

MULTI-MODEL APPROACH TO RECOMMEND PERSONALIZED MUSIC PLAYLIST

TMP – 2023 – 24 - 065

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Supervisor

Mr. Thusithanjana Thilakarathne



Co-Supervisor

Dr. Dharshana Kasthurirathne



Our Team



IT20665616
Sumanasekara H.P

Group Leader



IT20610852
Fernando M.P.T.K



IT20665852
Gunasekara C.M



IT20667078
Dhananjaya W.K.S.

Introduction

- The proposed system, personalized music and song recommendation system aims to provide users with customized music suggestions based on emotion, age, gender, user's current surroundings etc.
- The nature of the solution revolves around exploiting user data, advanced algorithms, and machine-learning techniques to deliver a tailored music experience.

Research Areas

- Emotion based filtering
- Image Processing
- Music recommendation
- Machine learning concepts
- Cold start problem

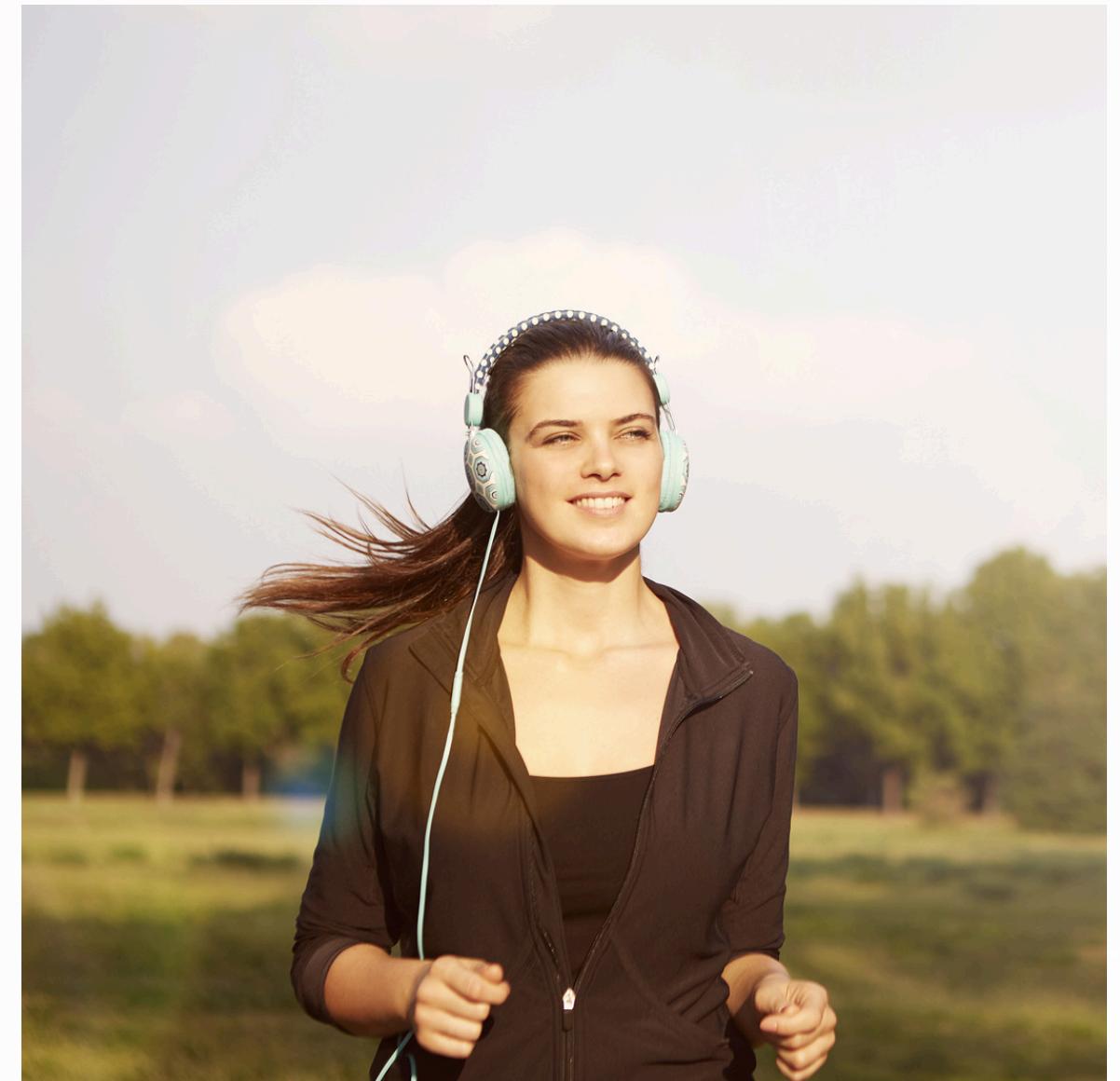


Research Problem

- Currently there is no system for emotion basis music recommendation applications in the market.
- No system in the market is considering user's context for filtering.
- Predicting user's age and gender using a selfie rather than using a form.
- There is no any post evaluation after listening to the recommended playlist in current apps in the market.

Main Objective

- To give the user a tailored playlist according to his or her current mood /emotion, personal data like age, gender, and current surroundings using voice recognition and image processing mechanisms.
- To assess the impact for the user after listening to the recommended playlist.



Sub Objectives



Analyze a user-specific Profile - This component tackles the music recommendation by using selfie images to predict user age and gender.



Current weather of the user - Context-aware music recommendations consider user surroundings / weather for personalized, engaging music streaming experience



Emotions using vocal responses - improving emotion detection by learning user voice frequency.

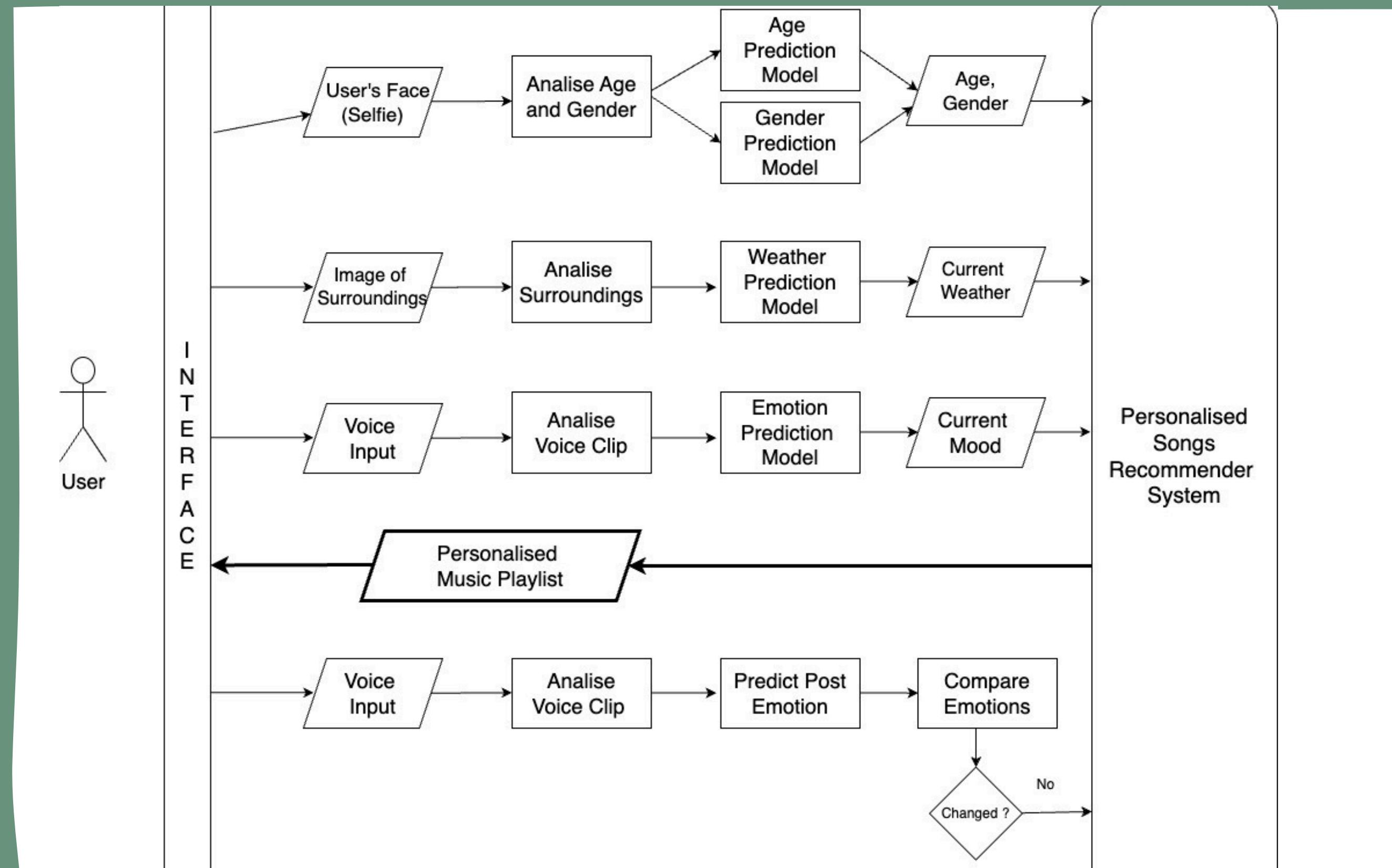


Effects on users' emotional state - Addressing the uncertainty of whether music recommendations effectively improve users' moods and feelings in daily life.

Research Gap

- Predict user profile using a selfie.
- Predict user's current outside weather.
- Detect user's emotion using a voice clip.
- Assessing the effect on user's emotion from the recommended playlist.

SYSTEM OVERVIEW DIAGRAM





IT20665616
Sumanasekara H. P.

- Image classification model to predict a user profile -

Research background

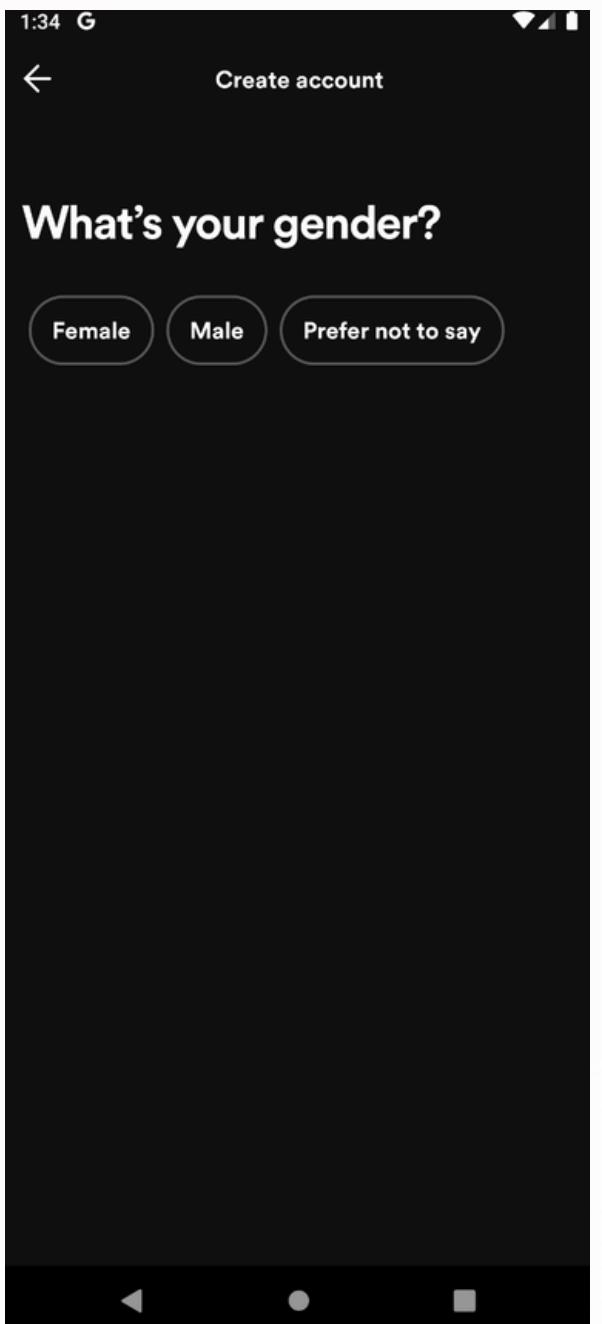
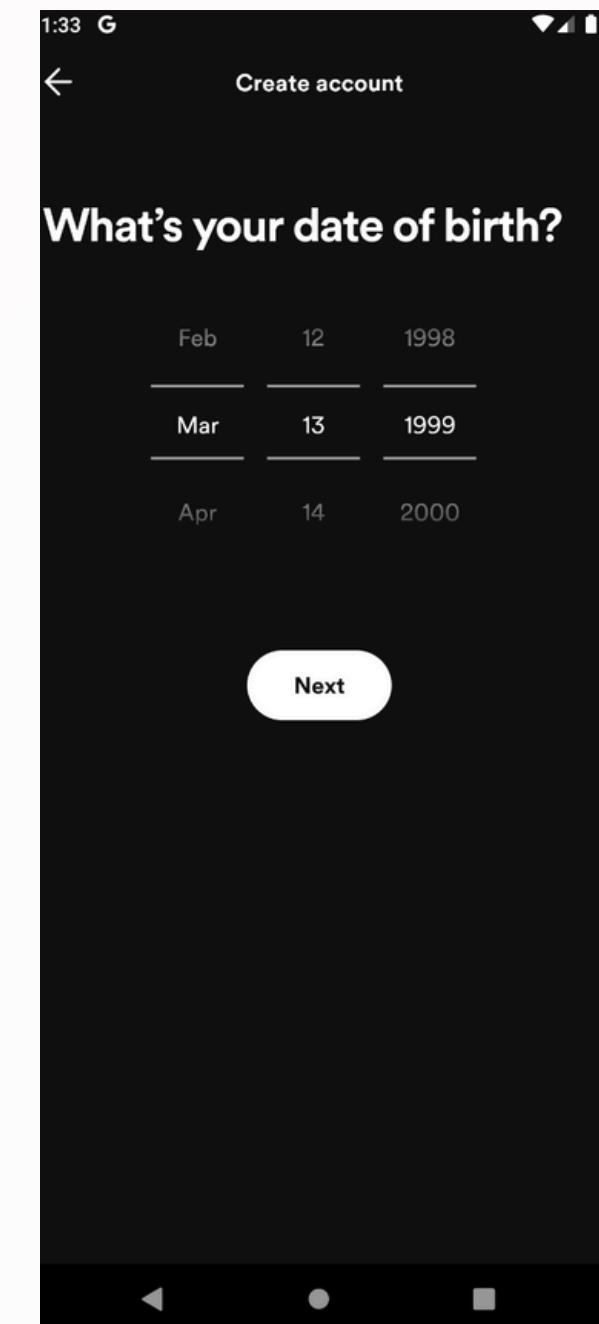
- There are popular and successful music recommendation applications currently in the market like youtube, spotify, iTunes etc.
- Most of them are using content - bases, collaborative and hybride filtering methods in their applications.
- Most of them are facing the cold - start problem.
- Every application use a form to collect the data about the user.

Research Problem

- When a user first sign-up to the application, the machine learning algorithms do not have any inputs from the user to generate a personalized music playlist.
- Most of the music platforms have a form to get all the details of the user and the user preference.

Research Problem

Example in the registration of Spotify application..



Novelty

- Using a selfie image, the system automatically predict the gender and the age of the user for the user profile and use it for the music recommendation model.



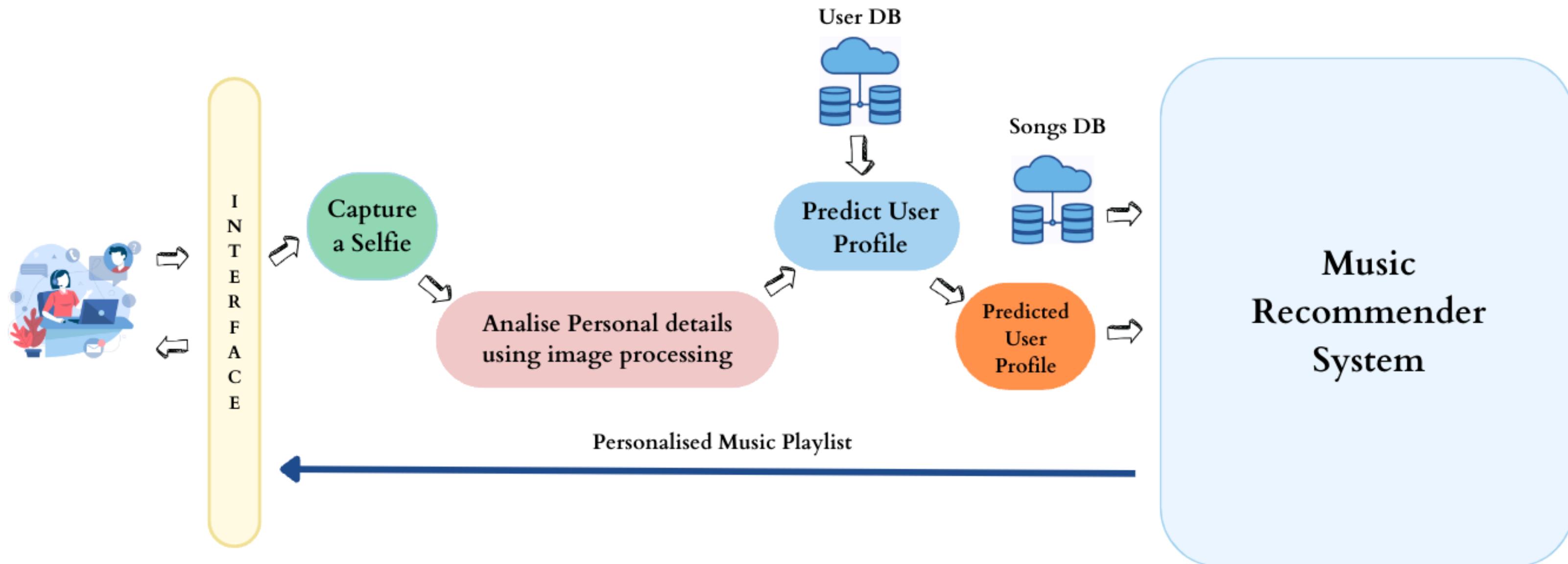
Main Objective

- By using a selfie image, analize the user specific details on the face using image processing techniques to extract the age and the gender of the user to create a user profile.

Sub Objectives

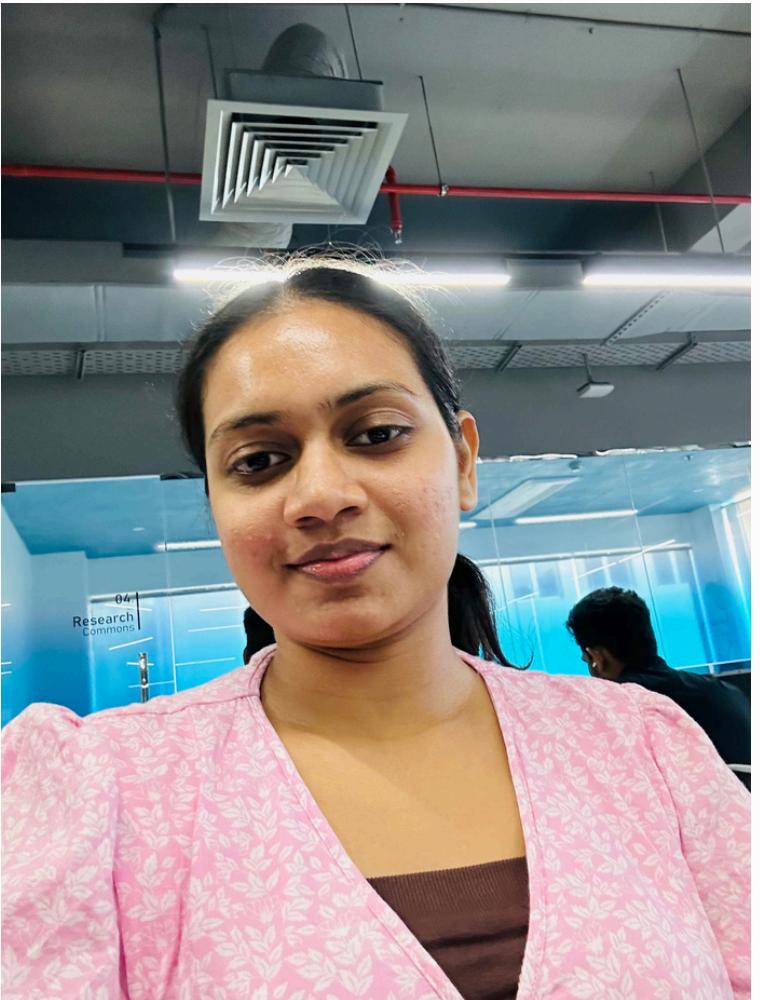
- Allowing user to capture a selfie from the mobile application.
- Collect a quality image.
- Generate two machine learning models to predict the user age and the gender separately.
- Train the models and increase the accuracy.
- Evaluate the model.
- Testing and deploying.

Methodology – System Overview Diagram



Completion

- Swagger API end points - Age



file * required
string(\$binary)
 mySelfie

Responses

Curl

```
curl -X 'POST' \
'http://192.168.8.147:8000/age-predict' \
-H 'accept: application/json' \
-H 'Content-Type: multipart/form-data' \
-F 'file=@mySelfie.jpg;type=image/jpeg'
```

Request URL

```
http://192.168.8.147:8000/age-predict
```

Server response

Code Details

200 Response body
"18-40"

A screenshot of a Swagger UI interface for an API endpoint. At the top, there is a file input field labeled "mySelfie" with the placeholder "Choose file". Below the input field are two buttons: "Execute" and "Clear". Under the "Responses" section, there is a "Curl" code block showing a POST request to "http://192.168.8.147:8000/age-predict" with various headers and a file parameter. Below the curl block is a "Request URL" field containing the same URL. Under the "Server response" section, there is a "Code" button and a "Details" button. The "Code" button is highlighted in blue, indicating it is selected. Below the "Code" button is a status code "200" and a "Response body" field containing the text "'18-40'".

Completion cont..

- Swagger API end points - Age



file * required
string(\$binary) Choose file age55Male.jpeg

Execute

Responses

Curl

```
curl -X 'POST' \
  'http://192.168.8.147:8000/age-predict' \
  -H 'accept: application/json' \
  -H 'Content-Type: multipart/form-data' \
  -F 'file=@age55Male.jpeg;type=image/jpeg'
```

Request URL

<http://192.168.8.147:8000/age-predict>

Server response

Code	Details
200	Response body "40-60"

Completion cont..

- Swagger API end points - Gender



file * required
string(\$binary) Choose file 30yearWoman.jpeg

Execute Clear

Responses

Curl

```
curl -X 'POST' \
'http://192.168.8.147:8000/gender-predict' \
-H 'accept: application/json' \
-H 'Content-Type: multipart/form-data' \
-F 'file=@30yearWoman.jpeg;type=image/jpeg'
```

Request URL

```
http://192.168.8.147:8000/gender-predict
```

Server response

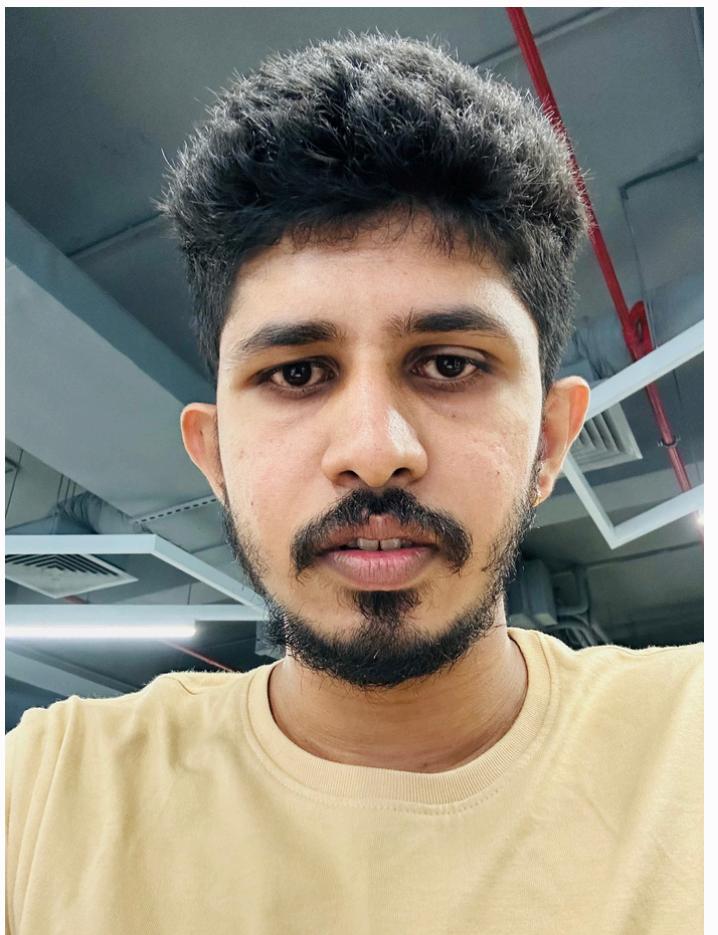
Code Details

200 Response body

```
"Female"
```

Completion cont..

- Swagger API end points - Gender



file * required
string(\$binary) Choose file Mashan

Execute Clear

Responses

Curl

```
curl -X 'POST' \
  'http://192.168.8.147:8000/gender-predict' \
  -H 'accept: application/json' \
  -H 'Content-Type: multipart/form-data' \
  -F 'file=@Mashan.jpg;type=image/jpeg'
```

Request URL

<http://192.168.8.147:8000/gender-predict>

Server response

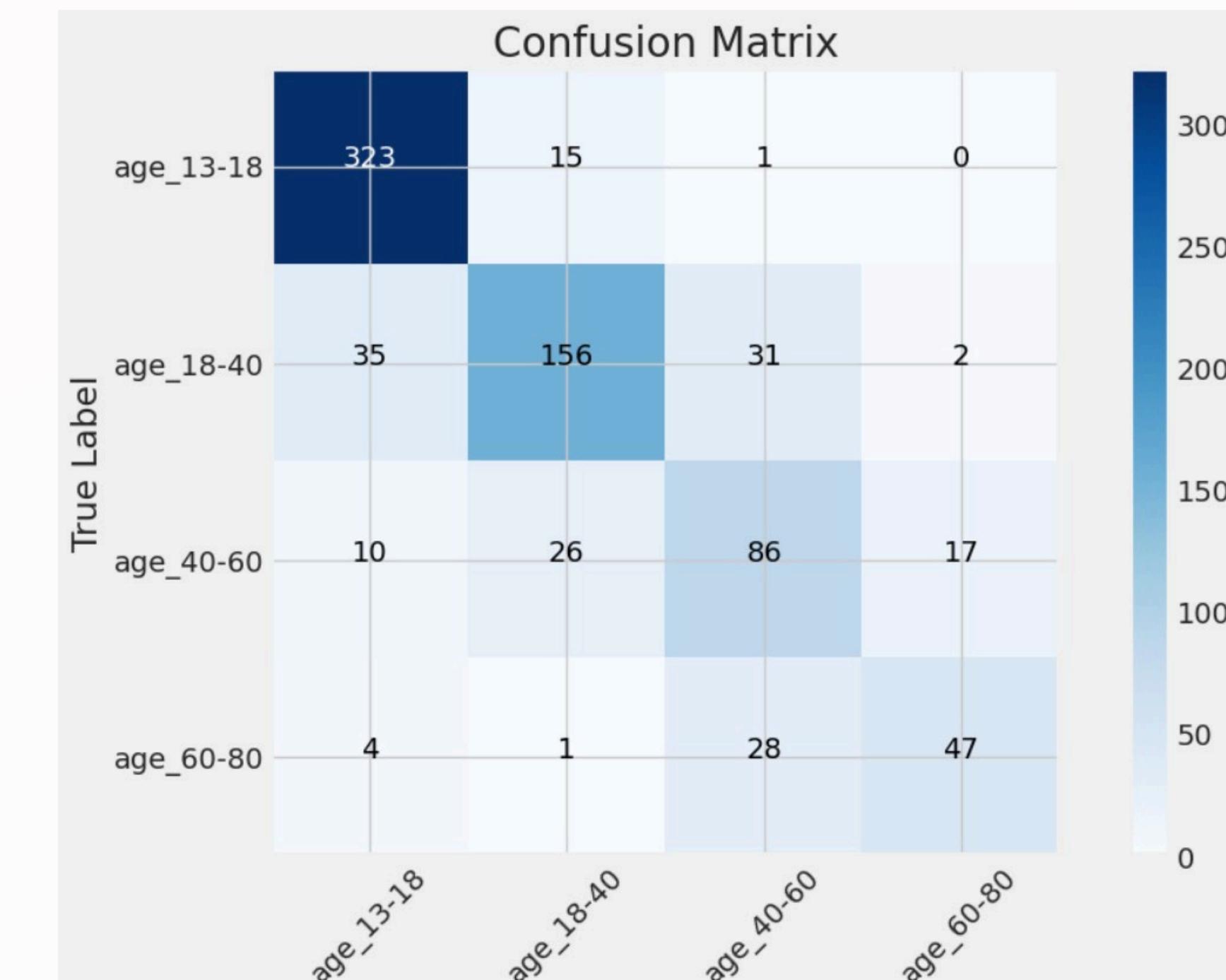
Code Details

200 Response body
"Male"

A screenshot of a Swagger UI interface for a gender prediction API. At the top, there is a file input field labeled "file * required" with the placeholder "string(\$binary)" and a "Choose file" button containing the text "Mashan". Below the file input is a blue "Execute" button and a "Clear" button. The main area is titled "Responses". Under "Responses", there is a "Curl" section containing a command-line request for a POST to the "gender-predict" endpoint. Below the curl command is the "Request URL" which is "http://192.168.8.147:8000/gender-predict". Under "Server response", there is a "Code" section with a "Details" link, and a "200" status row with a "Response body" column containing the text "'Male'".

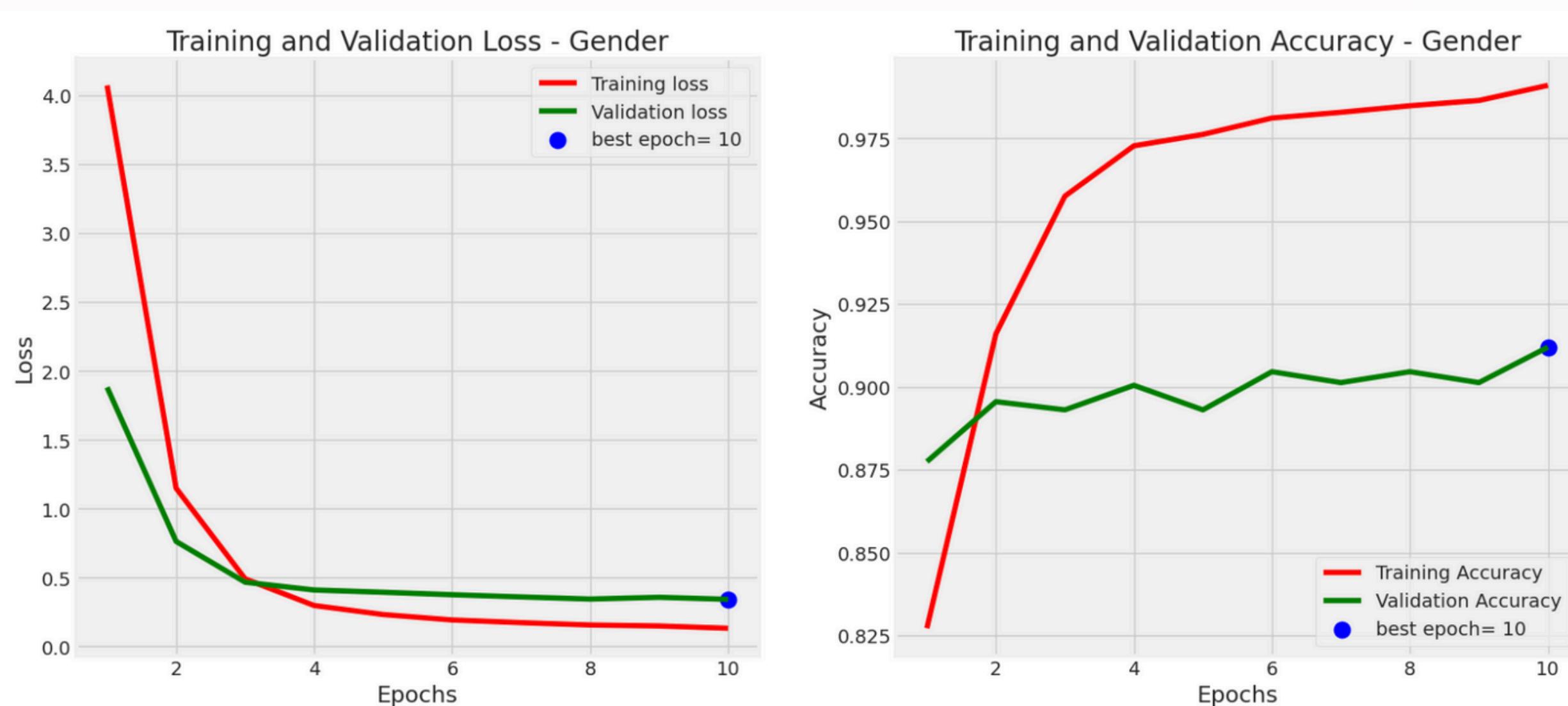
Completion cont..

Age Prediction Model - Confusion Matrix



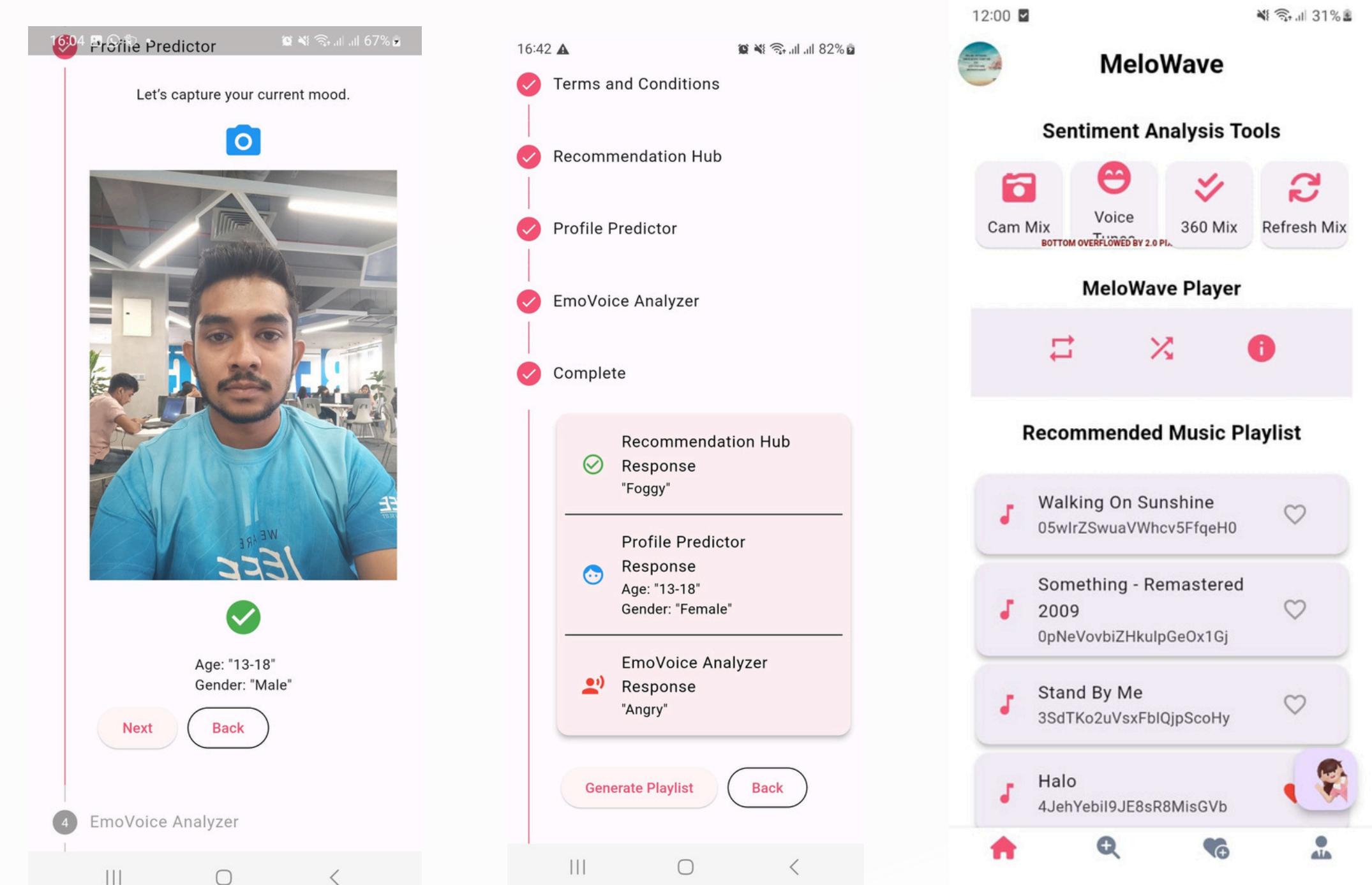
Completion cont..

Gender Prediction Model - Accuracy and Loss



Completion cont..

Mobile APP - UIs

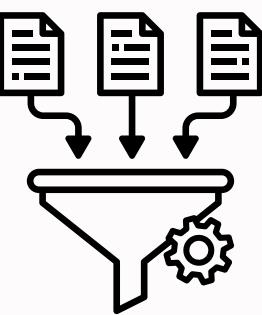


ACHIEVEMENTS OF 90%



Finding Datasets

- UTKFace Dataset



Preprocess Data

- Organizing images based on age and gender.
- Extracting and resizing facial images.



Training models for age and gender prediction

- EfficientNetB3, a pre-trained CNN architecture, is chosen.

ACHIEVEMENTS OF 90%

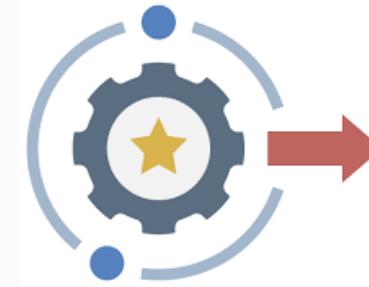


Drawing prototypes of the UIs of mobile app



Developing mobile App

- Used flutter for the development



Finalize the integrated mobile app as the deliverable

References

- [1] P. Darshna, "Music recommendation based on content and collaborative approach & reducing coldstart problem," 2018 2nd International Conference on Inventive Systems and Control (ICISC), Coimbatore, India, 2018, pp. 1033-1037, doi: 10.1109/ICISC.2018.8398959.
- [2] O. Ghosh, R. Sonkusare, S. Kulkarni and S. Laddha, "Music Recommendation System based on Emotion Detection using Image Processing and Deep Networks," 2022 2nd International Conference on Intelligent Technologies (CONIT), Hubli, India, 2022, pp. 1-5, doi: 10.1109/CONIT55038.2022.9847888.
- [3] E. Mayrhuber and O. Krauss, "User Profile-Based Recommendation Engine Mitigating the Cold-Start Problem," 2022 International Conference on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME), Maldives, Maldives, 2022, pp. 1-6, doi: 10.1109/ICECCME55909.2022.9988037.
- [4] J. Jayakumar and P. Supriya, "CNN based Music Recommendation system based on Age, Gender and Emotion," 2022 6th International Conference on Electronics, Communication and Aerospace Technology, Coimbatore, India, 2022, pp. 1356-1359, doi: 10.1109/ICECA55336.2022.10009391.



IT20610852
Fernando M.P.T.K.

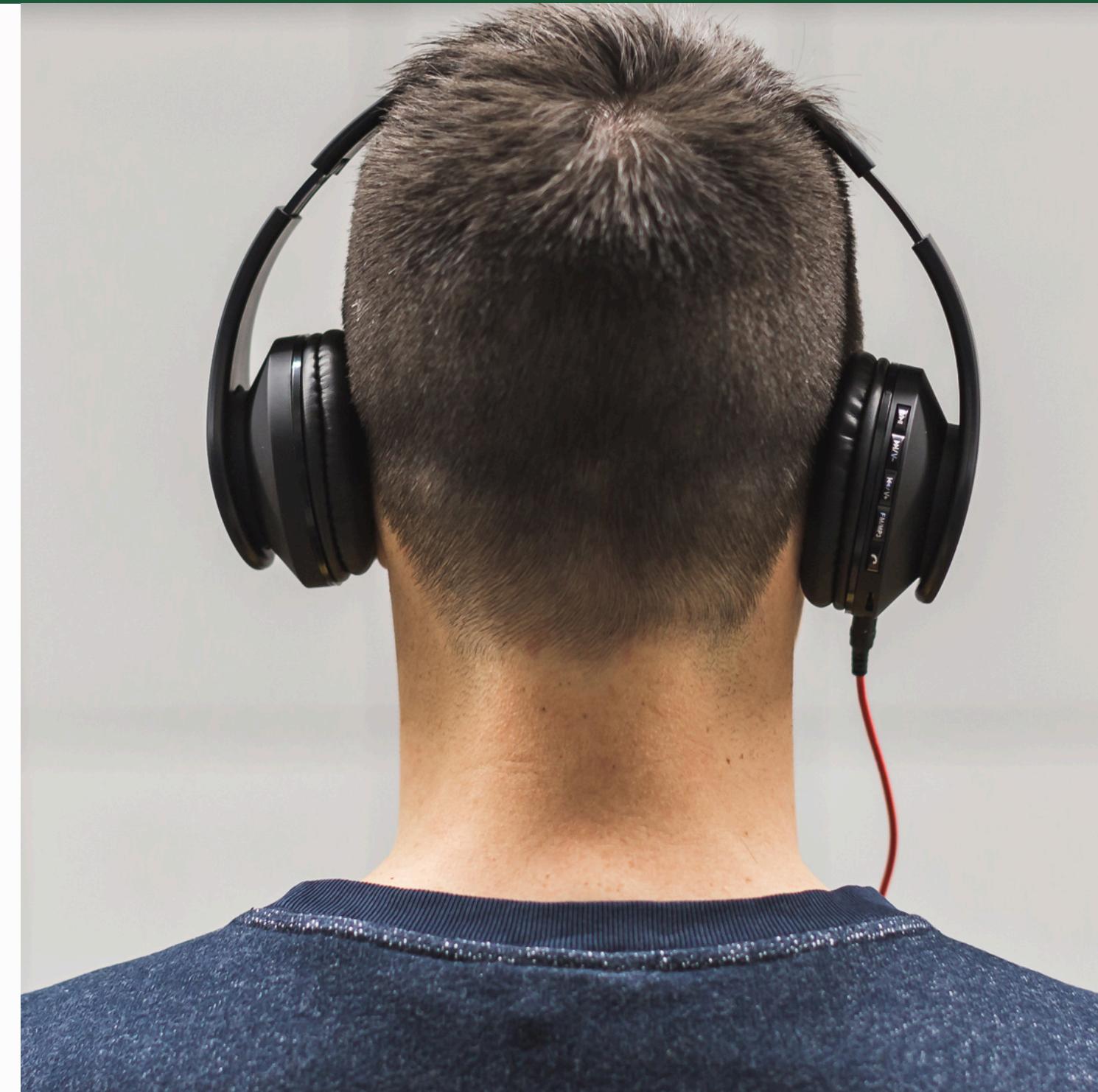
- Music Recommendations based On the current weather -

Research background

- Music recommendation based on weather.
- Involves categorizing the image into different weather categories.
- Training images of the user's surroundings for personalized playlist suggestions.
-

Research Problem

- How can machine learning and image processing techniques be leveraged to create a context-aware music recommendation system that recommends songs based on the user's surroundings, such as weather ?"



Novelty

- Novelty - By using machine learning and image processing, enhance user music satisfaction by recommending personalized songs according to the current weather.



Specific and sub-objectives

Specific Objective

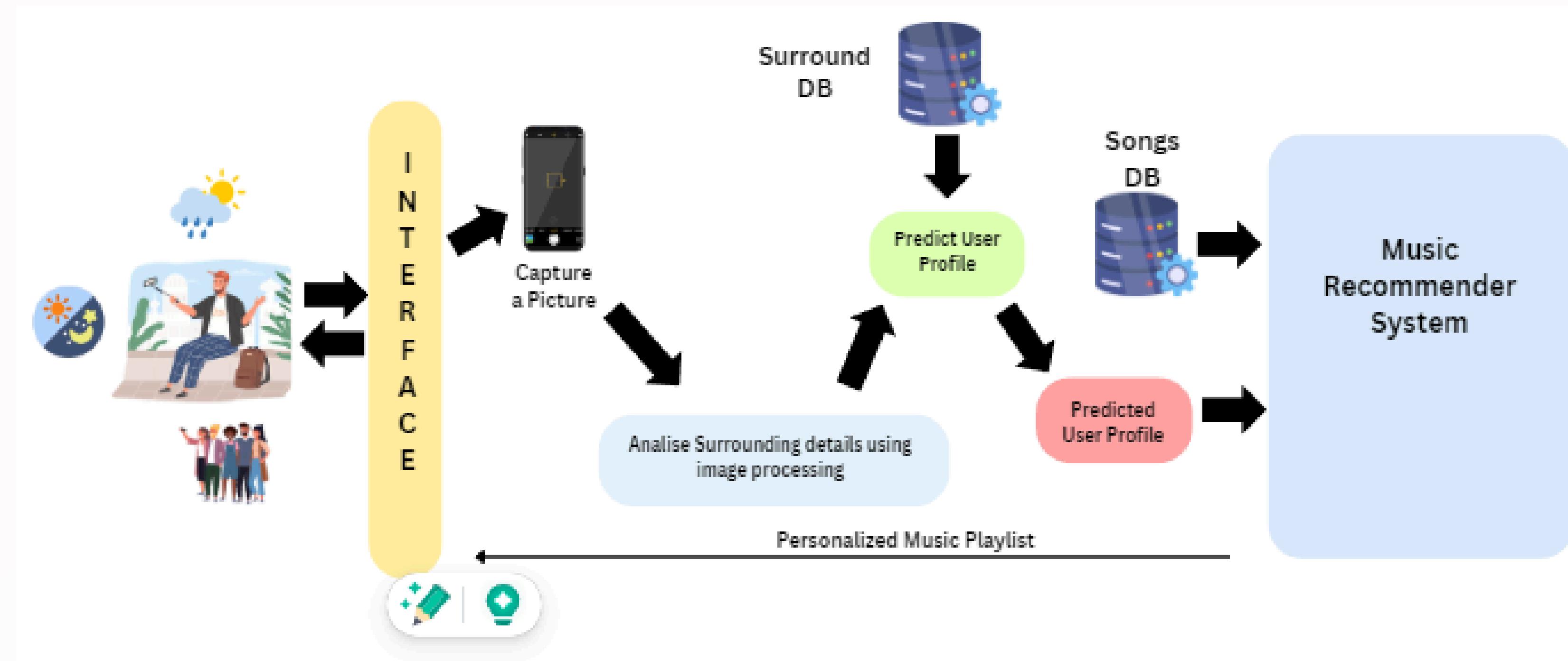
Using image processing and deep learning to recognize the weather of the user's surrounding photo and suggest a personalised playlist.

Sub Objective

- Obtaining Data Sets
- Image Analysis and Context Detection
- Validating the performance of the developed models
- Real-time data integration



Methodology – System Overview Diagram



Completion

Swagger API end points - Weather Prediction



Request body

file * required
string(\$binary) Choose file sunnyDay.jpeg

Execute Clear

Responses

Curl

```
curl -X 'POST' \
'http://192.168.8.147:8000/weather-predict' \
-H 'accept: application/json' \
-H 'Content-Type: multipart/form-data' \
-F 'file=@sunnyDay.jpeg;type=image/jpeg'
```

Request URL

<http://192.168.8.147:8000/weather-predict>

Server response

Code Details

200 Response body
"Shine"

Completion cont..

Swagger API end points - Weather Prediction



file required string(\$binary)

Execute **Clear**

Responses

Curl

```
curl -X 'POST' \
  'http://192.168.8.147:8000/weather-predict' \
  -H 'accept: application/json' \
  -H 'Content-Type: multipart/form-data' \
  -F 'file=@fog.jpeg;type=image/jpeg'
```

Request URL

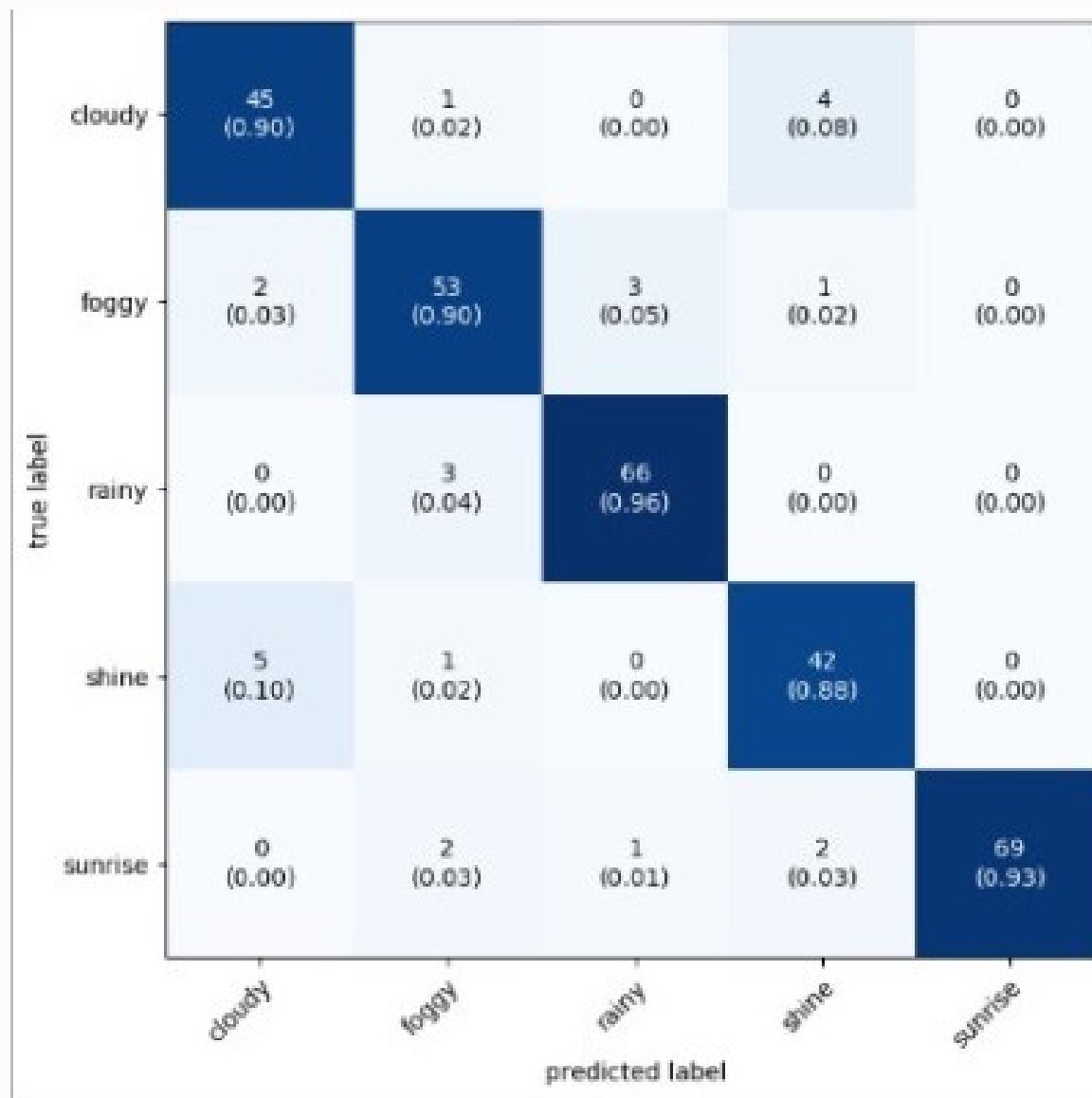
```
http://192.168.8.147:8000/weather-predict
```

Server response

Code	Details
200	Response body "Foggy"

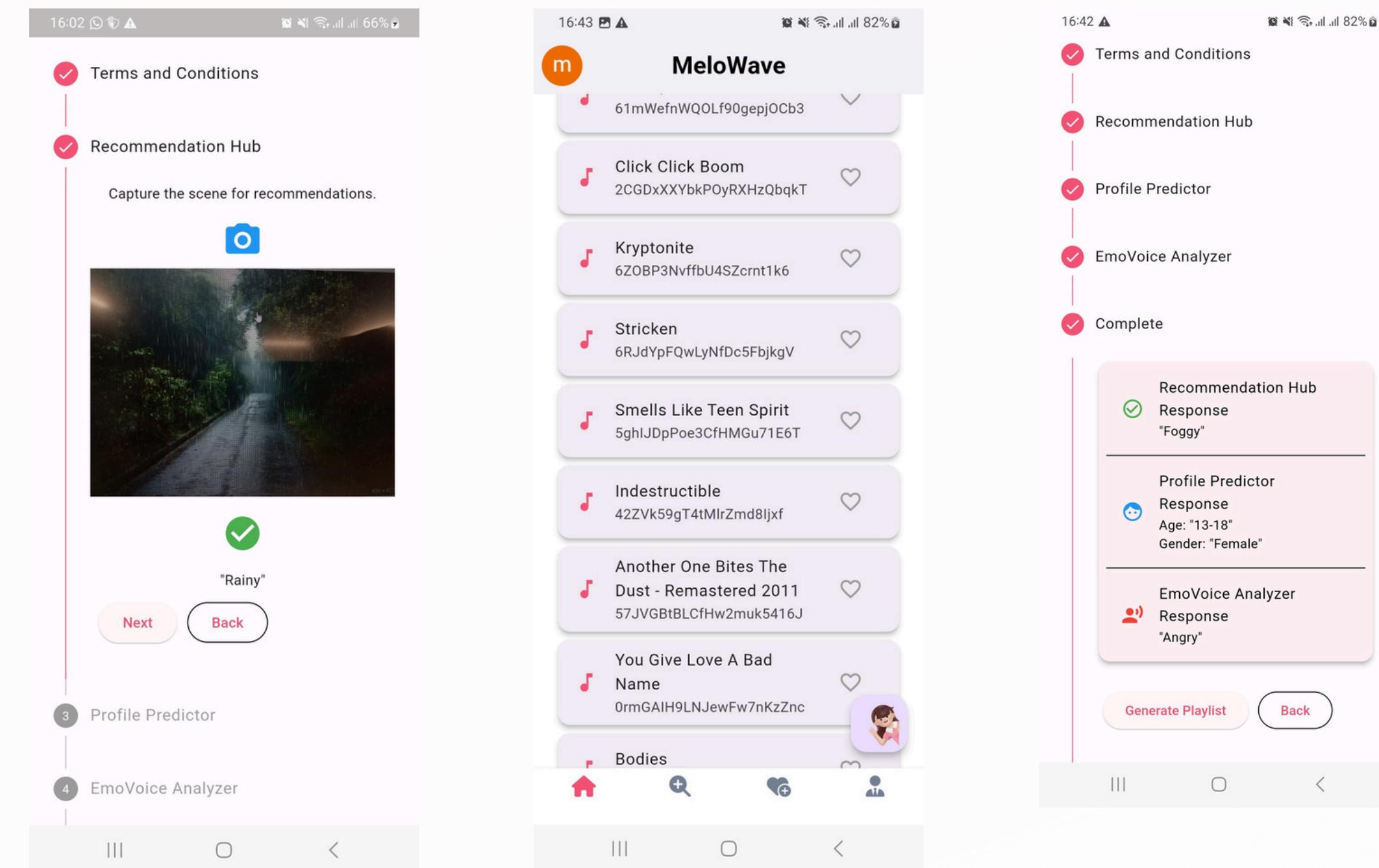
Completion cont..

Weather Prediction Model



Completion cont..

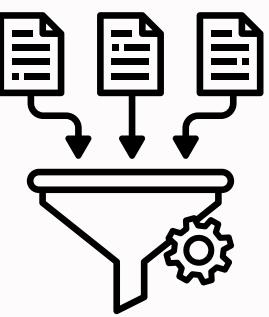
Mobile APP - UIs



ACHIEVEMENTS OF 90%



Finding Datasets



Preprocess Data

- Organizing images based on weather.
- Extracting and resizing images.



Training weather prediction model

ACHIEVEMENTS OF 90%

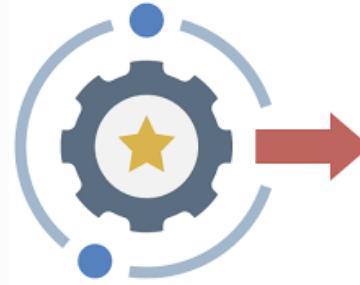


Drawing prototypes of the UIs of mobile app



Developing mobile App

- Used flutter for the development



Finalize the integrated mobile app as the deliverable

References

1. Use IEEE reVerma, Varsha & Marathe, Ninad & Sanghavi, Parth & Nitnaware, Dr. (2021). Music ecommendation System Using Machine Learning. International Journal of Scientific Research in Computer Science, Engineering and Information Technology. 80-88. 10.32628/CSEIT217615.erencing format
2. Verma, Varsha & Marathe, Ninad & Sanghavi, Parth & Nitnaware, Dr. (2021). Music Recommendation System Using Machine Learning. International Journal of Scientific Research in Computer Science, Engineering and Information Technology. 80-88. 10.32628/CSEIT217615.
3. Dorochowicz, Aleksandra & Kostek, Bozena. (2019). Relationship between album cover design and music genres. 93-98. 10.23919/SPA.2019.8936738
4. Johnson, M., White, E. (2019). "Analyzing Image Texture for Scene Classification." Proceedings of the IEEE International Conference on Computer Vision, 789-802. DOI:



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Gunasekara C. M.

-User emotion extraction through a voice clip -

Research background

- Currently, there is no system for identifying users' emotion state using voice input and a system to recommend a playlist based on that emotional state.
- Some machine learning models are used in other industries but emotion based recommendation does not happen in music industry.
- There is no such system to Optimize real-time voice processing.

Research Problem

- Currently there is no system for identifying users emotion state using voice input and a system to recommend a playlist based on that emotion state.
- Some machine learning models are used in other industries but emotion based recommendation does not happen in music industry.

Novelty

- Novelty - use audio frequency analysis to predict the user's current emotional state.



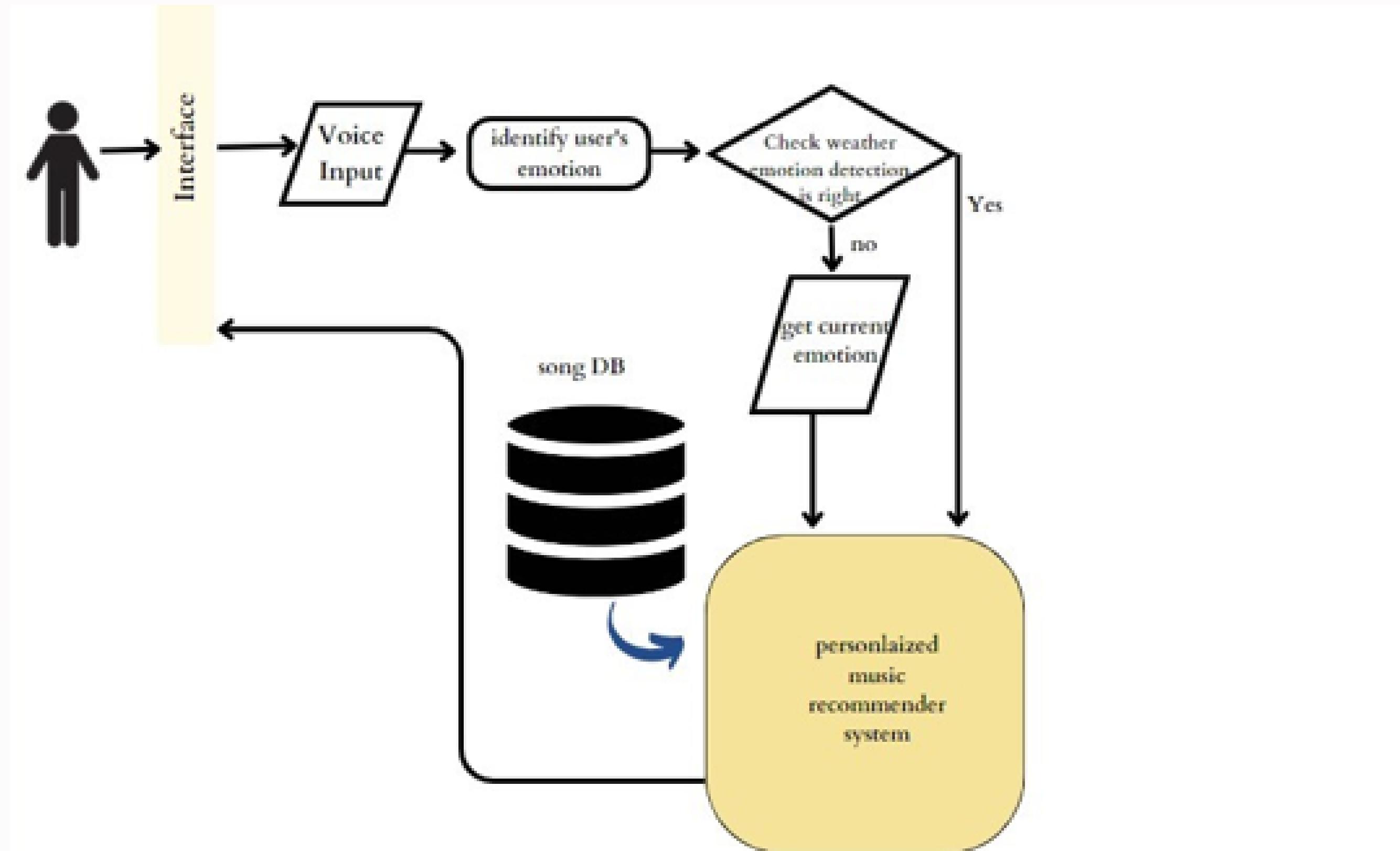
Main Objective

- Get the user's voice input to extract the emotion state and suggest a playlist according to that emotion state. Enhance the accuracy of the user's emotion by getting vocal feedback from the user.

Sub Objectives

- Getting user's voice inputs and using those inputs for further classifications Extract features.
- Remove noises from the voice clips.
- Identify pitch using voice inputs.
- identify the user's emotional state.
- Recommend a playlist based on emotional state.

Methodology – System Overview Diagram



Completion

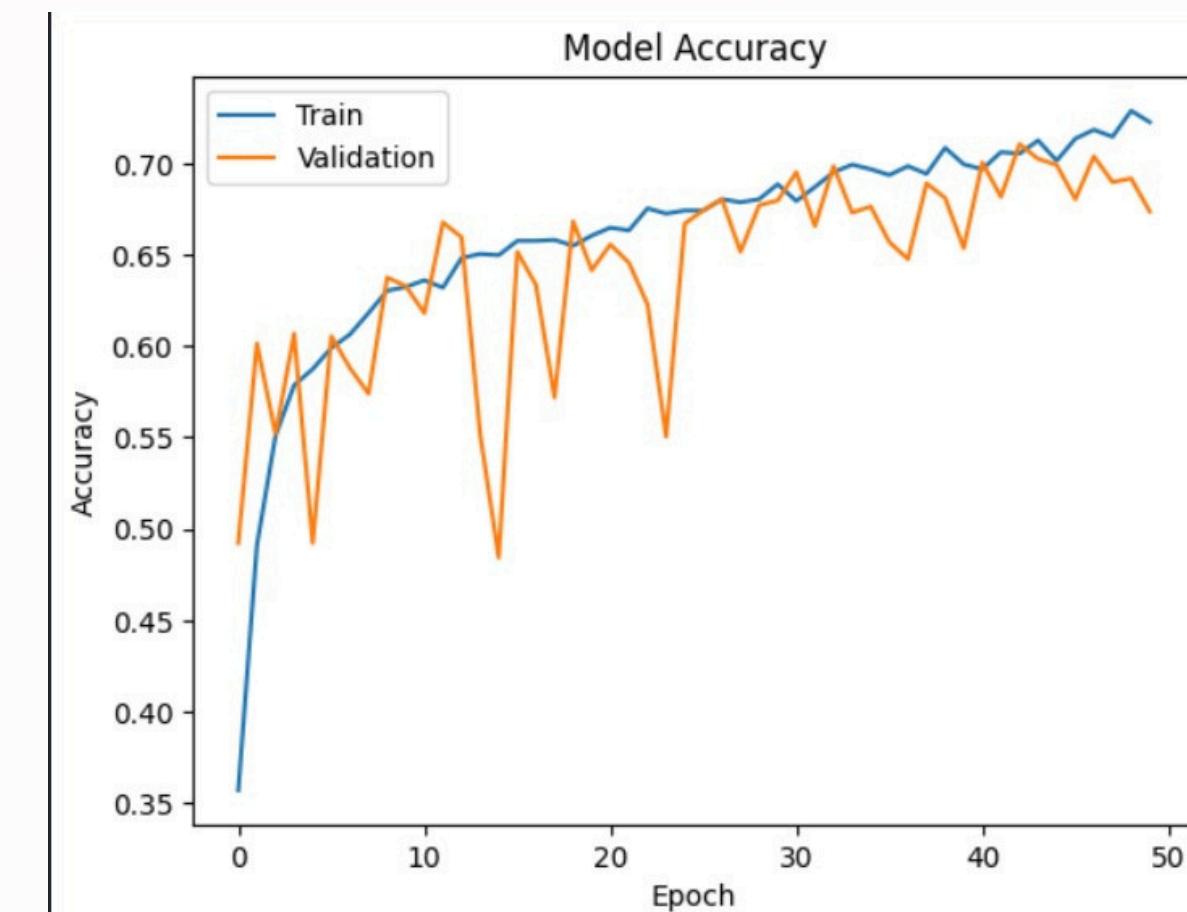
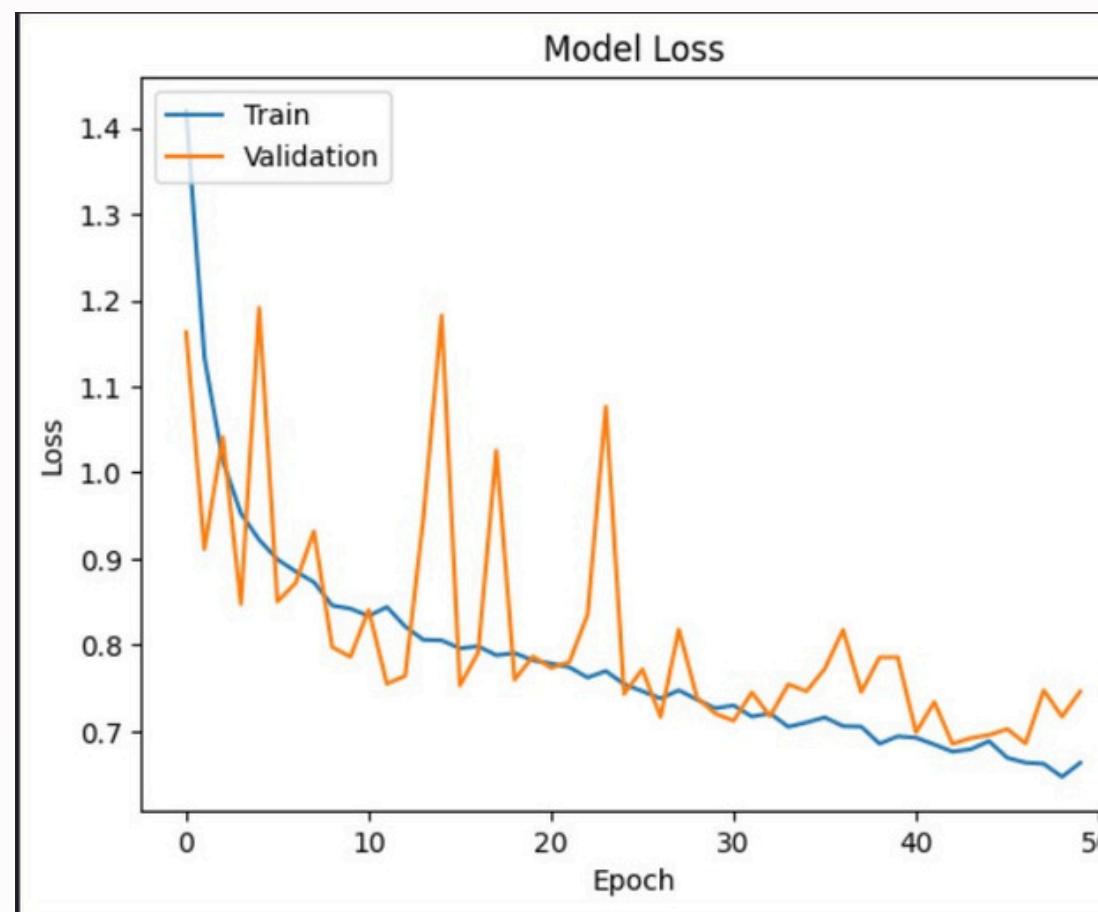
Swagger API end points - Emotion Prediction

The screenshot shows a Swagger UI interface for a POST endpoint. The endpoint is used for emotion prediction on audio files. The interface includes a file input field with a placeholder "Choose file New Recording 42.m4a", a "string(\$binary)" parameter, and a "file" parameter marked as required. Below the input fields are "Execute" and "Clear" buttons. The "Responses" section is currently empty. The "Curl" section contains a command to make a POST request to "http://192.168.8.147:8000/emotion-prediction" with a file named "New Recording 42.m4a" as the payload. The "Request URL" is also listed as "http://192.168.8.147:8000/emotion-prediction". In the "Server response" section, a table shows a single row for status code 200, with the response body containing the string "Angry".

Code	Details
200	Response body "Angry"

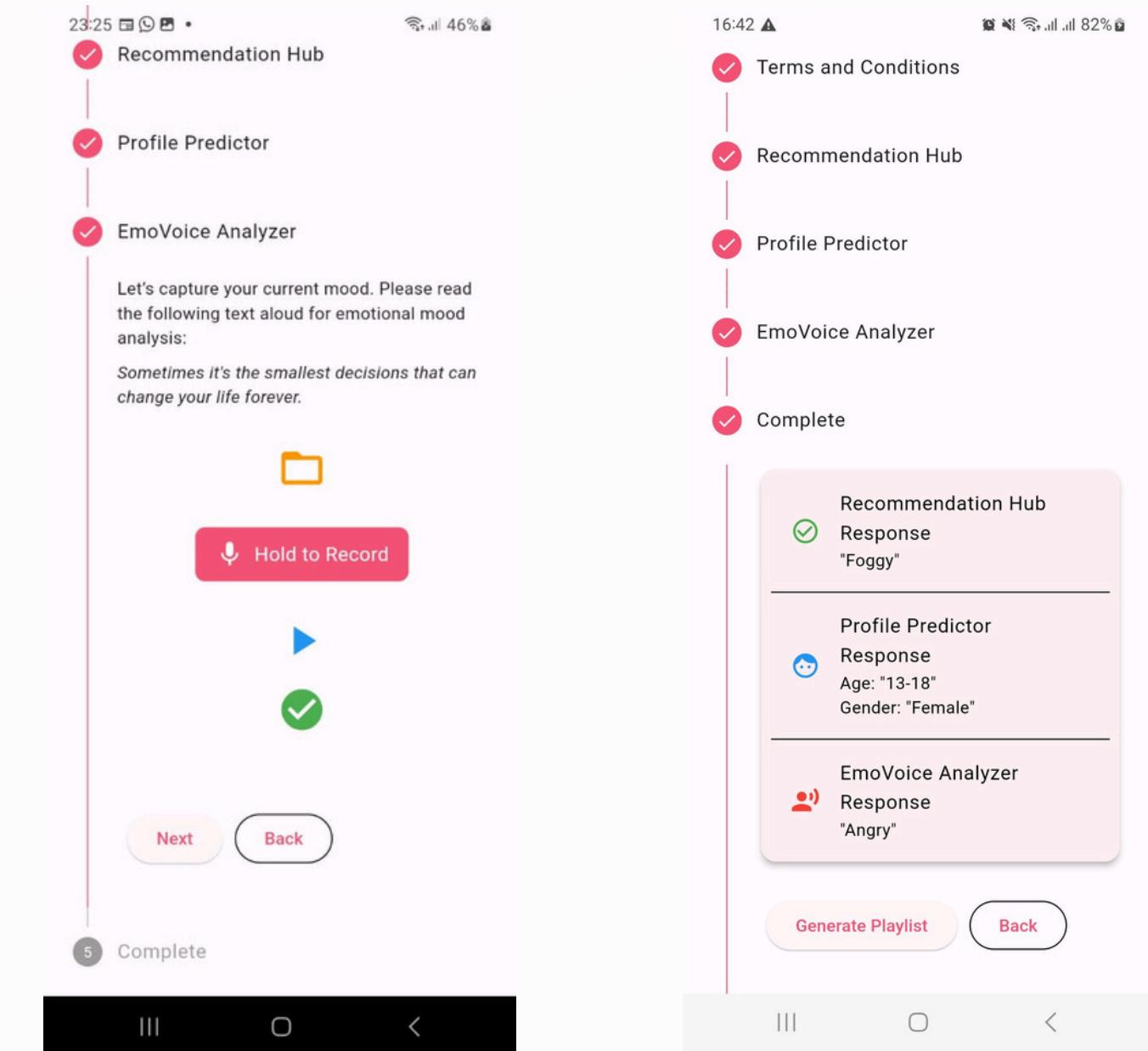
Completion cont..

Emotion Prediction Model - accuracy and loss



Completion cont..

Mobile APP - UIs

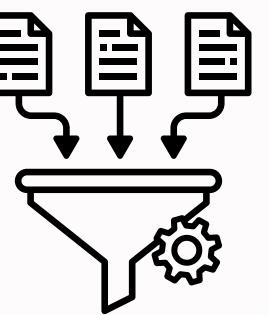


ACHIEVEMENTS OF 90%



Finding Datasets

- Voice Input
- CREMA-D, TESS, RAVDESS, and SAVEE datasets



Preprocess Data

- Merge the DataFrames containing data for male and female speakers from different datasets



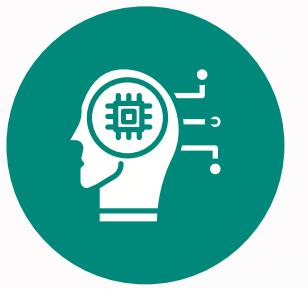
Training emotion prediction model

- 80% of the data is to the training set and 20% to the testing set. training model consists of Input Layer, LSTM Layer, batch normalised Layer, dense layer and output layer.

ACHIEVEMENTS OF 90%

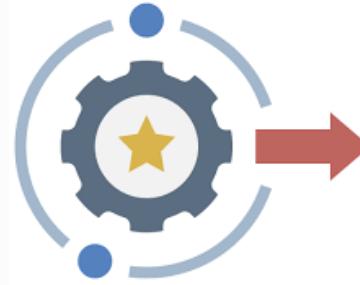


Drawing prototypes of the UIs of mobile app



Developing mobile App

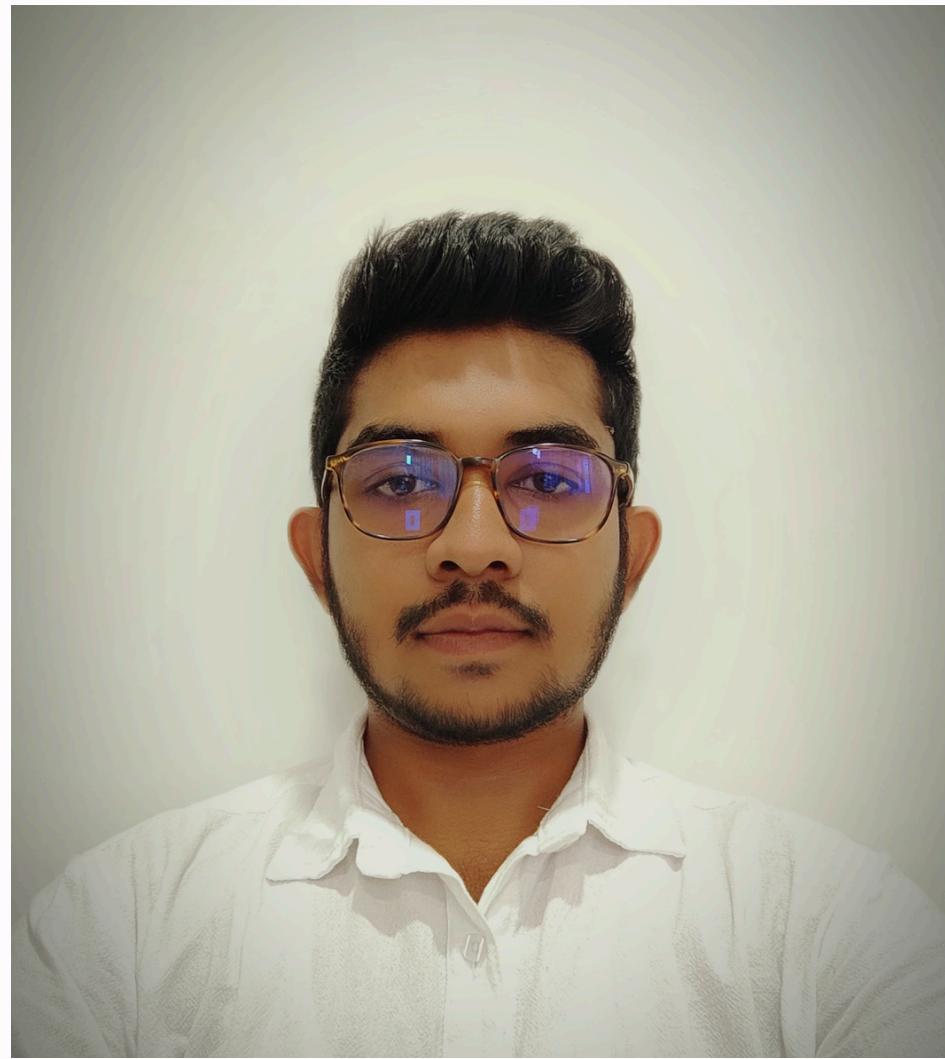
- Used flutter for the development



Finalize the integrated mobile app as the deliverable

References

- [1]K. R. Nambiar and S. Palaniswamy, "Speech Emotion Based Music Recommendation," 2022 3rd International Conference for Emerging Technology (INCET), Belgaum, India, 2022, pp. 1-6, doi: 10.1109/INCET54531.2022.9824457.
- [2]K. S. Krupa, G. Ambara, K. Rai and S. Choudhury, "Emotion aware Smart Music Recommender System using Two Level CNN," 2020 Third International Conference on Smart Systems and Inventive Technology (ICSSIT), Tirunelveli, India, 2020, pp. 1322-1327, doi: 10.1109/ICSSIT48917.2020.9214164.
- [3]V. Mounika and Y. Charitha, "Mood -Enhancing Music Recommendation System based on Audio Signals and Emotions," 2023 International Conference on Inventive Computation Technologies (ICICT), Lalitpur, Nepal, 2023, pp. 1766-1772, doi: 10.1109/ICICT57646.2023.10134211.



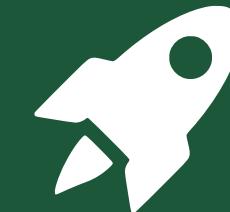
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Dhananjaya W. K. S

-Speech Emotion Recognition to detect post emotional state of a user. -

Research background



There is currently no established recommendation system for identifying post-user emotional state.



Current recommendation systems only consider the pre-emotion of user.



There is less focus on personalized music playlists based on emotion.

Research Problem

- There is no way to compare the impact on user emotion after listening to the system-generated playlist.
- Currently, there is no system for identifying a user's post-emotional state using voice input and a system to recommend a playlist based on that emotional state.

Novelty

- Novelty - By using sentiment analysis and AI, find a user's post-emotional state after listening to the playlist





Specific and sub-objectives

Specific Objective

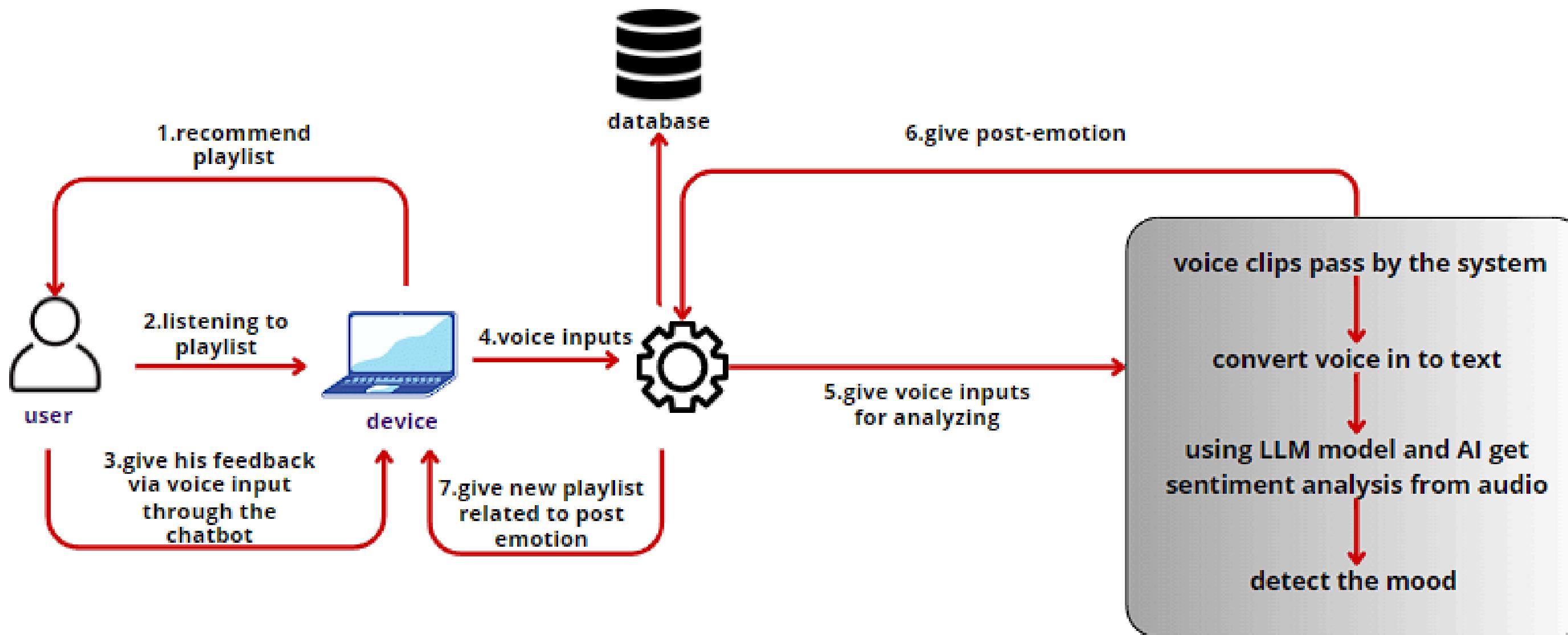
Improve user experience by understanding their emotional state and Improve more personalised experience

Sub Objective

- Identify the post-emotional state of the user.
- Obtaining data sets, Identification and classification of post emotion through audio processing.
- use speech recognition to extract text content from audio files.
- using the AI GPT model to predict the post-emotional state.



Methodology – System Overview Diagram



Completion

Swagger API end points

POST /predict-emotion-from-audio Predict Emotion From Audio

Parameters

No parameters

Request body required **multipart/form-data**

audiofile1 * required
string(\$binary)
 Sad-text1.wav

audiofile2 * required
string(\$binary)
 Happy-text2.wav

audiofile3 * required
string(\$binary)
 Happy-text3.wav

Cancel **Reset**

Completion cont..

Swagger API end points

```
curl -X 'POST' \
  'http://127.0.0.1:8000/predict-emotion-from-audio' \
  -H 'accept: application/json' \
  -H 'Content-Type: multipart/form-data' \
  -F 'audiofile1=@Sad-text1.wav;type=audio/wav' \
  -F 'audiofile2=@Happy-text2.wav;type=audio/wav' \
  -F 'audiofile3=@Happy-text3.wav;type=audio/wav'
```

Request URL
<http://127.0.0.1:8000/predict-emotion-from-audio>

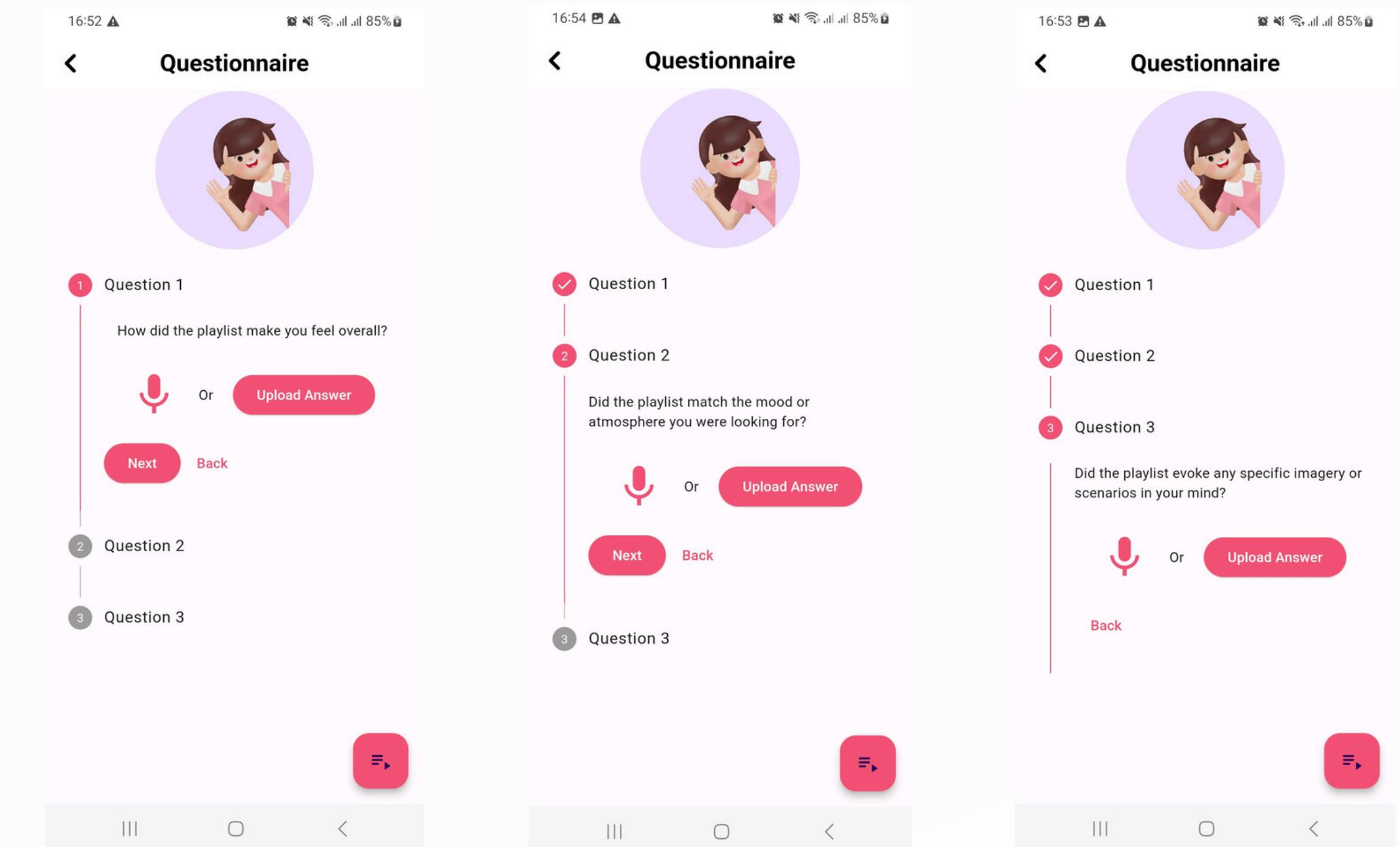
Server response

Code	Details
200	<p>Response body</p> <pre>{ "emotion": "happy", "playlist": ["Outside Inside": "4dSN0nghIzs8gu1DMywr33", "Dancing Queen": "0GjEhVFGZW8afUYGChu3Rr", "Hakuna Matata - From \"The Lion King\" Soundtrack": "5khPZny1Hf4w1XyHrZ6T0n", "I Just Called To Say I Love You": "6RNDeRnWsRMjPdNVgupZCs", "Ain't No Mountain High Enough": "7tqhbajSfrz2F7E1Z75ASX", "Watermelon Sugar": "6UellqGlWMcVH1E5c4H71Y", "Sweet Caroline": "62AuGbAkt80x2IrFFb8GKV", "Happy - From \"Despicable Me 2\"": "60nZcImufyMA1MKQY3dcCH", "Happy Together": "1J01xLtVc8mWhIoE3YaCL0", "Dance Monkey": "2XU0oxnq2qxCpomAAuJY8K"] }</pre> <p>Download</p>

Response headers

Completion cont..

Mobile APP - UIs

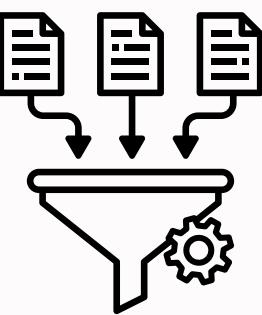


ACHIEVEMENTS OF 90%



Finding Data

- Voice Inputs from user



Preprocess Data

- turning vocal data into text



Training emotion prediction model

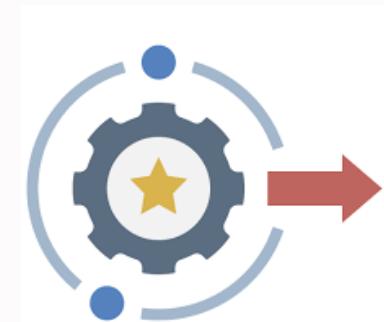
- Organizing text data and analysing them.
- Extracting emotion in text using LLM.

ACHIEVEMENTS OF 90%



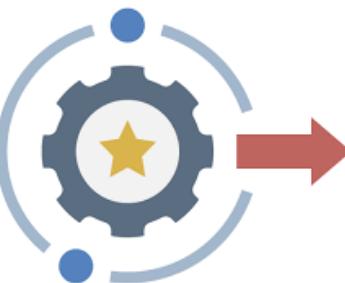
Prediction

- According to the 3 predictions of voice clips sentiment analysis, predict the post-emotion



Give output

- detect the user's post emotional state and the mobile app suggests a new personalized playlist.

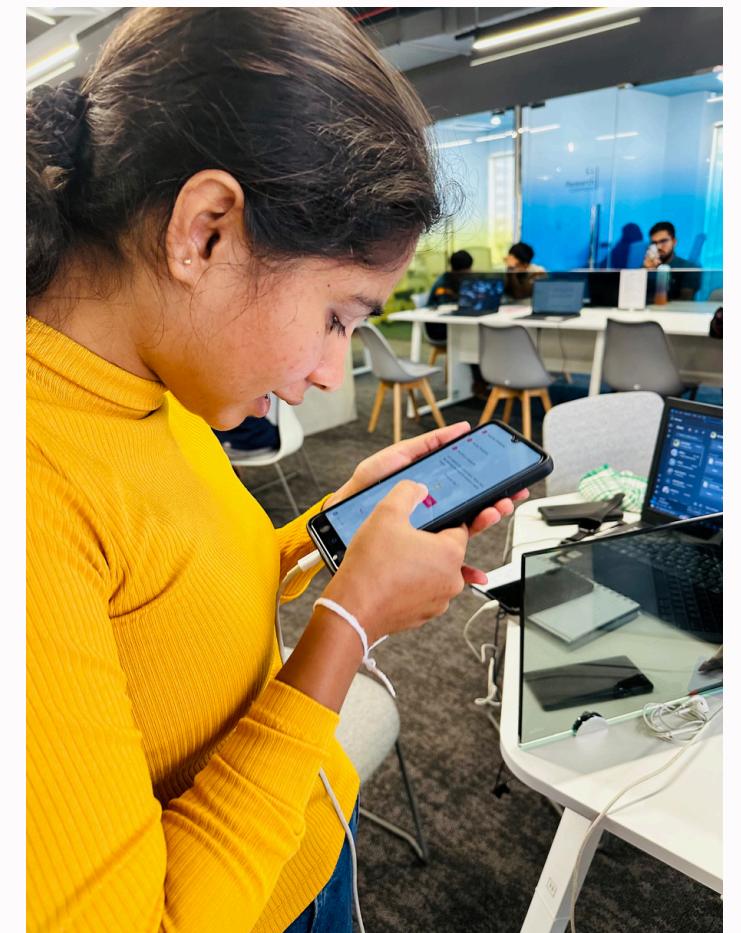
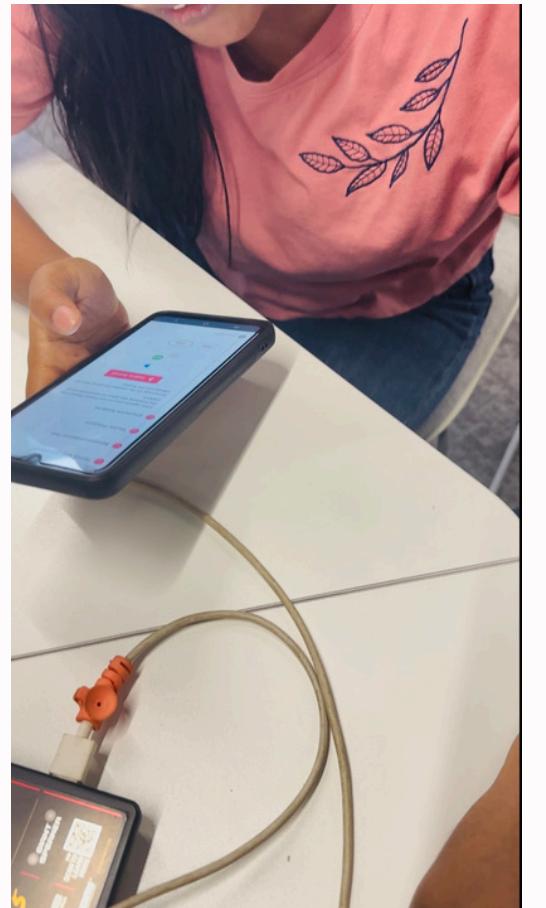


Finalize the integrated mobile app as the deliverable

References

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- [3] V. P. Sharma, A. S. Gaded, D. Chaudhary, S. Kumar and S. Sharma, "Emotion-Based Music Recommendation System," 2021 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), Noida, India, 2021, pp. 1-5, doi: 10.1109/ICRITO51393.2021.9596276.
- [4] M. Pant, S. Trivedi, S. Aggarwal, R. Rani, A. Dev and P. Bansal, "Driver's Companion-Drowsiness Detection and Emotion Based Music Recommendation System," 2022 International Conference on Computing, Communication, and Intelligent Systems (ICCCIS), Greater Noida, India, 2022, pp. 1-6, doi: 10.1109/ICCCIS56430.2022.10037226.

Field Testing



Feedbacks

4. Is your surrounding predicted correctly?

[More Details](#) [💡 Insights](#)

Yes	7
No	1
Slightly different	2
Completely different	1



5. Is your emotion state predict correctly?

[More Details](#) [💡 Insights](#)

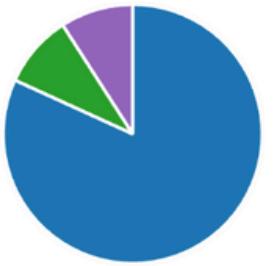
Yes	8
No	0
Maybe	3



6. Generate accurate playlist based on your current emotion state ?

[More Details](#) [💡 Insights](#)

Agree	9
Disagree	0
Partially agree	1
Partially disagree	0
Other	1



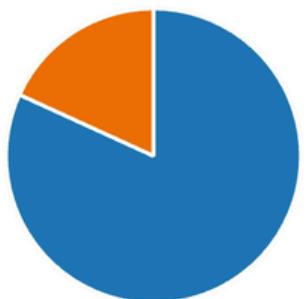
2 respondents (18%) answered **Bandara** for this question.

Thabittha
Hansi
Isuru
Charith Anjana
Bandara
Chapa Madhavee Tharushi
Kalpana
Sohan Bandara
Sadeep Bandara
Kalana Sithum

2. Is your gender predicted correctly?

[More Details](#) [💡 Insights](#)

yes	9
No	2



ANY QUESTIONS ???



THANK YOU

Thank You for the Attention..

