

CHENNAI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Sarathy Nagar, Kandrathur, Chennai-600069

Approved by AICTE and Affiliated to Anna University, Chennai

**B.E – COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)**

AI-Driven Interview Preparation Chatbot with Emotion, Confidence and Vocabulary Analysis



A Report on Internship

By

Selin Frajja S

23AM097

**B.E – COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)**

January 2025

**CHENNAI INSTITUTE OF TECHNOLOGY
CHENNAI-69**



**CHENNAI
INSTITUTE OF TECHNOLOGY**
(Autonomous)



Vision of the Institute:

To be an eminent centre for Academia, Industry and Research by imparting knowledge, relevant practices and inculcating human values to address global challenges through novelty and sustainability.

Mission of the Institute:

IM1: To create next generation leaders by effective teaching learning methodologies and in still scientific spark in them to meet the global challenges.

IM2: To transform lives through deployment of emerging technology, novelty and Sustainability.

IM3: To inculcate human values and ethical principles to cater to the societal needs.

IM4: To contribute towards the research ecosystem by providing a suitable, effective platform for interaction between industry, academia and R & D establishments.

IM5: To nurture incubation centers enabling structured entrepreneurship and start-ups.



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(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

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- DM2: To collaborate with enterprise and research Laboratories thru tasks-primarily based mastering, internships permitting the students to discover, apply diverse guidelines of learning.
- DM3: To establish value creating networks and linkages with company, industries, academic institutes and universities of countrywide and global significance.
- DM4: To equip students with interdisciplinary talent units to build intelligent structures which in flip affords dynamic and promising careers inside the worldwide marketplace.

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CERTIFICATE

This is to certify that the “**Internship Report**” Submitted by **Selin Frajja S (Reg no: 23AM097)** is the work done by her and submitted during the academic year **2024-2025**, in partial fulfilment of the requirements for the award of the degree of **BACHELOR OF ENGINEERING** in – **Computer Science And Engineering (Artificial Intelligence And Machine Learning)**, at **National Institute of Technology, Tiruchirappalli.**

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External Examiner

Dr.N.Kandavel, M.E., Ph.D.
Department Internship Coordinator

Internship Review Evaluation/Comments

Sl No.	Criterion	Max. Marks	Marks Allotted
1.	Regularity in maintenance of the diary.	10	
2.	Adequacy & quality of information recorded	10	
3.	Drawings, sketches and data recorded	10	
4.	Thought process and recording techniques used	05	
5.	Organization of the information	05	
6.	Originality of the Internship Report	10	
7.	Adequacy and purposeful write-up of the Internship Report	10	
8.	Organization, format, drawings, sketches, style, language etc. of the Internship Report	10	
9.	Practical applications, relationships with basic theory and concepts	10	
10.	Presentation Skills	20	
Total		100	
<p>External Internship Advisor's Name:</p> <p>Company:</p> <p>Date:</p> <p>Signature</p>			

Internship Offer Mail

Regarding Internship Offer Letter

External

Inbox

☆

S

Selin Frajja S AIML

20/11/2024

Respected mam, I am Selin Frajja S from Chennai Institute of Technology

M

msridevi@nitt....

24/11/2024

to me, karthikeyanp

↩

⋮

Dear Selin Frajja,
Kindly consider this mail as my consent for your internship under my guidance during the winter 2024.

With regards,
Sridevi

ACKNOWLEDGEMENT

First, I would like to thank **Dr. M. Sridevi, Associate Professor, at National Institute of Technology, Tiruchirappalli** for giving me the opportunity to do an internship within the organization.

I also would like all the people who worked along with me in **National Institute of Technology Tiruchirappalli** with their patience and openness they created an enjoyable working environment.

It is indeed with a great sense of pleasure and immense sense of gratitude that I acknowledge the help of these individuals.

I am highly indebted to our Chairman **Shri. P.SRIRAM** and Principal **Dr.A.RAMESH, M.E., Ph.D.**, for the facilities provided to accomplish this internship.

I would like to thank my Head of the Department **Dr.R.Gowri, M.E., Ph.D.**, for his constructive criticism throughout my internship.

I would like to thank **Dr.R.BALAMURALI, M.Tech., Ph.D.**, College internship coordinator and **Dr.N.Kandavel, M.E., Ph.D.**, internship coordinator Department name for their support and advices to get and complete internship in above said organization.

I am extremely great full to my department staff members and friends who helped me in successful completion of this internship.

Selin Frajja
23AM097

PREFACE

I student of CSE (AI & ML) require to do an Industrial Internship to enhance my knowledge. The purpose of Industrial Internship is to acquaint the students with practical application of theoretical concept taught to me during my course period.

It was a great opportunity to have close comparison of theoretical concept in practical field. This report may depict deficiencies on my part but still it is an account of my effort.

The output of my analysis is summarised in a shape of Industrial Internship the content of report shows the details of sequence of these. This is my Industrial Internship report which I have prepared for the sake of my Second year Industrial Internship. Being an engineer, I should help the society for inventing something new by utilising my knowledge which can help them to solve their problem so for this I am working in **National Institute of Technology Tiruchirappalli**

ABSTRACT

I had the opportunity to intern at the prestigious National Institute of Technology (NIT) Trichy, one of India's top engineering institutions renowned for its excellence in education, research, and innovation. Established in 1964, NIT Trichy has consistently been ranked among the best institutions in the country, offering a wide range of undergraduate, postgraduate, and doctoral programs. The institute is known for fostering a culture of creativity, technical brilliance, and interdisciplinary research, preparing students to excel in both academia and industry.

During my internship, I gained hands-on experience in several advanced technologies:

- **Natural Language Processing (NLP):** I learned to analyze speech patterns, process text data, and extract meaningful insights using techniques such as feature extraction and sentiment analysis. This enhanced my understanding of linguistic evaluation methods.
- **Flask Web Development:** I developed skills in creating dynamic web applications using Flask, a Python-based framework. This included designing intuitive user interfaces, integrating back-end logic, and connecting web applications to machine learning models for enhanced functionality.
- **Deep Learning Model Integration:** I gained valuable experience in deploying and training deep learning models into interactive applications. This involved optimizing workflows, ensuring seamless communication between components, and making applications more efficient.
- These technical skills provided me with a solid foundation in emerging technologies and their practical applications, further enhancing my knowledge and confidence in working on real-world problems.

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WEEKLY OVERVIEW OF INTERNSHIP ACTIVITIES

1 st Week	Date	Day	Work done
	25.11.2024	Monday	Literature Review
	26.11.2024	Tuesday	Environment Setup
	27.11.2024	Wednesday	DeepFace Exploration
	28.11.2024	Thursday	Flask Review
	29.11.2024	Friday	Documentation study

2 nd Week	Date	Day	Work done
	2.12.2024	Monday	NLP Basics
	3.12.2024	Tuesday	Text Tokenization
	4.12.2024	Wednesday	Feature Extraction
	5.12.2024	Thursday	Speech Data Preprocessing
	6.12.2024	Friday	NLP Testing

3 rd Week	Date	Day	Wok done
	9.12.2024	Monday	DeepFace Overview
	10.12.2024	Tuesday	Model Testing
	11.12.2024	Wednesday	Emotion Classification
	12.12.2024	Thursday	Integration with Python
	13.12.2024	Friday	Real-Time Trials

4 th Week	Date	Day	Wok done
	16.12.2024	Monday	Flask Setup
	17.12.2024	Tuesday	Routes Design
	18.12.2024	Wednesday	User Interface Development
	19.12.2024	Thursday	API Integration
	20.12.2024	Friday	Web Testing

5 th Week	Date	Day	Wok done
	23.12.2024	Monday	Flask-NLP Integration
	24.12.2024	Tuesday	Holiday
	25.12.2024	Wednesday	Holiday
	26.12.2024	Thursday	Data Handling
	27.12.2024	Friday	Testing & Debugging

6 th Week	Date	Day	Wok done
	30.12.2024	Monday	Flask-Emotion Integration
	31.12.2024	Tuesday	Model Refinement
	01.1.2025	Wednesday	Holiday
	02.1.2025	Thursday	Flask Integration Testing
	03.1.2025	Friday	User Feedback

7 th Week	Date	Day	Wok done
	06.1.2025	Monday	Performance Analysis
	07.1.2025	Tuesday	Model Efficiency
	08.1.2025	Wednesday	Optimization Techniques
	09.1.2025	Thursday	Code Refactoring
	10.1.2025	Friday	Efficiency Testing

8 th Week	Date	Day	Wok done
	13.1.2025	Monday	Holiday
	14.1.2025	Tuesday	Holiday
	15.1.2025	Wednesday	UI/UX Refinements
	16.1.2025	Thursday	Workflow Testing
	17.1.2025	Friday	Bug Fixing

9th Week	Date	Day	Wok done
	20.1.2025	Monday	Final Integration
	21.1.2025	Tuesday	Final Integration
	22.1.2025	Wednesday	Documentation Writing
	23.1.2025	Thursday	Paper Work
	24.1.2025	Friday	Paper Work

9th Week	Date	Day	Wok done
	27.1.2025	Monday	Paper Work
	28.1.2025	Tuesday	Paper Work
	29.1.2025	Wednesday	Paper Work
	30.1.2025	Thursday	Paper Work
	31.1.2025	Friday	Paper Work

INTRODUCTION

In today's competitive job market, candidates often struggle with interview preparation, leading to a lack of confidence, poor communication skills, and limited vocabulary. Traditional preparation methods are often generic and do not offer personalized feedback or effectively simulate real interview scenarios. To address these challenges, there is a growing need for an intelligent, interactive solution that not only mimics realistic interview environments but also evaluates a candidate's confidence, emotional state, and vocabulary through their spoken responses.

The proposed solution integrates advanced methodologies such as Natural Language Processing (NLP) and the Natural Language Toolkit (NLTK) to interpret human language and process text. The chatbot engages users in a conversational manner, asking commonly asked interview questions and recording responses.

This tool serves as an effective practice platform for job candidates, offering personalized feedback to help them prepare for real-world interviews. It can also be beneficial to educational institutions, providing students with an interactive space to rehearse interview scenarios before entering the job market. Additionally, this technology can be integrated into employee development programs, enabling professionals to refine their interview techniques for internal promotions or job transfers.

PROBLEM STATEMENT

The problem arises from the challenges candidates face in preparing effectively for interviews, often leading to a lack of confidence, poor communication, and limited vocabulary. Traditional methods of interview preparation are often generic, lacking personalized feedback or realistic interview simulations. This results in candidates being unprepared for real-world interviews, impacting their performance and success. There is a need for an intelligent, interactive solution that not only simulates real interview scenarios but also evaluates key aspects like confidence, emotional state, and vocabulary based on spoken responses, offering personalized feedback to help candidates improve.

FLOW CHART

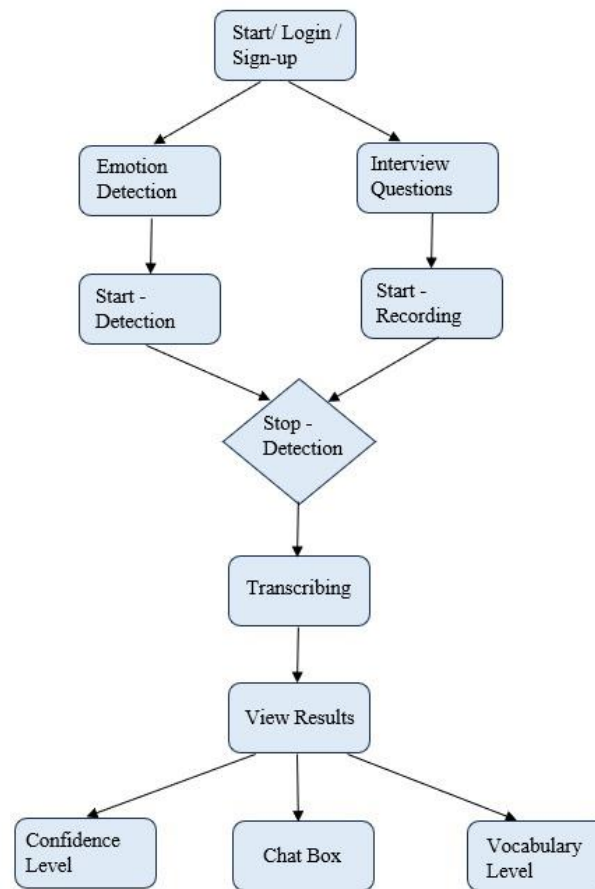


Fig. 1 Flow chart

METHODOLOGY

(a) User Authentication and Interview Guideline:

(a.1): User Login (Secure Access)

The user begins by accessing the platform through a designated URL or app interface, which prominently displays the login form. They input their registered credentials, including a username or email and a secure password. The system ensures security by implementing password hashing to prevent unauthorized access.

- The system verifies the credentials against the database for authentication.
- Upon successful login, the user is redirected to the interview dashboard.
- If login fails, the system displays an error message.

(a.2): Displaying Interview Instructions

After logging in, the user is presented with clear and concise instructions outlining how to navigate the interview process. These instructions are displayed on a user-friendly page, ensuring the user understands each step of the workflow.

(b) Interview Interface with Real-Time Camera featuring Emotion Detection:

(b.1) Face Emotion recognition:

The user clicks the **"Start"** button to enter the interview page. The page features a live camera feed that continuously monitors the user's facial expressions. Two buttons are provided: **"Start Detection"** and **"Stop Detection"**. The emotion detection system starts upon pressing "Start Detection."

This process performs real-time emotion detection using the DeepFace library and OpenCV. Video frames captured by the webcam are analyzed using the **MTCNN** model for face detection due to its high precision in challenging conditions. MTCNN uses PNet, RNet, and ONet to identify and refine face areas. Once a face is detected, the VGG 16-Face model, a deep CNN trained on large face datasets, is used for emotion recognition. The model employs transfer learning by fine-tuning **VGG-16** on emotion datasets, utilizing techniques such as resizing, normalization, the softmax activation function, and Adam optimizer with cross-entropy loss for accurate predictions.

Emotions are tracked across frames, and the most frequent emotion during the session is displayed upon stopping detection. This system integrates reliable face detection (MTCNN) and emotion recognition (VGG 16-Face), ensuring accurate real-time emotion analysis for interactive applications.

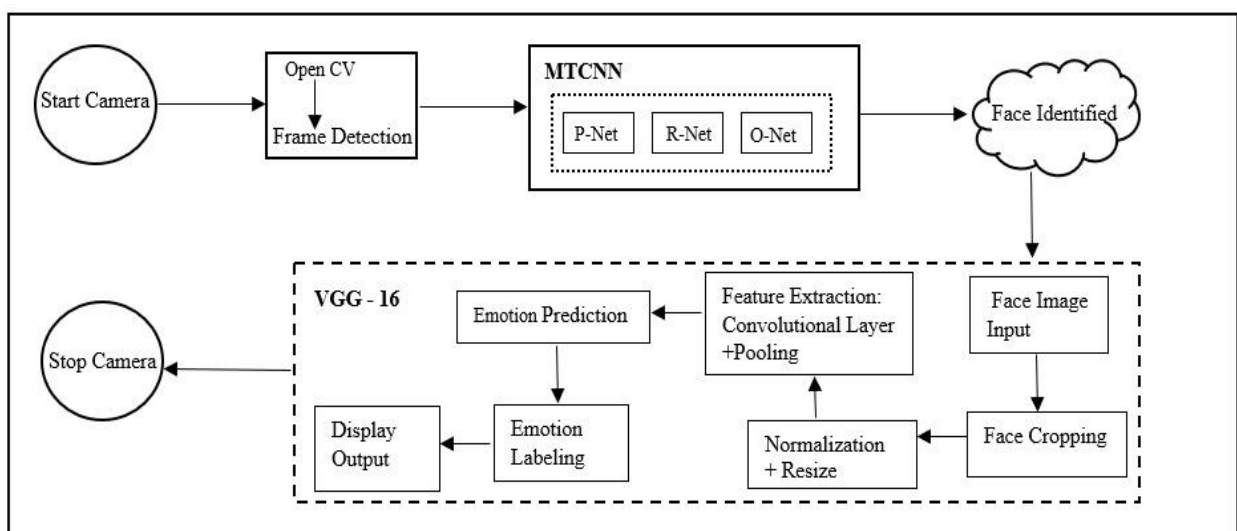


Fig. 2 Face and Emotion Detection Architecture
Diagram

(b.2) Audio Response:

The **"Start Recording"** button is used to record the user's verbal responses to interview questions and becomes active only when emotion detection is turned on. During the recording, the system continuously monitors and analyzes the user's facial expressions in real time, capturing detailed emotional variations displayed through facial features. This integration allows the simultaneous capture of emotional cues and speech flow. Once the user completes their response, they must click the **"Stop Detection"** button to end both the recording and emotion detection. This marks the conclusion of this phase and ensures a seamless transition to the next stage of the interview.

(c) *Transcription and Analysis:*

After moving to the next page, users will see two buttons: **"Transcribe"** and **"View Result."** Initially, only the "Transcribe" button is active. Clicking this button initiates the transcription process using OpenAI's Whisper, a highly accurate automatic speech recognition (ASR) model designed for transcribing and translating audio into multiple languages. The medium model of Whisper is employed to handle audio files in formats such as MP3, WAV, M4A, and FLAC.

The transcription process involves iterating through all audio files stored in a designated folder. For each file, Whisper generates a transcription, which is saved as a UTF-8 encoded text file. This entire process is automated using Python's 'os' module for efficient file management. Once transcription is complete, the text is stored for further analysis. This transcription serves as the foundation for assessing users' vocabulary and confidence levels, enabling a smooth progression to the next stage of the interview.

(d) *View Results – Confidence and Vocabulary Analysis:*

Once the transcription is complete, the "View Result" button becomes active, allowing users to proceed with the next stage of analysis. Clicking this button triggers two separate Python scripts, each focusing on a distinct aspect of performance evaluation. The first script conducts Speech Confidence Analysis, while the second performs Vocabulary Analysis, providing a comprehensive assessment of the user's responses.

The Speech Confidence system is built using PyTorch and centers on audio classification through feature extraction, dataset management, and deep learning techniques. It primarily utilizes **MFCC (Mel Frequency Cepstral Coefficients)**, a popular method for extracting features from audio signals. Originally introduced in the 1970s, MFCC has become a key technique in the field of audio analysis.

Mel Frequency Cepstral Coefficients (MFCC) are features used in speech and audio processing to represent audio signals in a way that mimics the human auditory system. MFCCs capture perceptually relevant information by focusing on how humans perceive pitch and loudness. The process involves converting an audio signal from the time domain into a compact set of features in the frequency domain.

The key steps in MFCC extraction are:

1. Pre-Emphasis:

- Amplifies high-frequency components using a high-pass filter.
- Equation: $y[n] = x[n] - \alpha x[n-1]$, where $\alpha \approx 0.95$

2. Framing:

- Divides the audio signal into short, overlapping frames (20-40 ms) for analysis.
- Ensures the signal remains stationary within each frame.

3. Windowing:

- Applies a window function (e.g., Hamming window) to each frame to smooth edges and reduce spectral leakage.

4. Fast Fourier Transform (FFT):

- Converts each frame from the time domain to the frequency domain.
- Provides the magnitude and phase spectrum of the signal.

5. Mel Filter Bank:

- Passes the frequency spectrum through triangular filters spaced on the Mel scale:

$$m = 2595 \cdot \log(1 + f/100)$$

- Simulates the human ear's sensitivity to different frequency ranges.

6. Logarithm:

- Computes the log of the Mel-filtered energies to model human perception of loudness.

7. Discrete Cosine Transform (DCT):

- Transforms the log-Mel energies into a set of coefficients.
- Captures the most important spectral features while reducing dimensionality.

8. Output MFCCs:

- Produces a small set of coefficients (typically 12-13) for each frame, which represent the audio signal compactly.

These MFCCs are then fed into deep learning models for tasks such as audio classification. The MFCC process effectively captures perceptually significant features, making it one of the most widely used techniques in audio and speech analysis.

The data is efficiently managed using PyTorch's Dataset and **DataLoader** modules. A custom Dataset class is implemented to handle audio features and their corresponding labels or targets. This enables batch processing with shuffling, which enhances training efficiency and reduces the risk of overfitting. The model is built using a fully connected neural network architecture

designed for multi-class classification. To prevent overfitting, dropout layers are included, along with activation functions like **ReLU** for non-linearity and **softmax** for probability distribution across classes. The training process uses cross-entropy loss, an ideal loss function for multi-class classification, and the **Adam optimizer** to ensure faster and more efficient training. The project encompasses the entire pipeline, from feature extraction to dataset management and model training, offering a scalable and effective solution for classifying audio data into distinct categories.

The second component focuses on vocabulary evaluation, which analyzes the user's transcribed text by assessing its depth, richness, and diversity in terms of complexity. This program is built using modern Python-based tools and libraries for text analysis and feedback generation. The process relies on the `os` module for file handling, **NLTK (Natural Language Toolkit)** for text preprocessing, and **TextBlob** for sentiment analysis. The evaluation involves comparing unique words in the input text against a defined professional vocabulary, identifying overlaps and gaps to measure vocabulary usage.

NLTK is a powerful library for Natural Language Processing (NLP), offering tools for text preprocessing and linguistic analysis. Key features include:

- **Tokenization:** Splitting text into words or sentences.
- **Stop Word Removal:** Filtering out common, insignificant words like "and" or "the."
- **Stemming:** Reducing words to their root forms.
- **Part-of-Speech Tagging:** Identifying grammatical categories of words.

These functionalities enable detailed examination and preprocessing of natural language data, streamlining text analysis tasks.

TextBlob, on the other hand, is a simpler library built on NLTK and Pattern, designed to make NLP tasks more intuitive. It excels in high-level operations such as sentiment analysis, noun phrase extraction, and text translation. For sentiment analysis, TextBlob calculates polarity (positive or negative tone) and subjectivity (degree of personal opinion) with ease and speed.

Together, NLTK and TextBlob complement each other, creating a robust framework for text processing. NLTK is ideal for in-depth preprocessing and linguistic analysis, while TextBlob simplifies higher-order tasks like sentiment analysis. The combination of these tools provides a comprehensive solution for analyzing and processing textual data effectively.

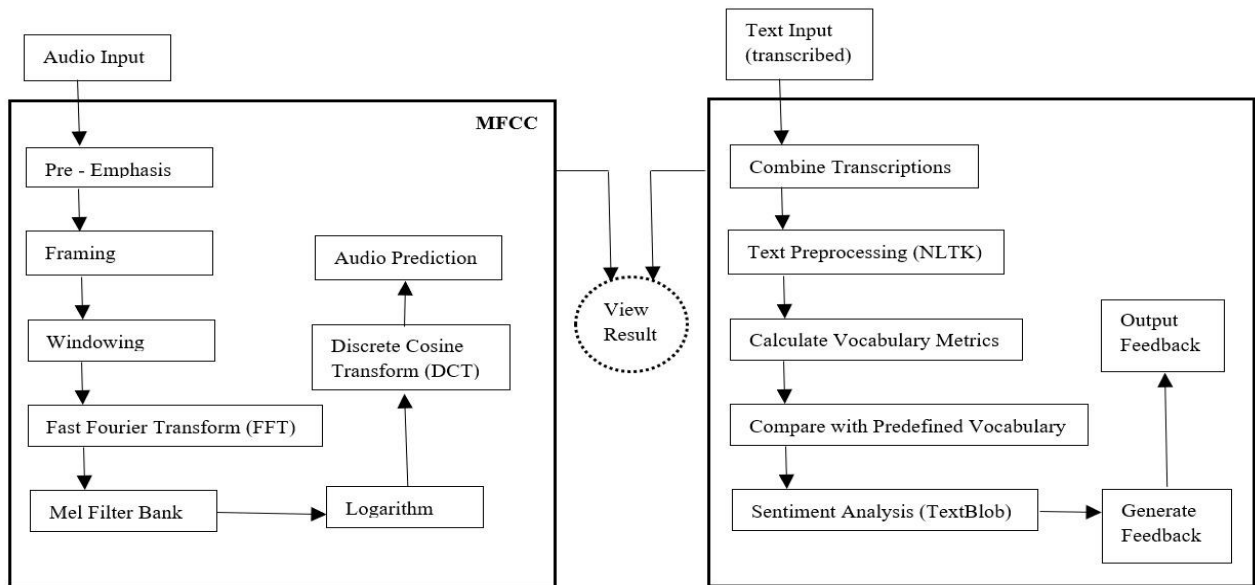


Fig. 3 Confident and Vocabulary Analysis Architecture Diagram

(e) Performance Review with Feedback and Learning Videos:

Once the analysis is complete, the results are displayed on a dedicated page with feedback on **Vocabulary, Confidence, and Emotion**.

- **Vocabulary Feedback:** Using NLP techniques like tokenization and stopword removal with NLTK, the script analyzes the vocabulary by comparing it to a professional vocabulary set. TextBlob classifies sentiment (positive, neutral, negative) and provides insights into word usage and complexity, offering feedback for vocabulary improvement.
- **Confidence Feedback:** The system evaluates the user's confidence by analyzing speech patterns like tone, pace, and hesitation to determine if the speech reflects certainty or hesitation.
- **Emotional Feedback:** It identifies the dominant emotion expressed during the interview, based on emotional tone in the user's responses.

Additionally, personalized **YouTube recommendations** are provided to help the user improve in specific areas like interview practice, vocabulary development, or emotional intelligence.

(f) Interactive Chatbot for General Doubts:

The results page includes an interactive chatbot to address general interview questions. Built with JavaScript (ES6), it updates the conversation flow in real-time, allowing users to type queries and receive instant responses. The user-friendly interface, designed with HTML and CSS, features chat bubbles, input fields, and buttons. Fetch API handles asynchronous communication, sending user queries to the Flask server for processing and response. CORS settings ensure secure cross-origin requests. The design is modern, responsive, and engaging, offering immediate support for interview preparation.

RESULT

Labels	Precision	Recall	F1 Score
Confident	99	100	99
Unconfident	100	99	100

Training Accuracy	98 %
Validation Accuracy	99 %

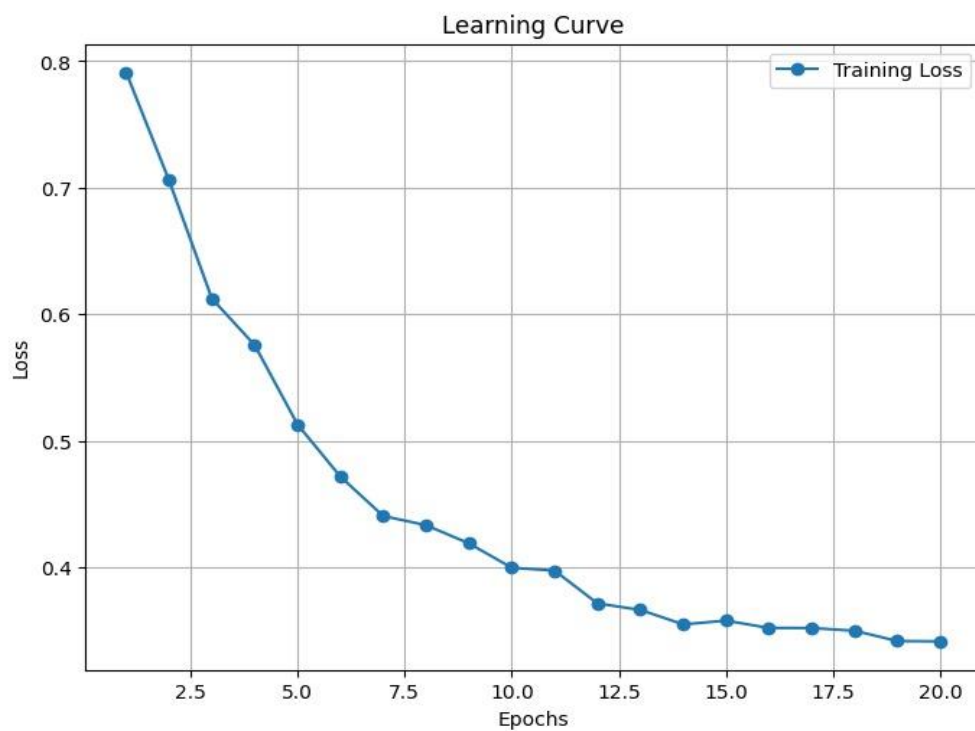


Fig. 4 Training Loss Graph

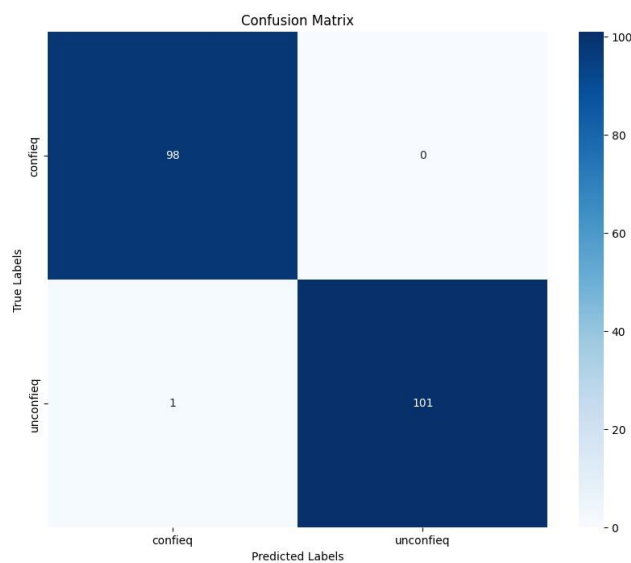


Fig. 5 Confusion Matrix

Technology Used:

- Flask: Backend framework for developing the web application and managing user interactions.
- DeepFace: Library for real-time emotion detection during audio recording.
- OpenCV: Handles the camera feed and captures live video during the interview process
- Natural Language Processing (NLP): Analyzes speech patterns and vocabulary for confidence and language evaluation.
- librosa: For advanced audio feature extraction and analysis.
- torch/transformers: For pretrained NLP models used in vocabulary and language analysis.
- Whisper: For Transcribing Speech-To-Text
- Matplotlib/Seaborn: Visualizes results such as confidence levels, vocabulary performance, and emotions.
- pyaudio: For audio recording during user interactions.
- nltk/spacy: For vocabulary analysis and natural language processing tasks.
- pandas: For processing and analyzing user responses and results.

Photos of the project

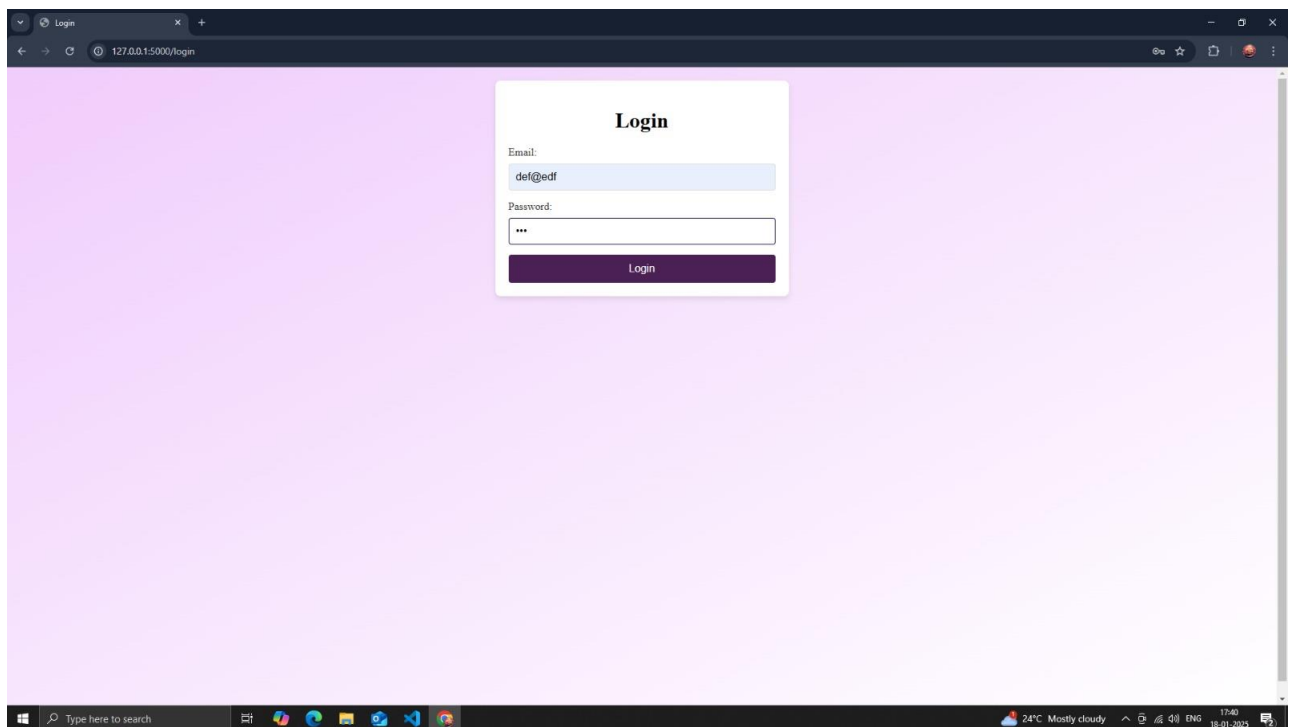


Fig. 6 Login Page

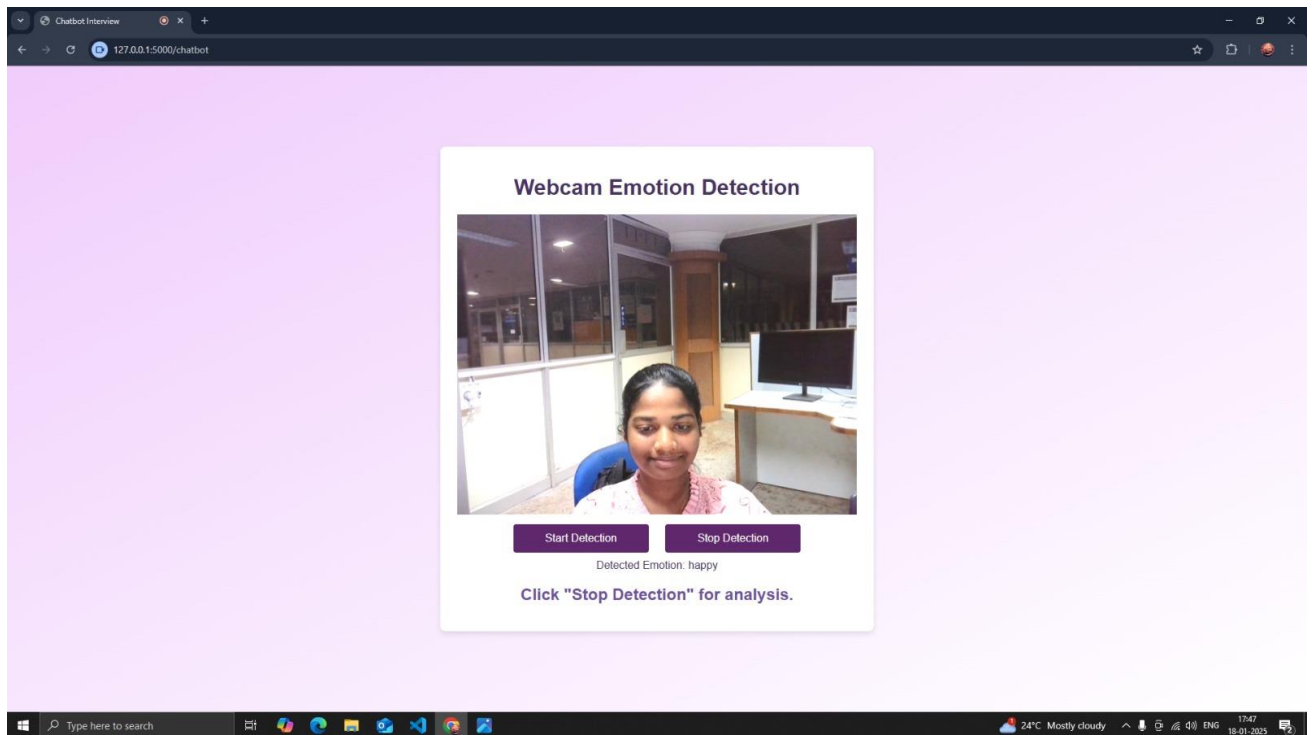


Fig. 7 Audio Recording and Emotion Detection

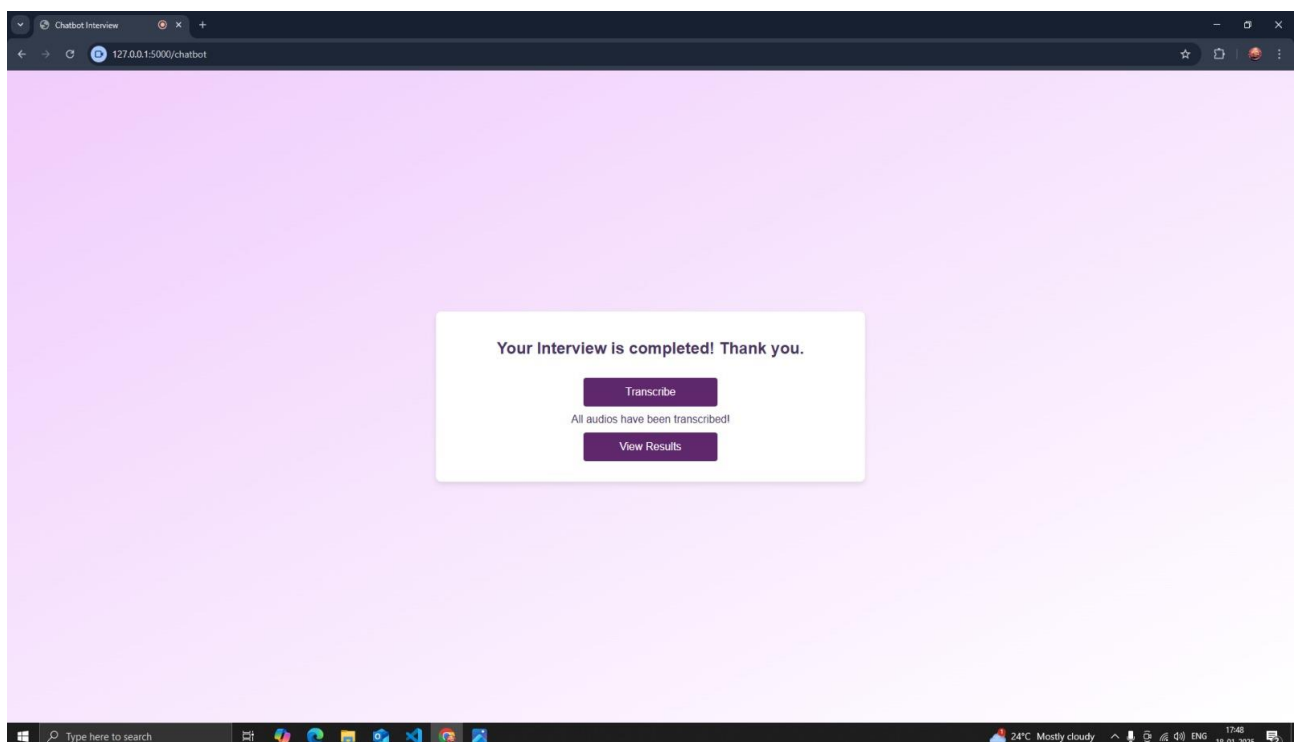


Fig. 8 Transcribing

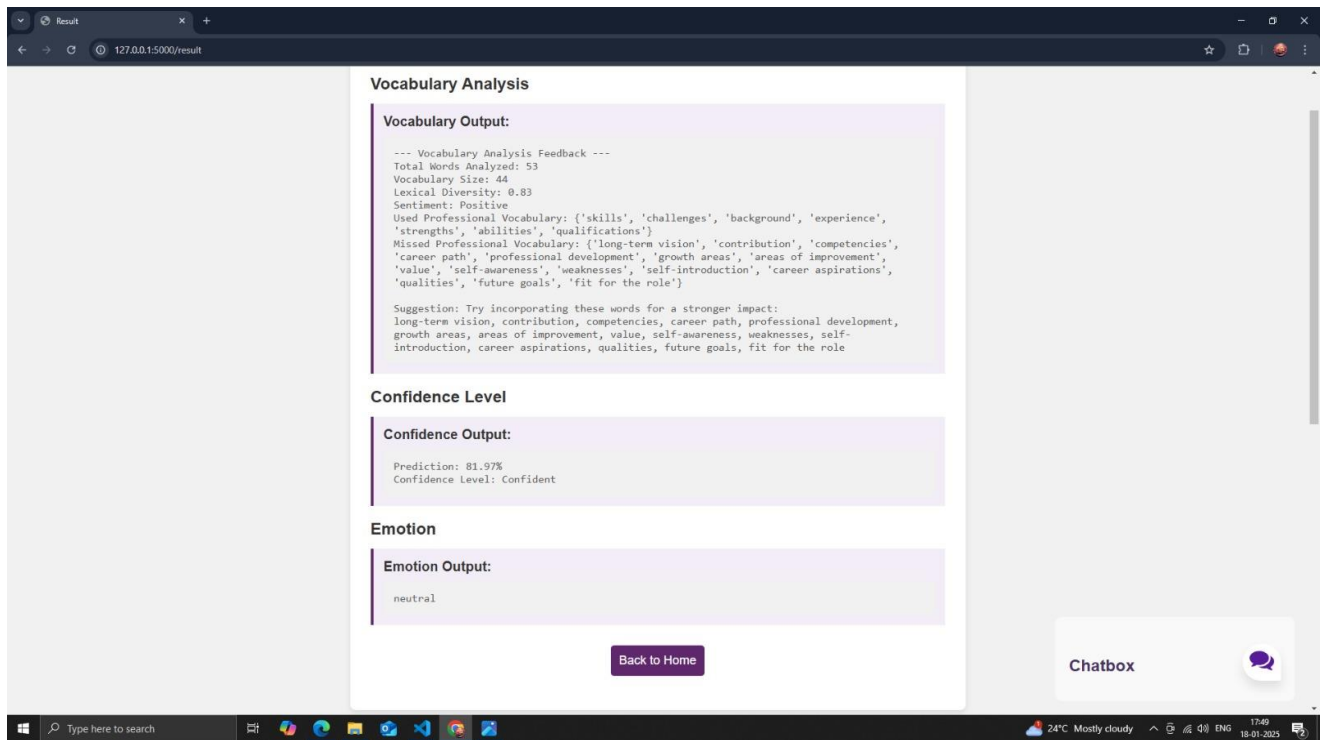


Fig. 9 Result Analysis

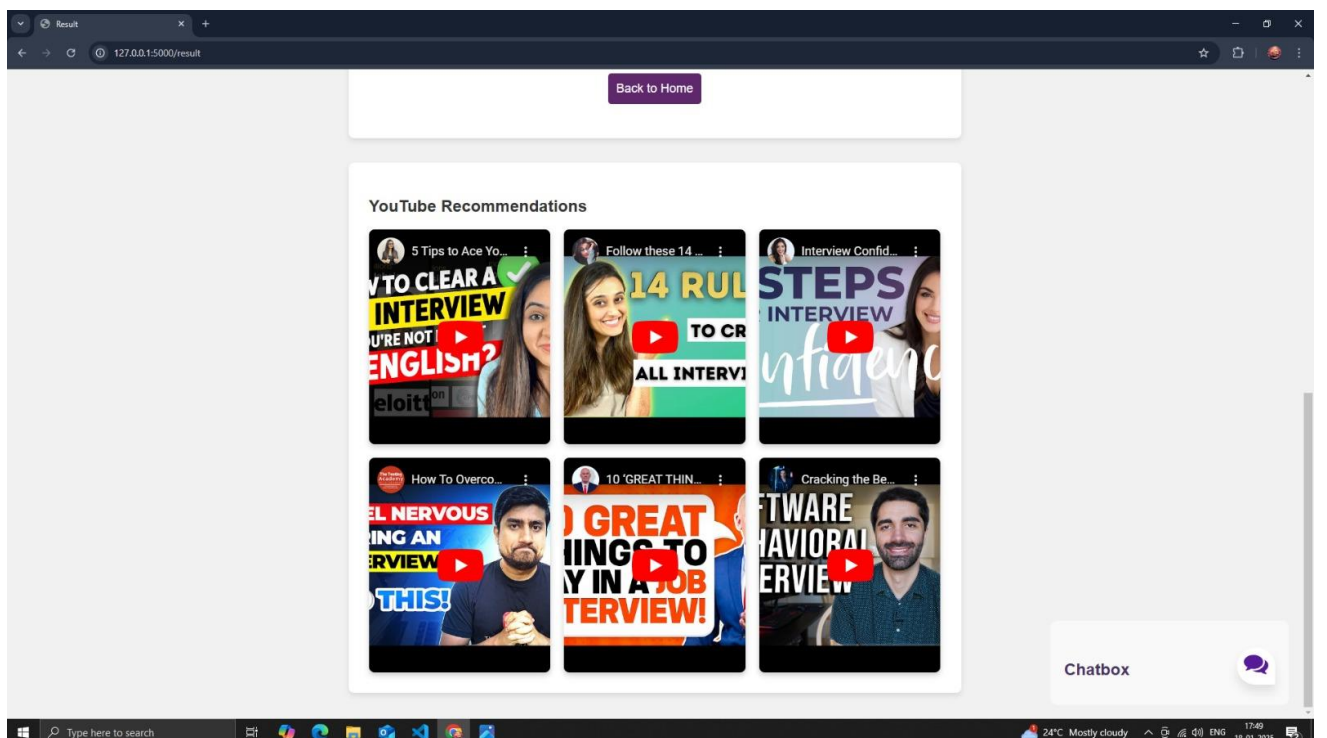


Fig. 10 Youtube Recommendations

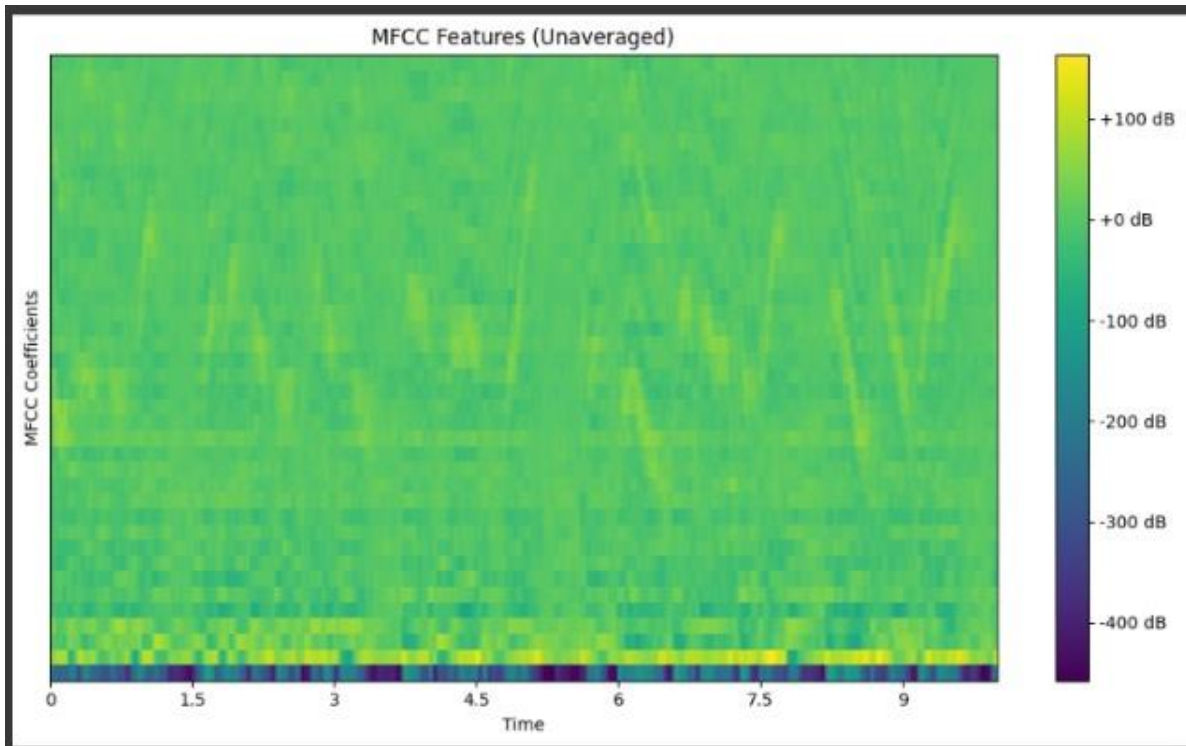


Fig. 11 MFCC for an Audio

CONCLUSION

In conclusion, this project provided an invaluable opportunity to explore and integrate advanced technologies such as Natural Language Processing (NLP), emotion detection, and Flask web development into a cohesive system aimed at improving interview performance assessment. Through the development of the interview chatbot, I learned how to combine various machine learning models and frameworks to create an interactive platform that not only analyzes a user's confidence and vocabulary but also gauges their emotional state during interviews.

This experience allowed me to enhance my technical skills, from developing web applications using Flask to deploying machine learning models for real-time use. Furthermore, the integration of emotion detection via DeepFace added an important layer of understanding, making the chatbot more intuitive and responsive to user inputs.

Ultimately, this project has deepened my understanding of both the technical and practical aspects of AI-driven systems, and I am confident that the skills acquired during this internship will contribute significantly to my future endeavors in the fields of web development, machine learning, and AI.

PO & PSO Attainment

PO.No	Graduate Attribute	Attained	Justification
PO 1	Engineering knowledge	Yes	Gained comprehensive knowledge of deep learning and neural networks concepts, algorithms, and NLP.
PO 2	Problem analysis	Yes	Analyzed data requirements and solved issues using deep learning models and techniques.
PO 3	Design/Development of solutions	Yes	Designed and built deep learning models to solve real-world problems.
PO 4	Conduct investigations of complex problems	Yes	Explored complex deep learning and neural networks concepts and troubleshoot issues in model performance.
PO 5	Modern Tool usage	Yes	Used tools like Python, Pytorch, pydub, Whisper and librosa for implementing audio classification
PO 6	The Engineer and society	Yes	Understood the impact of deep learning and neural networks on society, including ethical considerations and societal benefits.
PO 7	Environment and Sustainability	Yes	The project integrates sustainable technologies by promoting efficiency and reducing resource consumption through automation and AI-driven solutions.
PO 8	Ethics	Yes	Learned about ethical considerations in deep learning and neural networks, including data privacy and bias mitigation
PO 9	Individual and team work	Yes	Worked on both individual projects and collaborative team projects during the internship.

PO.No	Graduate Attribute	Attained	Justification
PO 10	Communication	Yes	Gained skills in communicating complex machine learning concepts and results effectively.
PO 11	Project management and finance	No	It is completely a software project so no financial management
PO 12	Life-long learning	Yes	Gained foundational knowledge for continued learning in the rapidly evolving field of machine learning.

PSO.No	Graduate Attribute	Attained	Justification
PSO 1	To analyze, design and develop solutions by applying the concepts of Robotics for societal and industrial needs.	Yes	Applied robotics concepts through AI-driven systems, focusing on real-time user interactions and automated solutions.
PSO 2	To create innovative ideas and solutions for real time problems in Manufacturing sector by adapting the automation tools and technologies.	Yes	Developed innovative solutions leveraging machine learning and automation technologies, applicable to real-time industrial and manufacturing challenges.