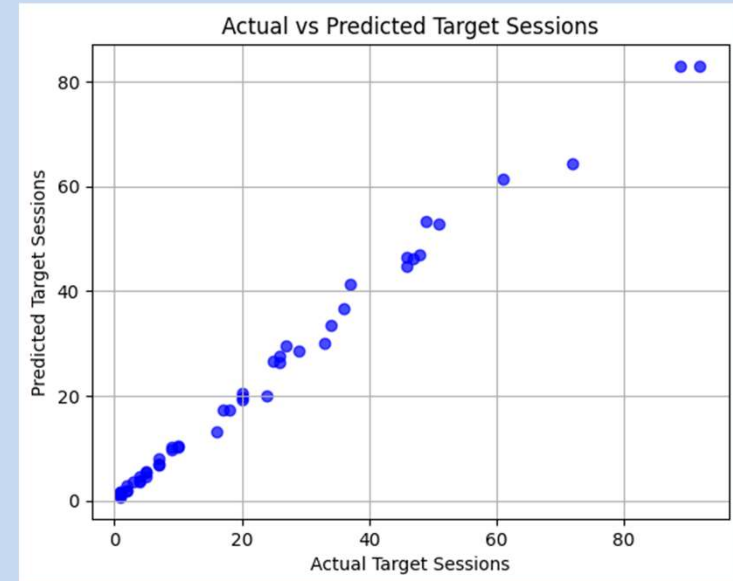
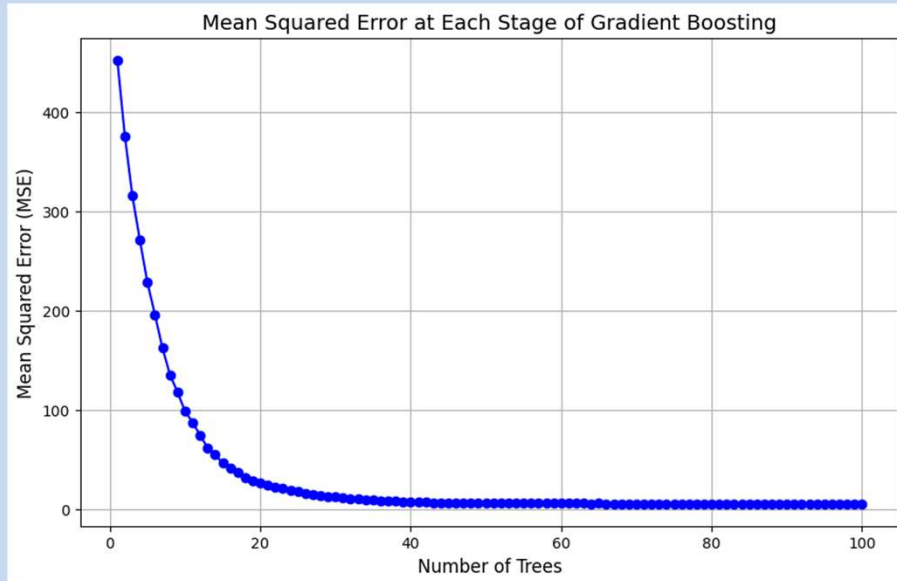
Techniques

- Facial Recognition
- Emotion Detection
- Real-time Facial Landmark Detection
- Data Normalization
- Feature Engineering
- Data Validation

Algorithms

- MediaPipe(CNN)
- Gradient Boosting Regression

Data Visualization



Completion and Future Works

90% Completion of the components

- Developed the frontend for the video conferencing tool, leveraging WebRTC for seamless real-time communication.
- Implemented signaling server with firebase
- Appointment management system.
- Trained and deployed a predictive algorithm to estimate the required number of therapy sessions.

10% Future Enhancements

- Implement doctor dashboard for more analytics
- Implement payment portla

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Thank You!