

Multi-Model Approach to Recommend Personalized Music Playlist

TMP – 2023 – 24 - 065



Supervisor

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Meet Our Team



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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 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.

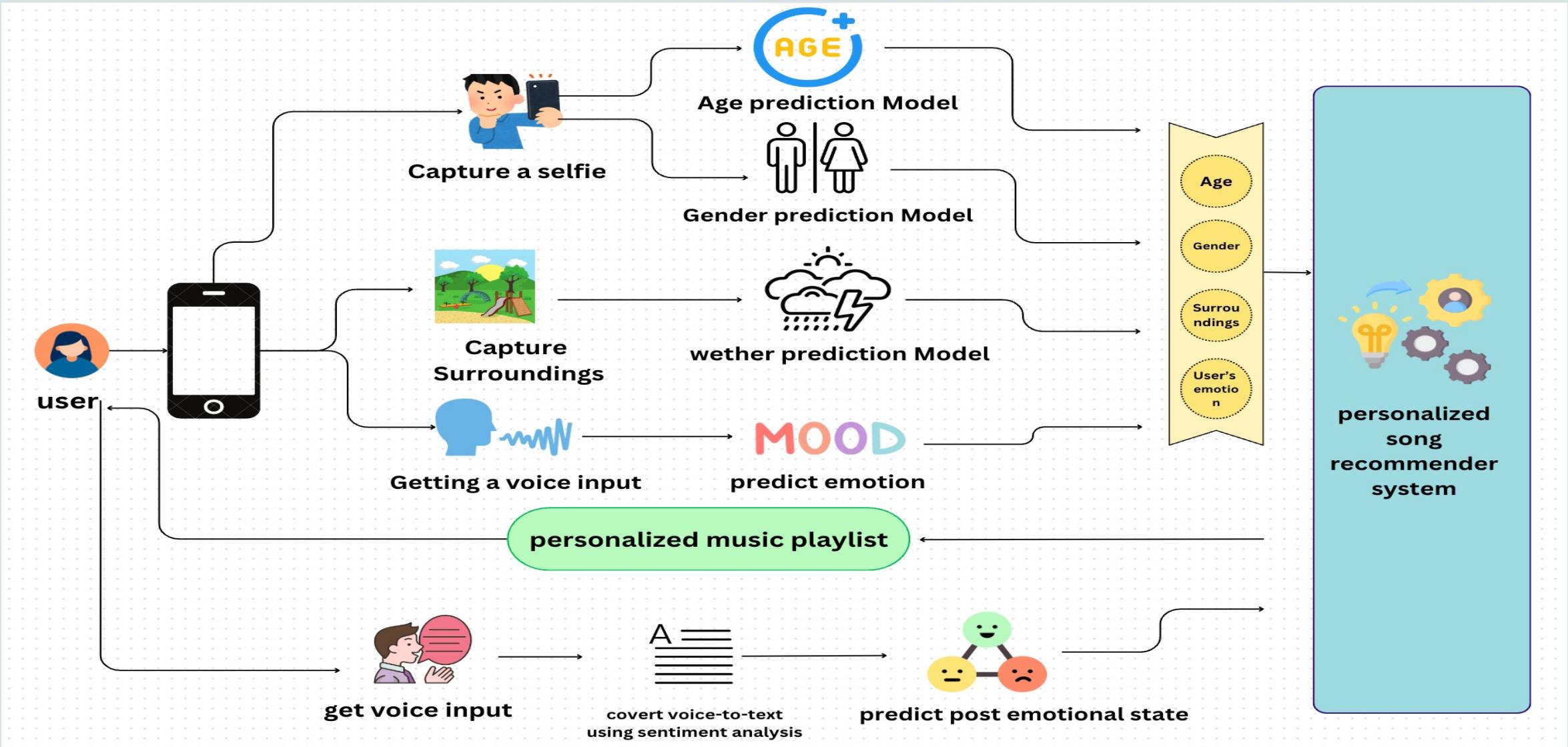
Main Objective

- 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.

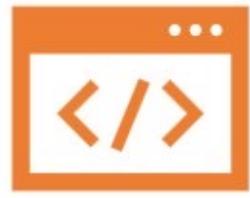
Sub Objectives

- 1. Analyze a user-specific Profile** - This component tackles the music recommendation by using selfie images to predict user age and gender.
- 2. Current weather of the user** - Context-aware music recommendations consider user surroundings / weather for personalized, engaging music streaming experience.
- 3. Emotions using vocal responses** - improving emotion detection by learning user voice frequency.
- 4. Effects on users' emotional state** - Addressing the uncertainty of whether music recommendations effectively improve users' moods and feelings in daily life.

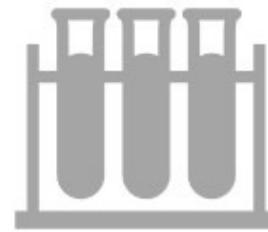
Overall System Architecture Diagram



PP2 to Final evaluation Progress



Improve UI/UX

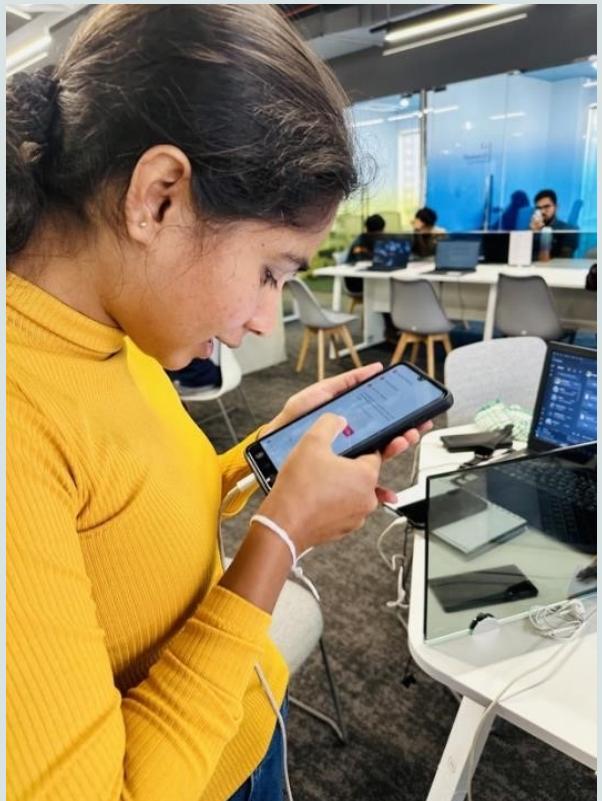


Testing



Deployment

Conducting User Acceptance Tests



Testing Results

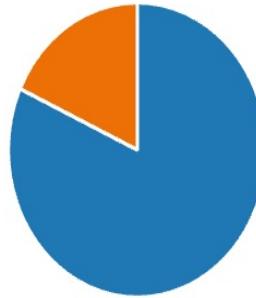


User Feedbacks Comparison from PP2 to Final Product

2. Is your gender predicted correctly?

[More Details](#) 

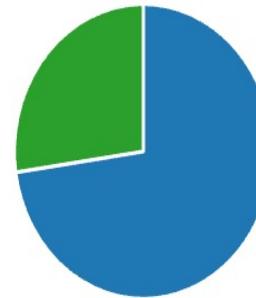
● yes	9
● No	2



3. Is your age predicted correctly?

[More Details](#) 

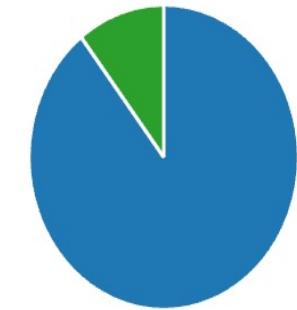
● Yes	8
● No	0
● Slightly different	3
● Completely different	0



2. Is your gender predicted correctly?

[More Details](#) 

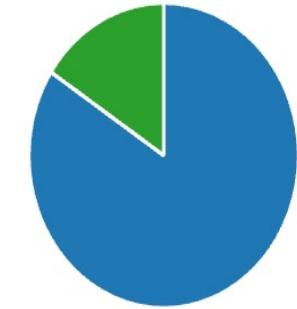
● yes	17
● No	0
● Other	2



3. Is your age predicted correctly?

[More Details](#) 

● Yes	16
● No	0
● Slightly different	3
● Completely different	0

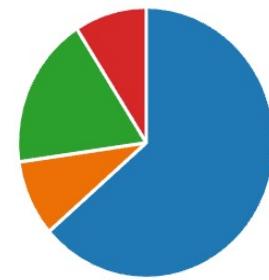


User Feedbacks Comparison from PP2 to Final Product

4. Is your surrounding predicted correctly?

[More Details](#) [💡 Insights](#)

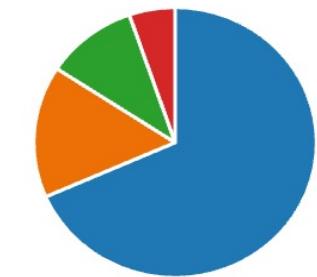
Yes	7
No	1
Slightly different	2
Completely different	1



4. Is your surrounding predicted correctly?

[More Details](#) [💡 Insights](#)

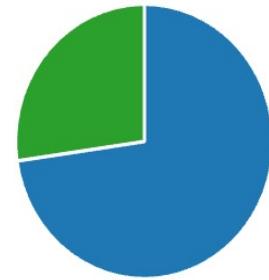
Yes	13
No	3
Slightly different	2
Completely different	1



5. Is your emotion state predict correctly?

[More Details](#) [💡 Insights](#)

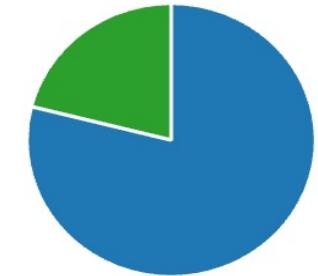
Yes	8
No	0
Maybe	3



5. Is your emotion state predict correctly?

[More Details](#) [💡 Insights](#)

Yes	15
No	0
Maybe	4

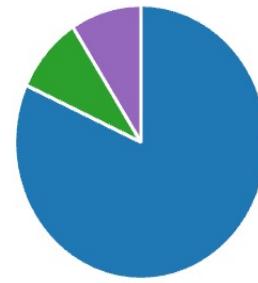


User Feedbacks Comparison from PP2 to Final Product

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

[More Details](#) [💡 Insights](#)

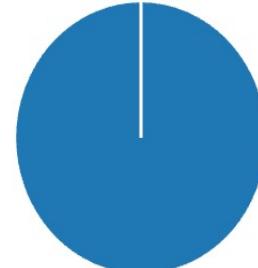
Agree	9
Disagree	0
Partially agree	1
Partially disagree	0
Other	1



7. Is the playlist affected to your emotion?

[More Details](#) [💡 Insights](#)

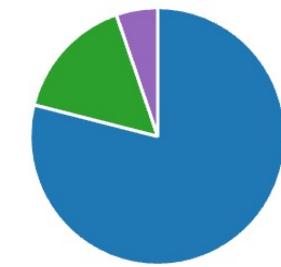
Yes	11
No	0



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

[More Details](#) [💡 Insights](#)

Agree	15
Disagree	0
Partially agree	3
Partially disagree	0
Other	1



7. Is the playlist affected to your emotion?

[More Details](#) [💡 Insights](#)

Yes	18
No	1

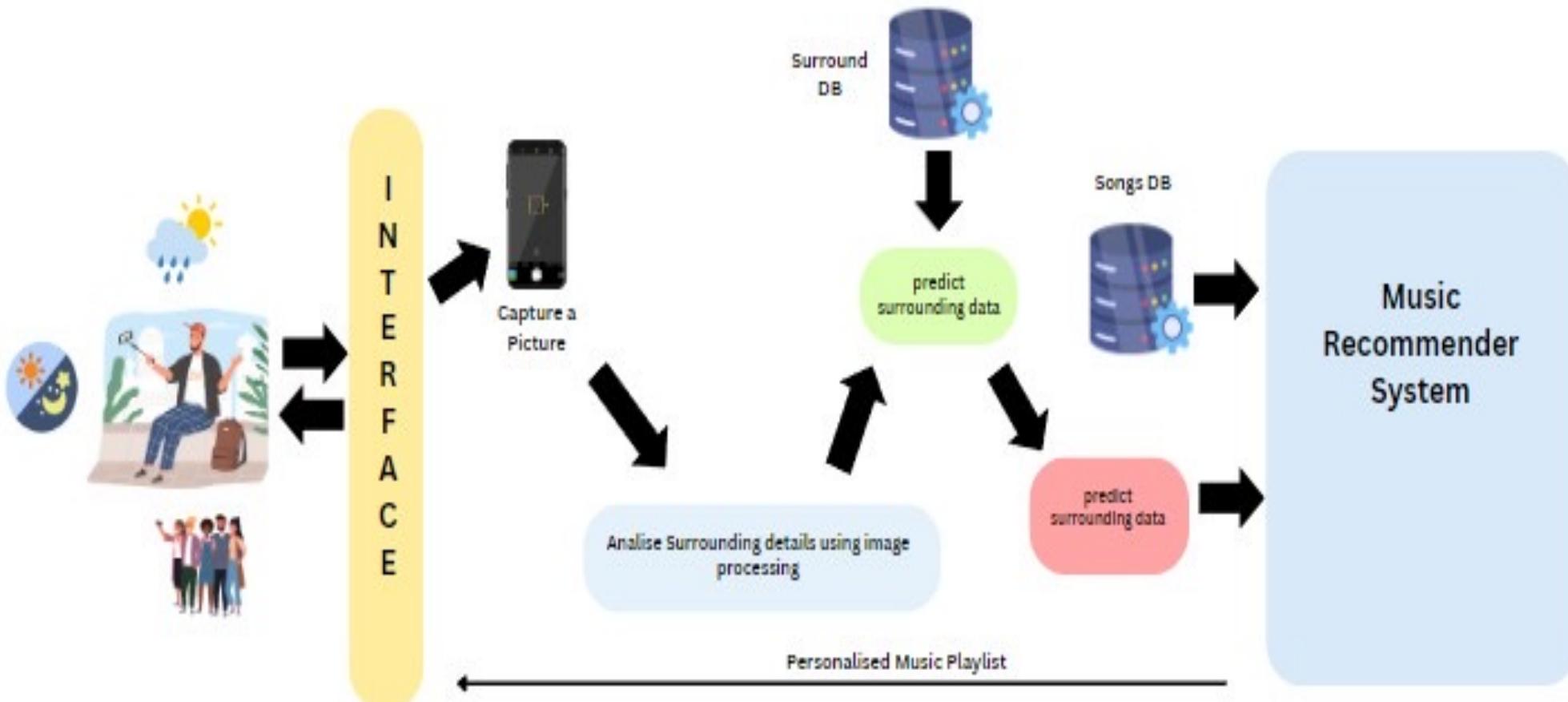




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User Surrounding Prediction

Component Overview Diagram



Model Training

```
Epoch 2: val_accuracy improved from 0.87333 to 0.88333, saving model to vgg19.h5
150/150 [=====] - 7s 45ms/step - loss: 0.3076 - accuracy: 0.9023 - val_loss: 0.3677 - val_accuracy: 0.8833
Epoch 3/30
149/150 [=====>.] - ETA: 0s - loss: 0.2172 - accuracy: 0.9379
Epoch 3: val_accuracy did not improve from 0.88333
150/150 [=====] - 7s 44ms/step - loss: 0.2163 - accuracy: 0.9382 - val_loss: 0.3914 - val_accuracy: 0.8733
Epoch 4/30
149/150 [=====>.] - ETA: 0s - loss: 0.1534 - accuracy: 0.9631
Epoch 4: val_accuracy improved from 0.88333 to 0.88667, saving model to vgg19.h5
150/150 [=====] - 8s 54ms/step - loss: 0.1535 - accuracy: 0.9624 - val_loss: 0.3449 - val_accuracy: 0.8867
Epoch 5/30
149/150 [=====>.] - ETA: 0s - loss: 0.1259 - accuracy: 0.9664
Epoch 5: val_accuracy improved from 0.88667 to 0.90667, saving model to vgg19.h5
150/150 [=====] - 7s 45ms/step - loss: 0.1261 - accuracy: 0.9658 - val_loss: 0.2995 - val_accuracy: 0.9067
Epoch 6/30
149/150 [=====>.] - ETA: 0s - loss: 0.0919 - accuracy: 0.9799
Epoch 6: val_accuracy did not improve from 0.90667
150/150 [=====] - 8s 54ms/step - loss: 0.0915 - accuracy: 0.9800 - val_loss: 0.3409 - val_accuracy: 0.8933
Epoch 7/30
149/150 [=====>.] - ETA: 0s - loss: 0.0908 - accuracy: 0.9799
Epoch 7: val_accuracy did not improve from 0.90667
150/150 [=====] - 8s 53ms/step - loss: 0.0910 - accuracy: 0.9800 - val_loss: 0.3251 - val_accuracy: 0.8900
Epoch 8/30
149/150 [=====>.] - ETA: 0s - loss: 0.0642 - accuracy: 0.9866
...
149/150 [=====>.] - ETA: 0s - loss: 0.0282 - accuracy: 0.9992
Epoch 13: val_accuracy did not improve from 0.92000
150/150 [=====] - 8s 54ms/step - loss: 0.0282 - accuracy: 0.9992 - val_loss: 0.3216 - val_accuracy: 0.9133
Epoch 13: early stopping
```

Model Accuracy & Loss

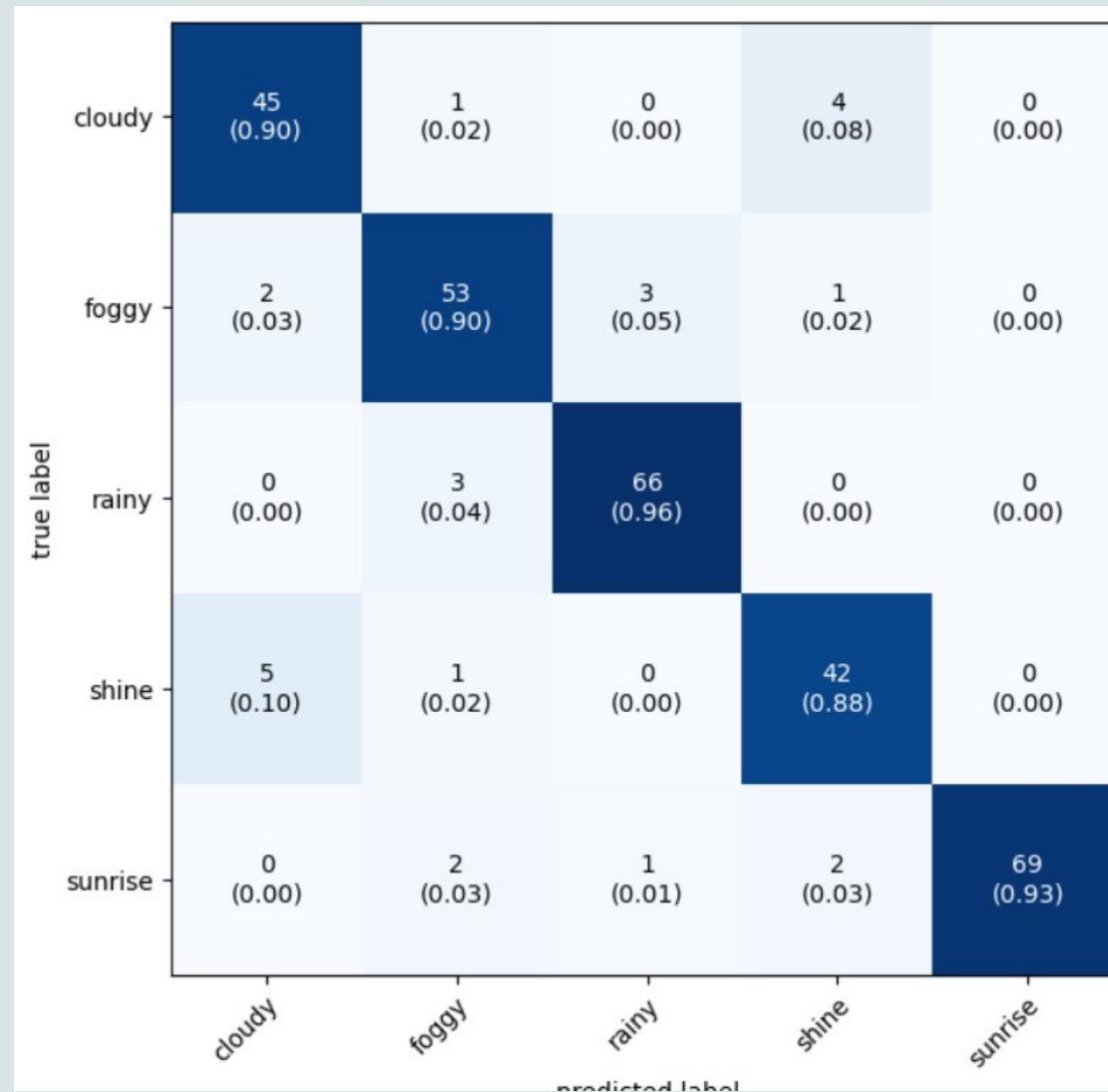
The screenshot shows a Google Colab notebook titled "Weather-prediction.ipynb". The code cell [34] displays the training progress for 150 epochs, showing loss and accuracy values. The final output of cell [35] shows the test loss and accuracy.

```
Weather-prediction.ipynb
File Edit View Insert Runtime Tools Help Save failed
+ Code + Text
1m [34] Epoch 11/30
149/150 [=====]. - ETA: 0s - loss: 0.0381 - accuracy: 0.9966
Epoch 11: val_accuracy did not improve from 0.90667
150/150 [=====] - 6s 42ms/step - loss: 0.0381 - accuracy: 0.9967 - val_loss: 0.3708 - val_accuracy: 0.8800
Epoch 12/30
149/150 [=====]. - ETA: 0s - loss: 0.0342 - accuracy: 0.9941
Epoch 12: val_accuracy did not improve from 0.90667
150/150 [=====] - 6s 42ms/step - loss: 0.0342 - accuracy: 0.9942 - val_loss: 0.3931 - val_accuracy: 0.8700
Epoch 13/30
149/150 [=====]. - ETA: 0s - loss: 0.0275 - accuracy: 0.9983
Epoch 13: val_accuracy did not improve from 0.90667
150/150 [=====] - 6s 43ms/step - loss: 0.0276 - accuracy: 0.9983 - val_loss: 0.4452 - val_accuracy: 0.8700
Epoch 14/30
149/150 [=====]. - ETA: 0s - loss: 0.0251 - accuracy: 0.9983
Epoch 14: val_accuracy did not improve from 0.90667
[35] loss,accuracy = model.evaluate(x_test,y_test)
print(f"Loss: {loss}")
print(f"Accuracy: {accuracy}")

10/10 [=====] - 6s 270ms/step - loss: 0.3769 - accuracy: 0.883333253860474
```

Accuracy:0.8833
Loss: 0.3769

Surrounding Prediction Confusion Matrix



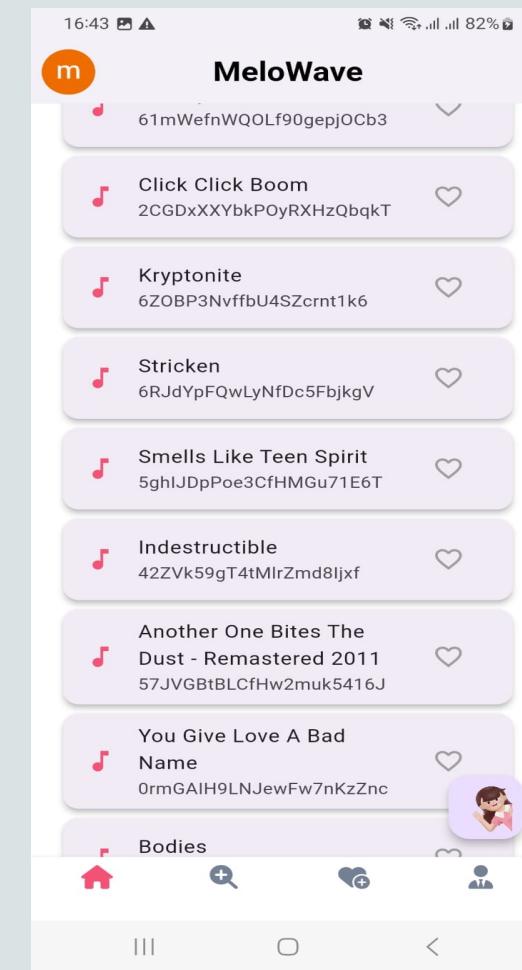
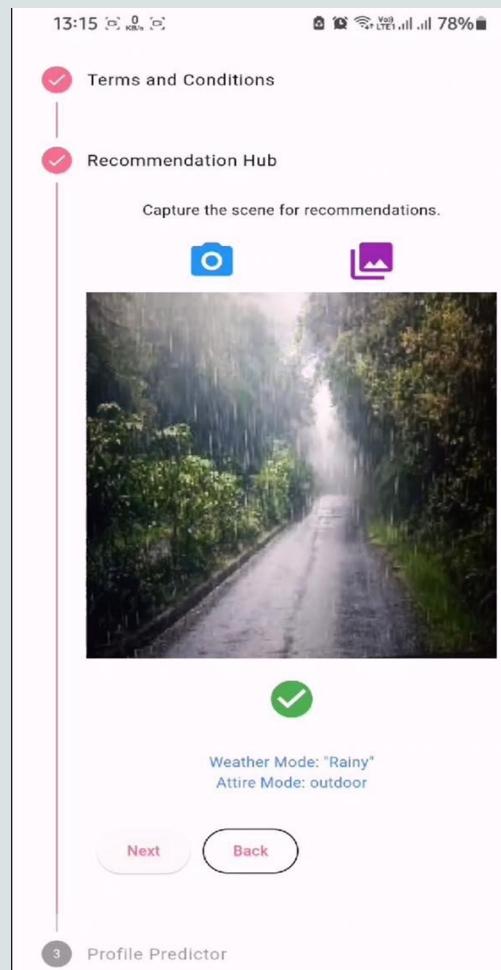
Model Accuracy & Loss

Model: "sequential"

Layer (type)	Output Shape	Param #
vgg19 (Functional)	(None, 4, 4, 512)	20024384
flatten (Flatten)	(None, 8192)	0
dense (Dense)	(None, 5)	40965
<hr/>		
Total params:	20065349 (76.54 MB)	
Trainable params:	40965 (160.02 KB)	
Non-trainable params:	20024384 (76.39 MB)	

Epochs: 30
Batch size: 32
Time : 4 hours
dense layers: 3
Dropout layers: 3
Trainable params: 40965
Non-Trainable params: 20024384

Sample Mobile UIs

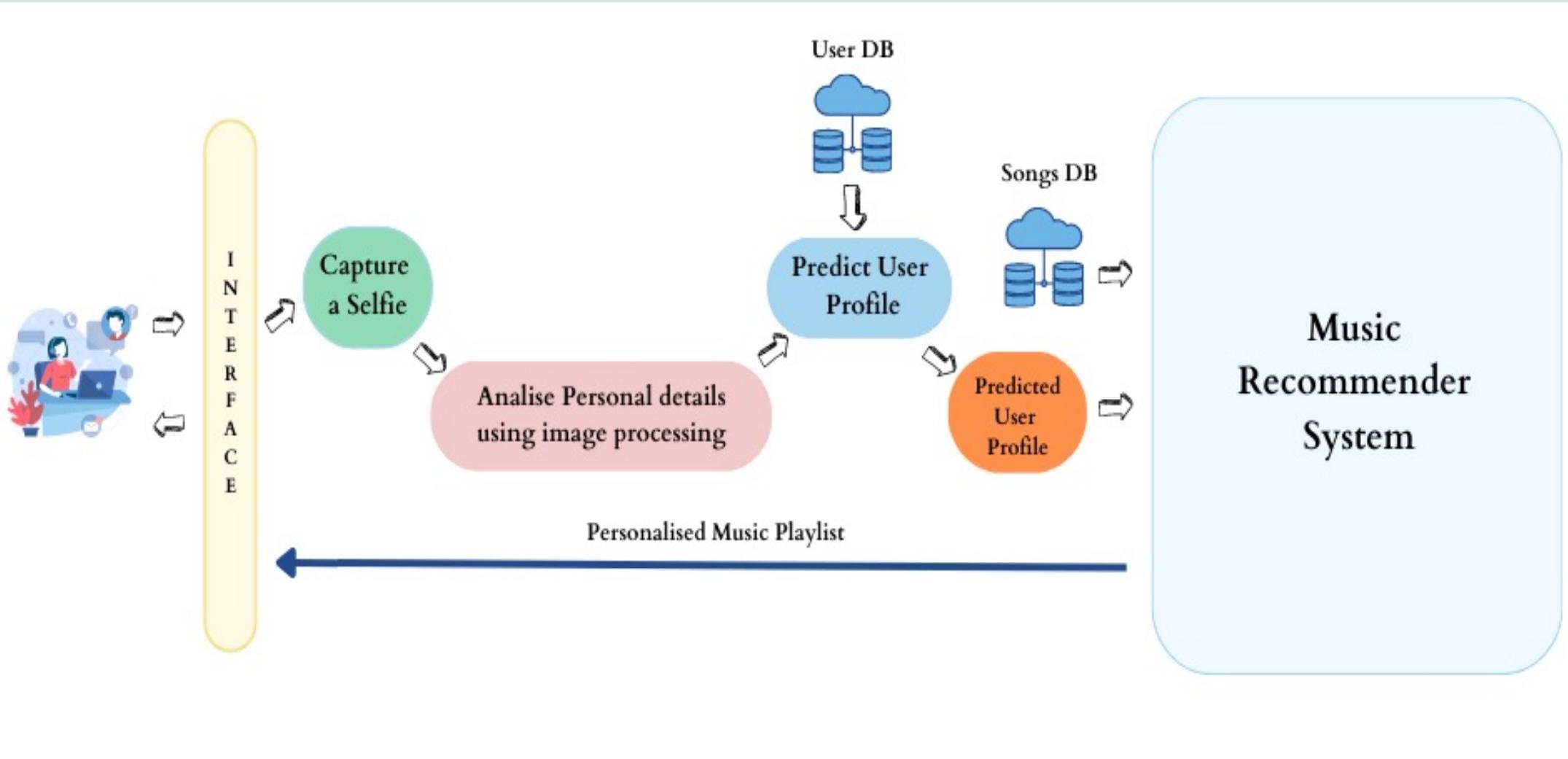




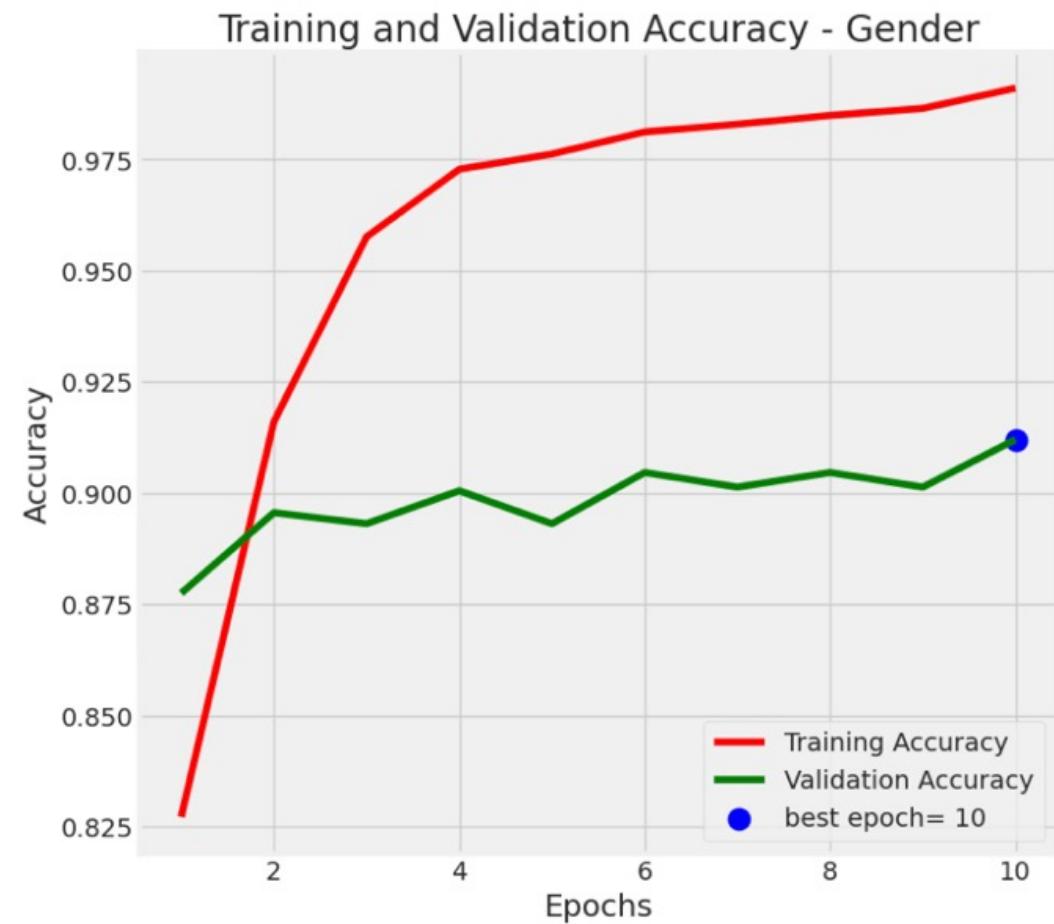
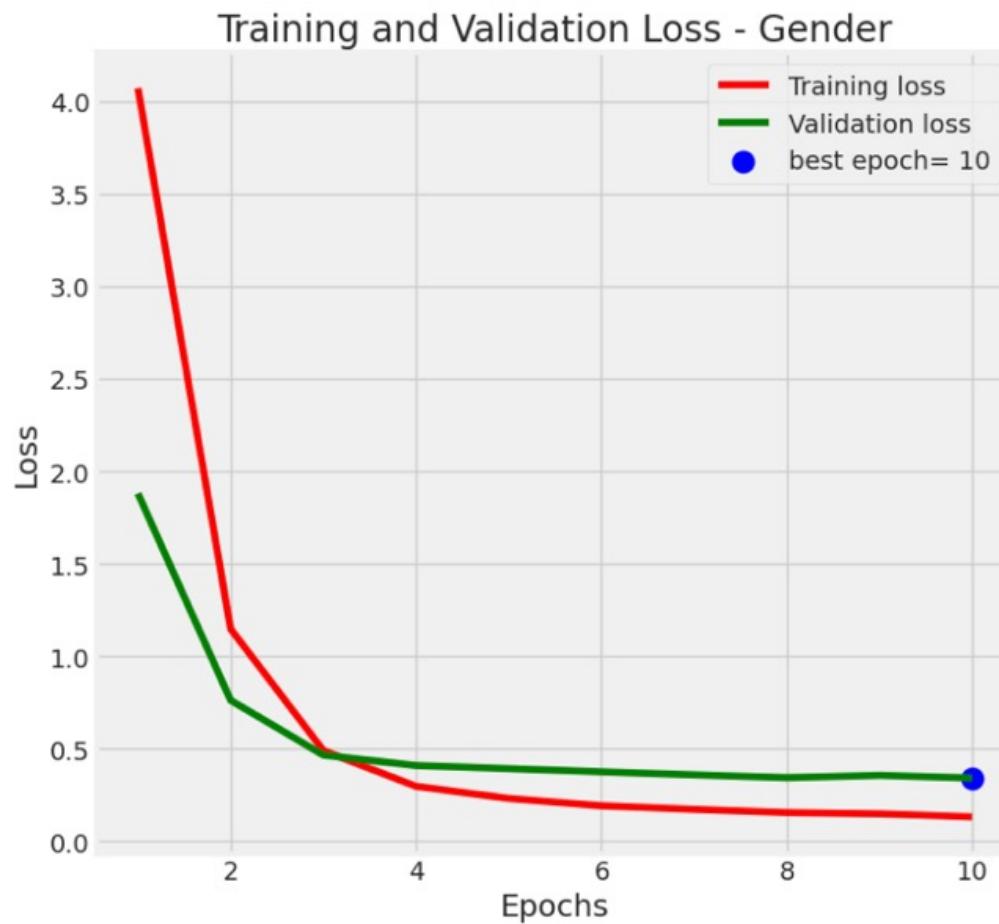
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Age - Gender Prediction Models

Component Overview Diagram



Training Loss and Accuracy of the models



Model Summaries

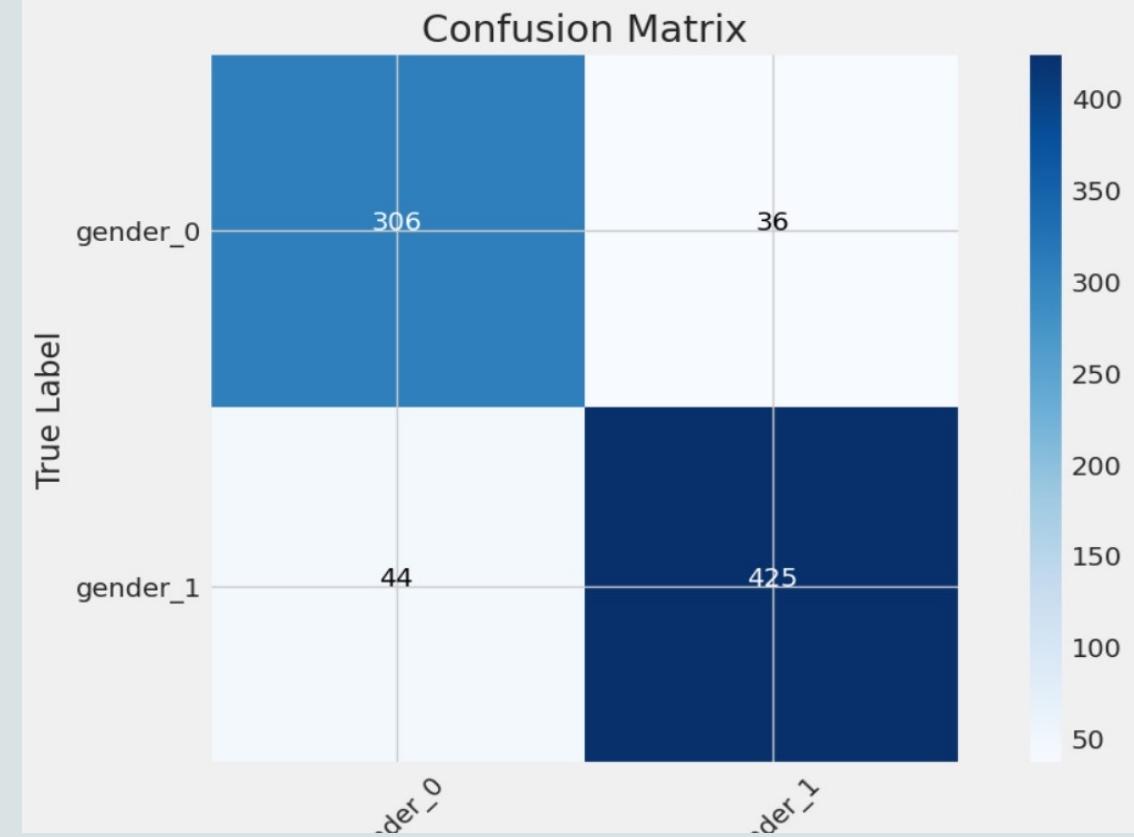
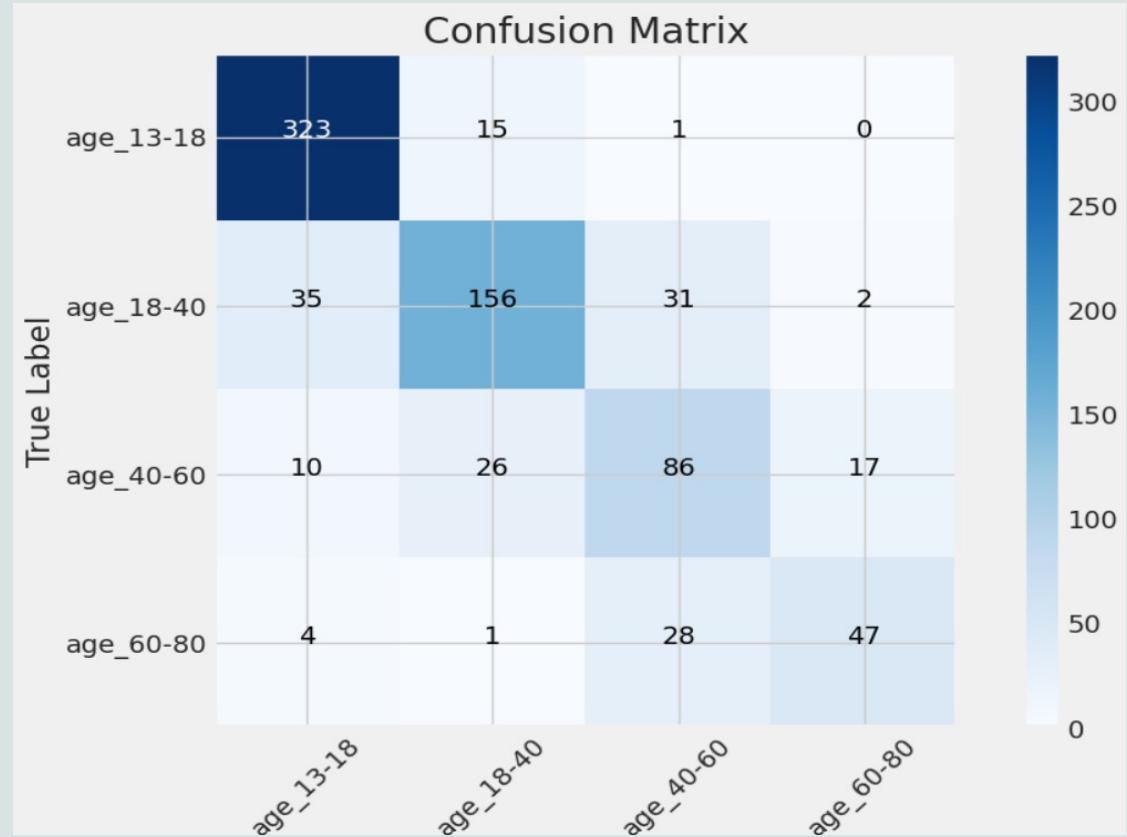
Age model summary

Model: "sequential"		
Layer (type)	Output Shape	Param #
efficientnetb3 (Functional	(None, 1536)	10783535
)		
batch_normalization (Batch Normalization)	(None, 1536)	6144
dense (Dense)	(None, 256)	393472
dropout (Dropout)	(None, 256)	0
dense_1 (Dense)	(None, 4)	1028
<hr/>		
Total params: 11184179 (42.66 MB)		
Trainable params: 11093804 (42.32 MB)		
Non-trainable params: 90375 (353.03 KB)		

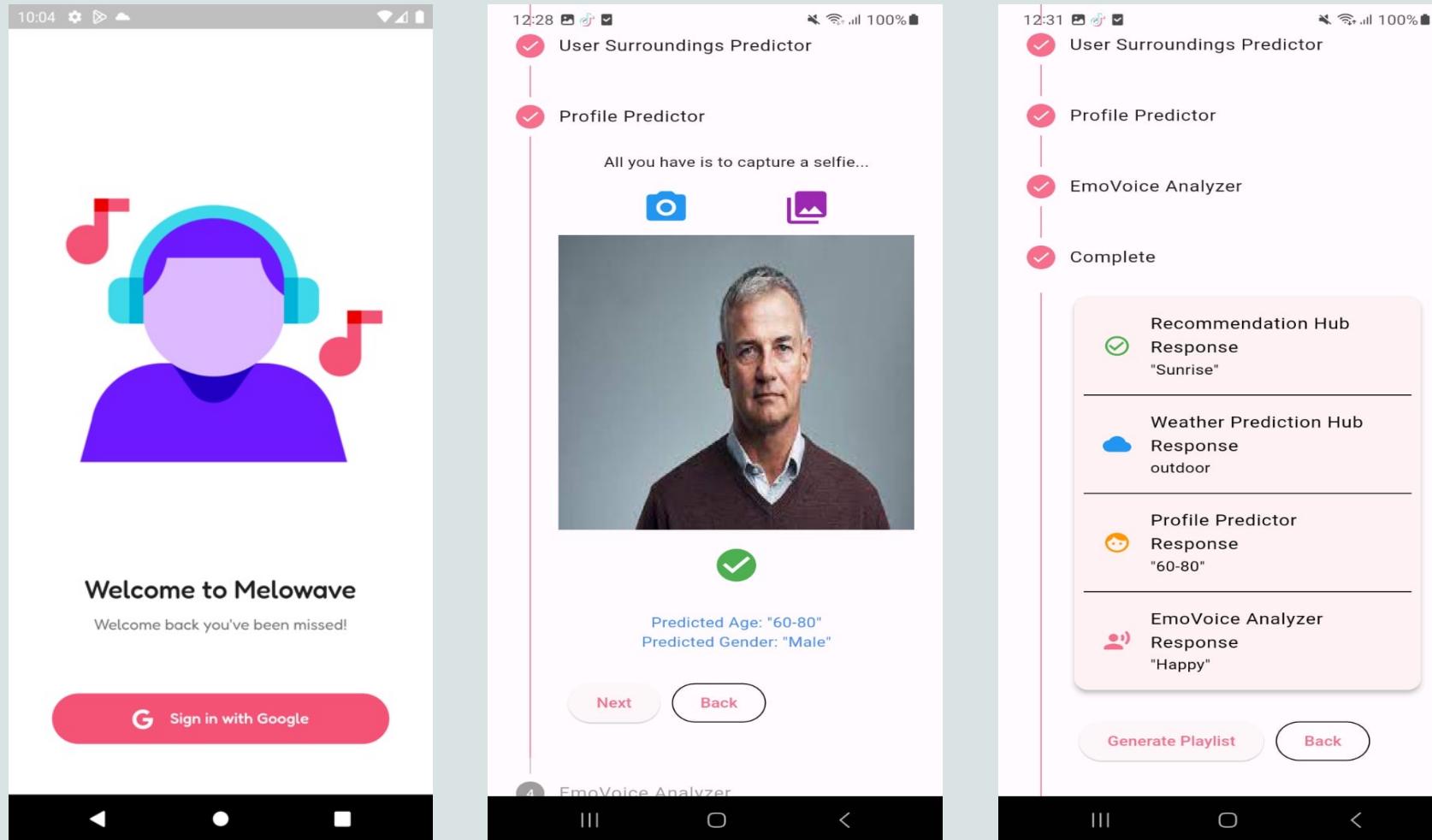
Gender model summary

Model: "sequential"		
Layer (type)	Output Shape	Param #
efficientnetb3 (Functional	(None, 1536)	10783535
)		
batch_normalization (Batch Normalization)	(None, 1536)	6144
dense (Dense)	(None, 256)	393472
dropout (Dropout)	(None, 256)	0
dense_1 (Dense)	(None, 2)	514
<hr/>		
Total params: 11183665 (42.66 MB)		
Trainable params: 11093290 (42.32 MB)		
Non-trainable params: 90375 (353.03 KB)		

Age & gender identification Confusion Matrixs



Sample User Interfaces

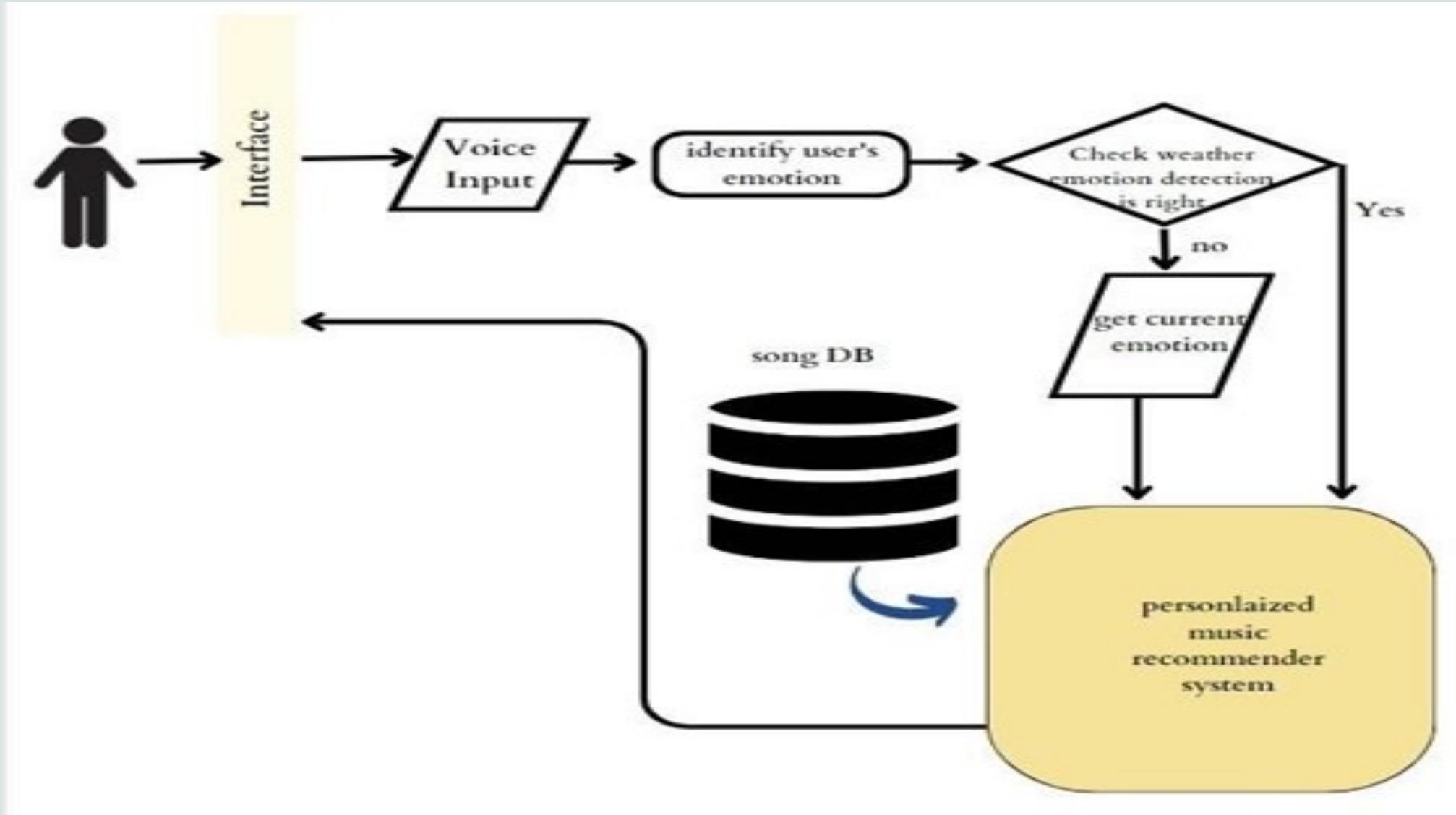




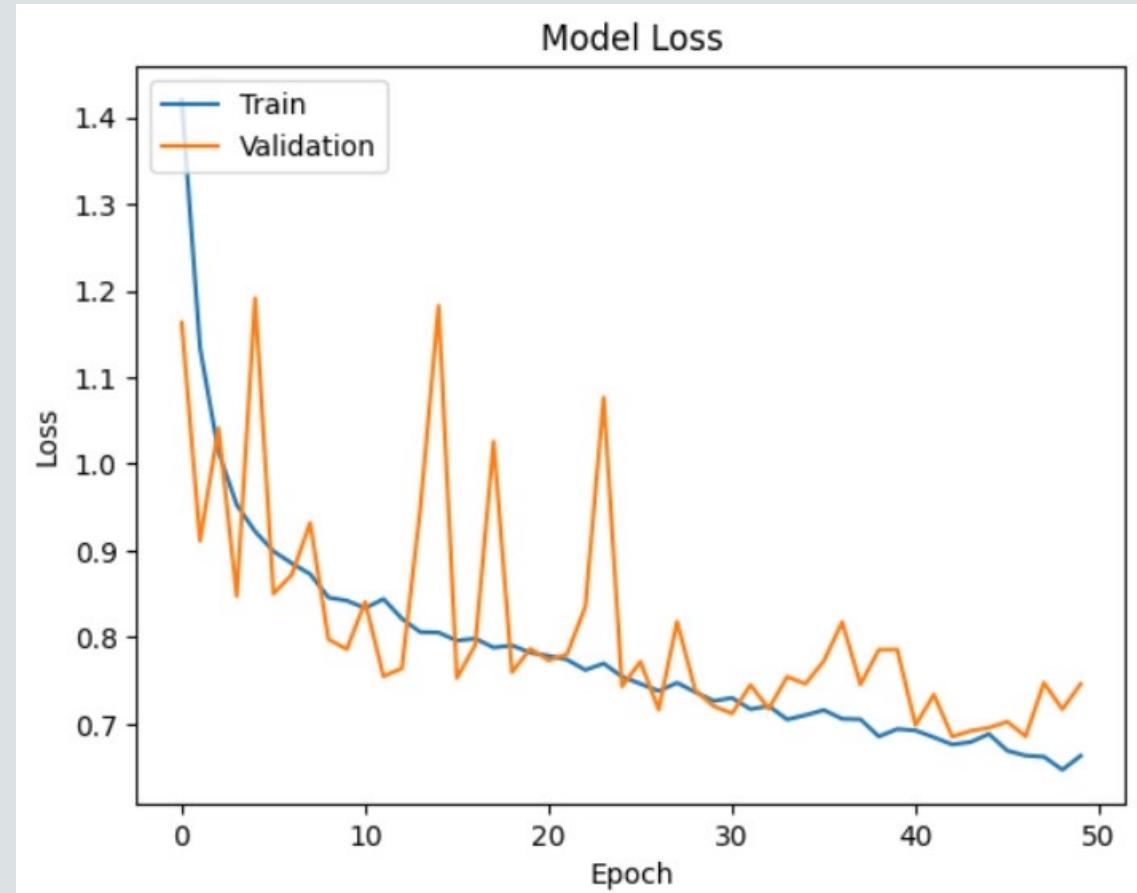
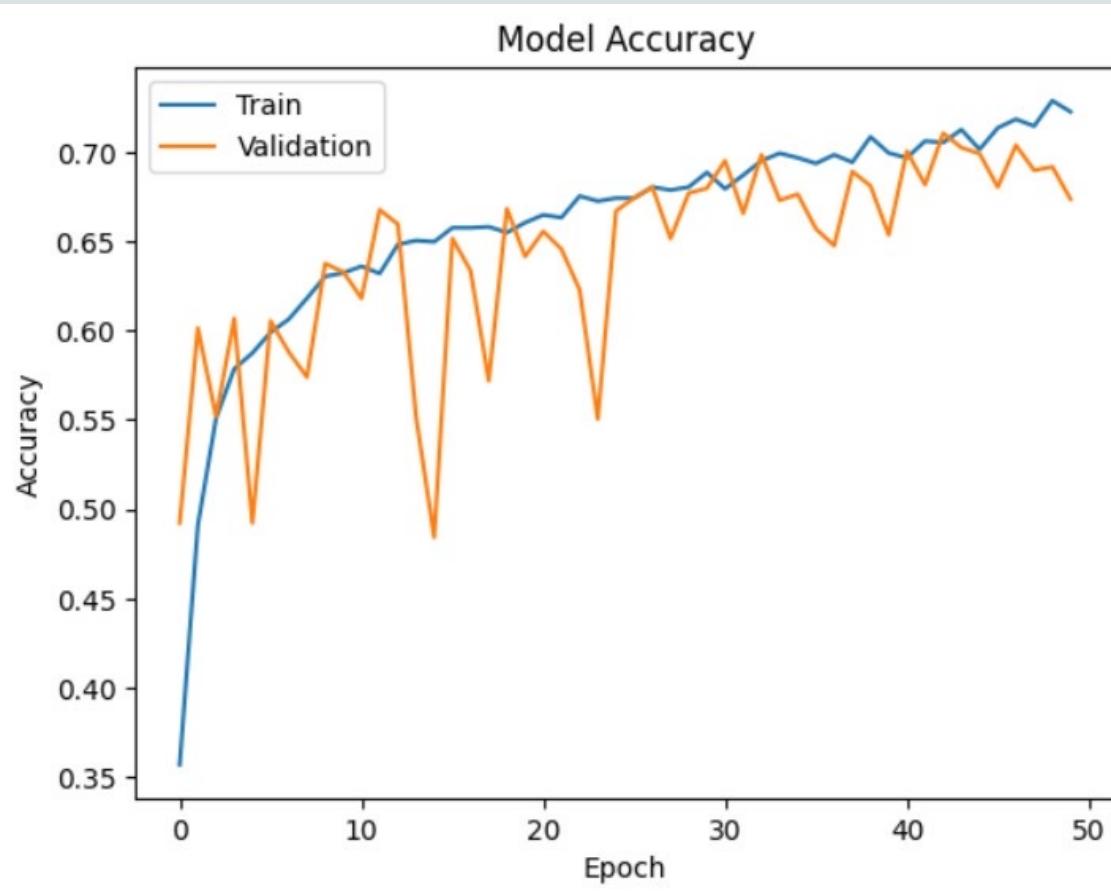
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Emotion Prediction using voice Frequency

Component Overview Diagram



Training Loss and Accuracy of the models



LSTM Model summary

Epochs: 50

Batch size: 16

Time : 6 hours

Dataset : 10000

dense layers: 4

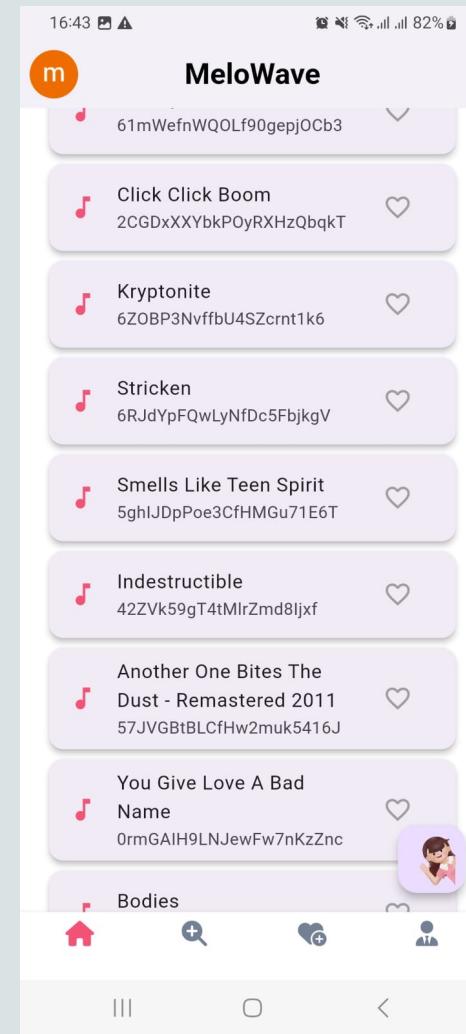
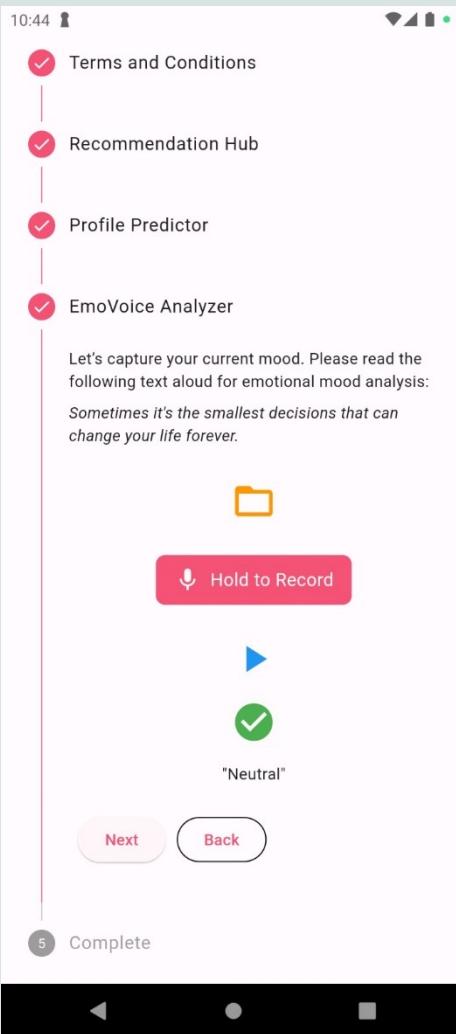
Dropout layers: 2

Trainable params: 1226564

Non-Trainable params: 1152

Model: "sequential_1"		
Layer (type)	Output Shape	Param #
lstm_1 (LSTM)	(None, 512)	1052672
batch_normalization_2 (BatchNormalization)	(None, 512)	2048
dense_4 (Dense)	(None, 256)	131328
dropout_2 (Dropout)	(None, 256)	0
dense_5 (Dense)	(None, 128)	32896
dropout_3 (Dropout)	(None, 128)	0
dense_6 (Dense)	(None, 64)	8256
batch_normalization_3 (BatchNormalization)	(None, 64)	256
dense_7 (Dense)	(None, 4)	260
<hr/>		
Total params: 1227716 (4.68 MB)		
Trainable params: 1226564 (4.68 MB)		
Non-trainable params: 1152 (4.50 KB)		

Sample User Interfaces

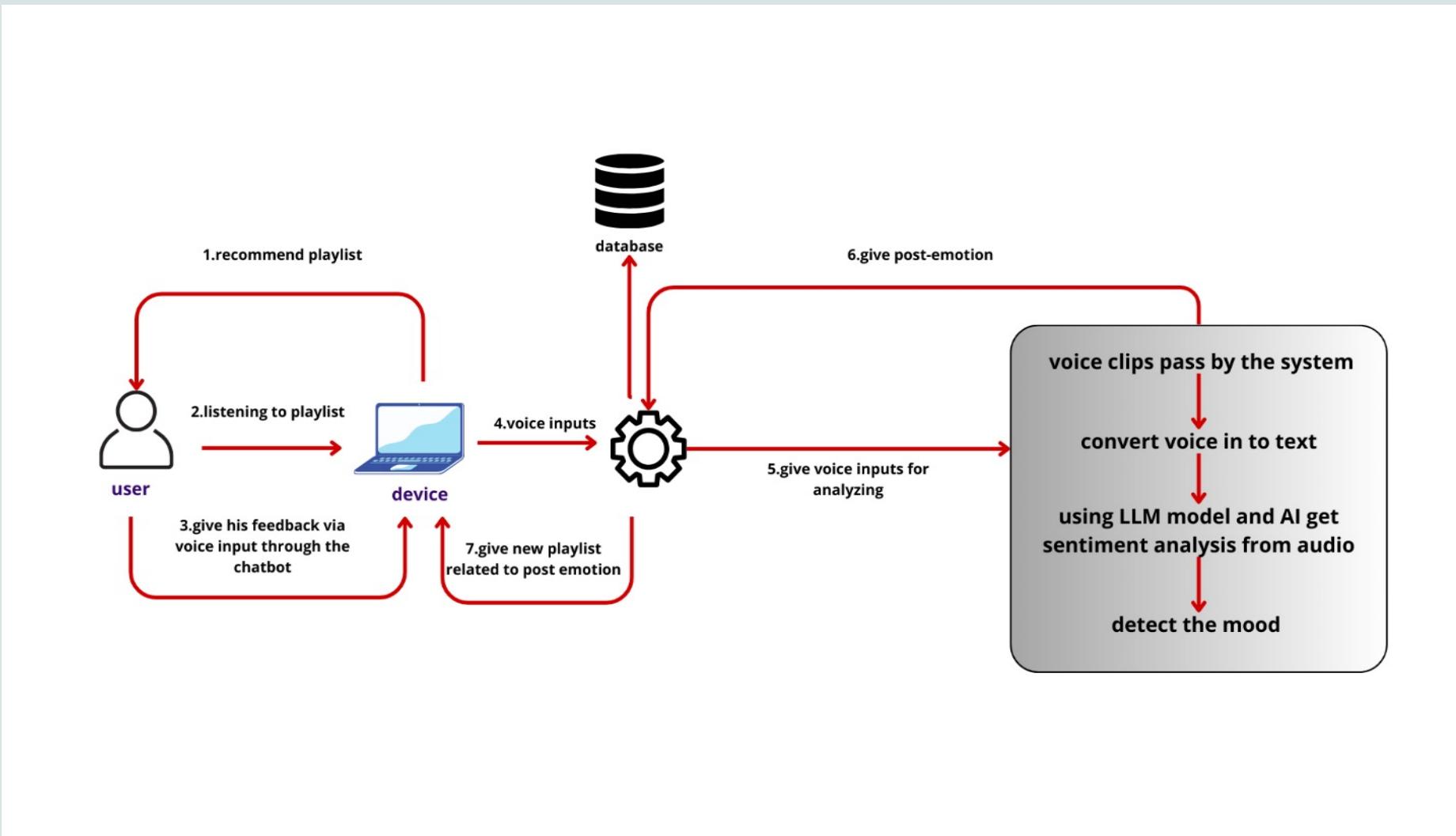




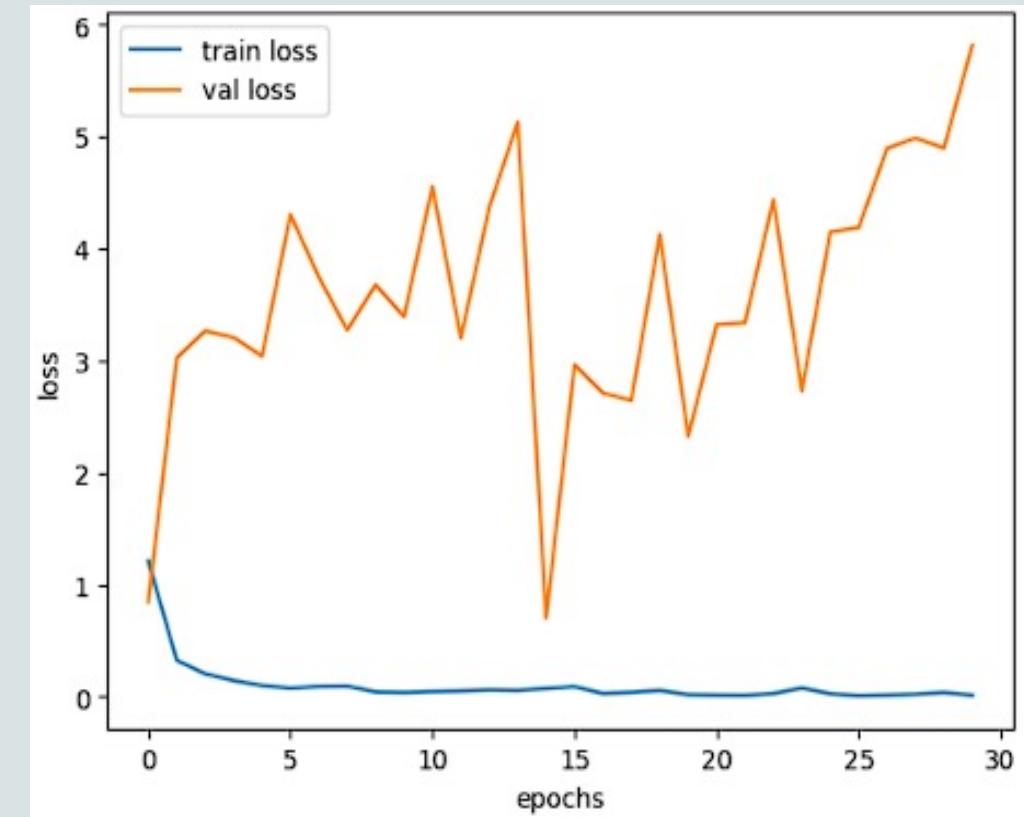
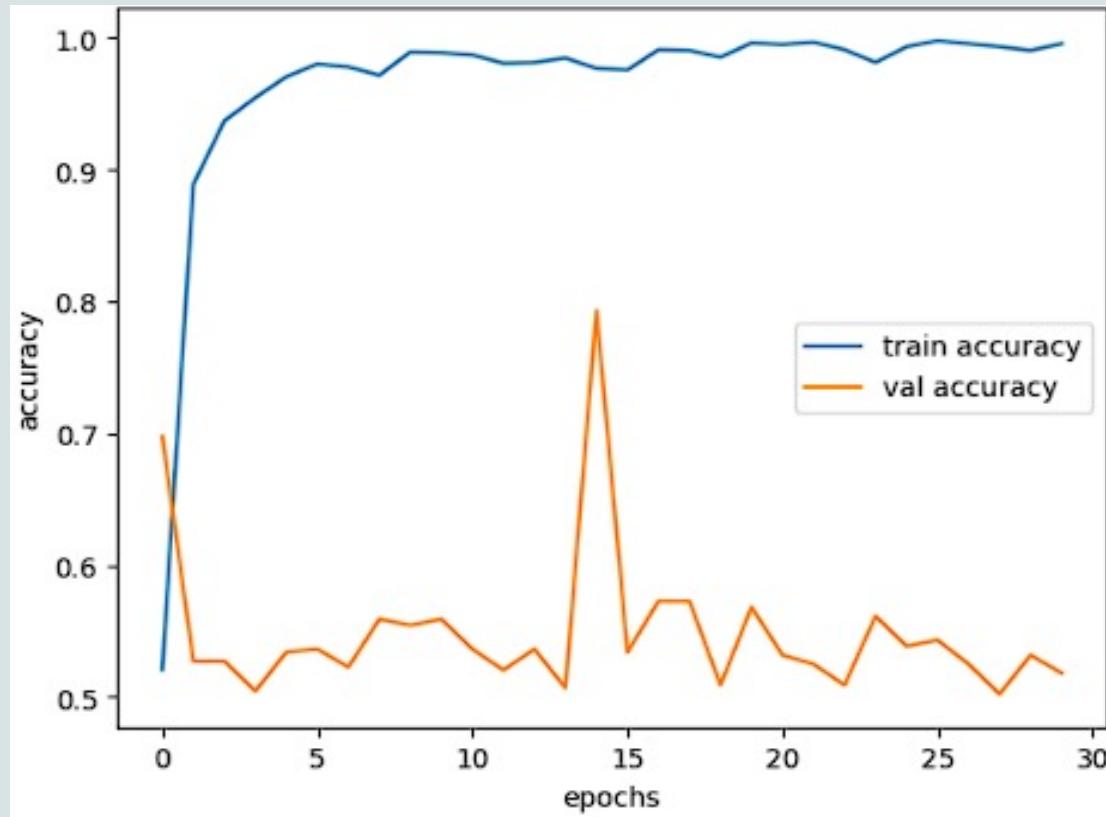
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Post Emotion Evaluation

Component Overview Diagram



Model Accuracy and the Loss - First Approach



Model Summary

- First Approach -

```
[ ] from keras.models import Sequential
from keras.layers import Dense, LSTM, Dropout

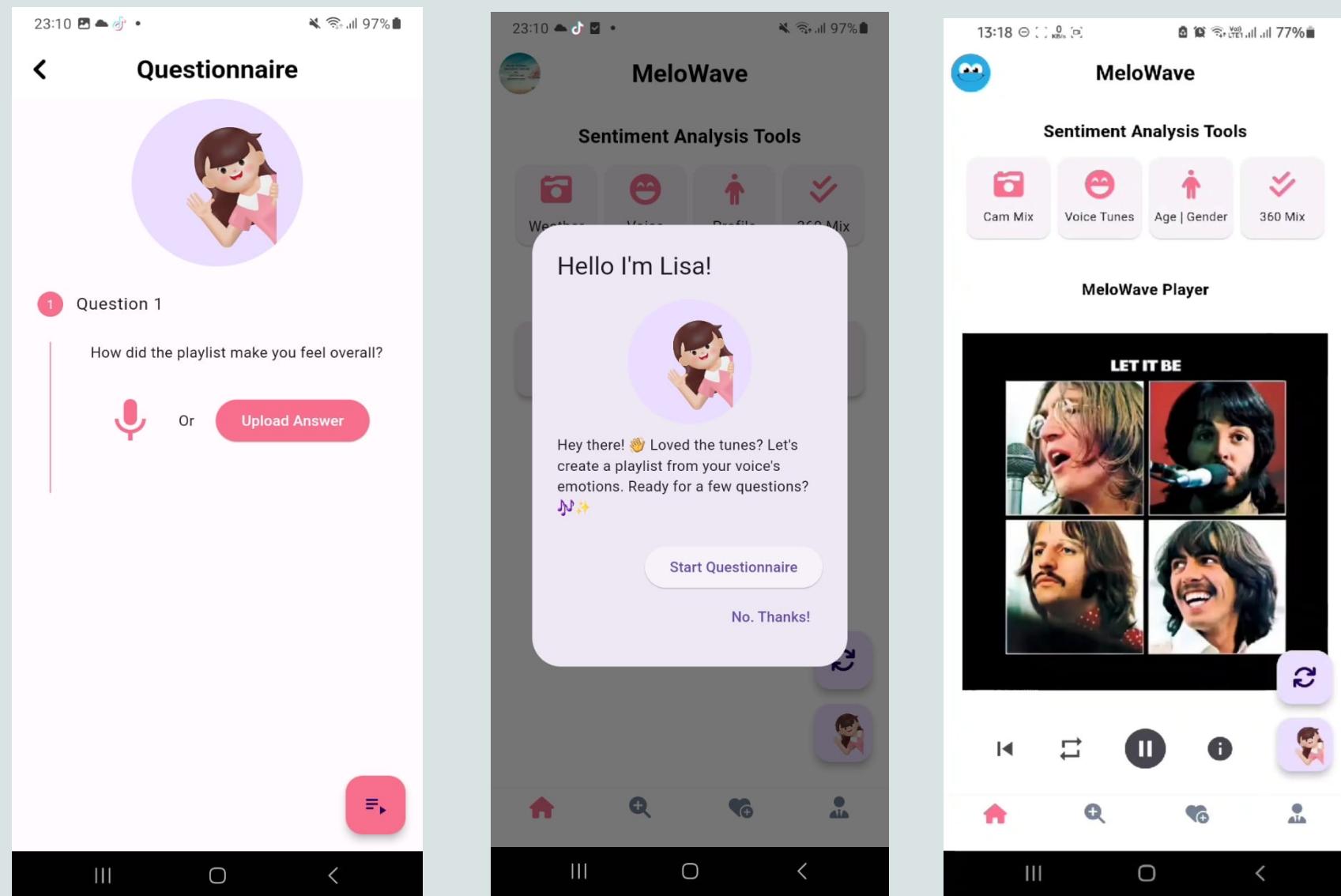
model = Sequential([
    LSTM(256, return_sequences=False, input_shape=(40,1)),
    Dropout(0.2),
    Dense(128, activation='relu'),
    Dropout(0.2),
    Dense(64, activation='relu'),
    Dropout(0.2),
    Dense(7, activation='softmax')#output layer
])

model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
model.summary()
```

Model: "sequential"

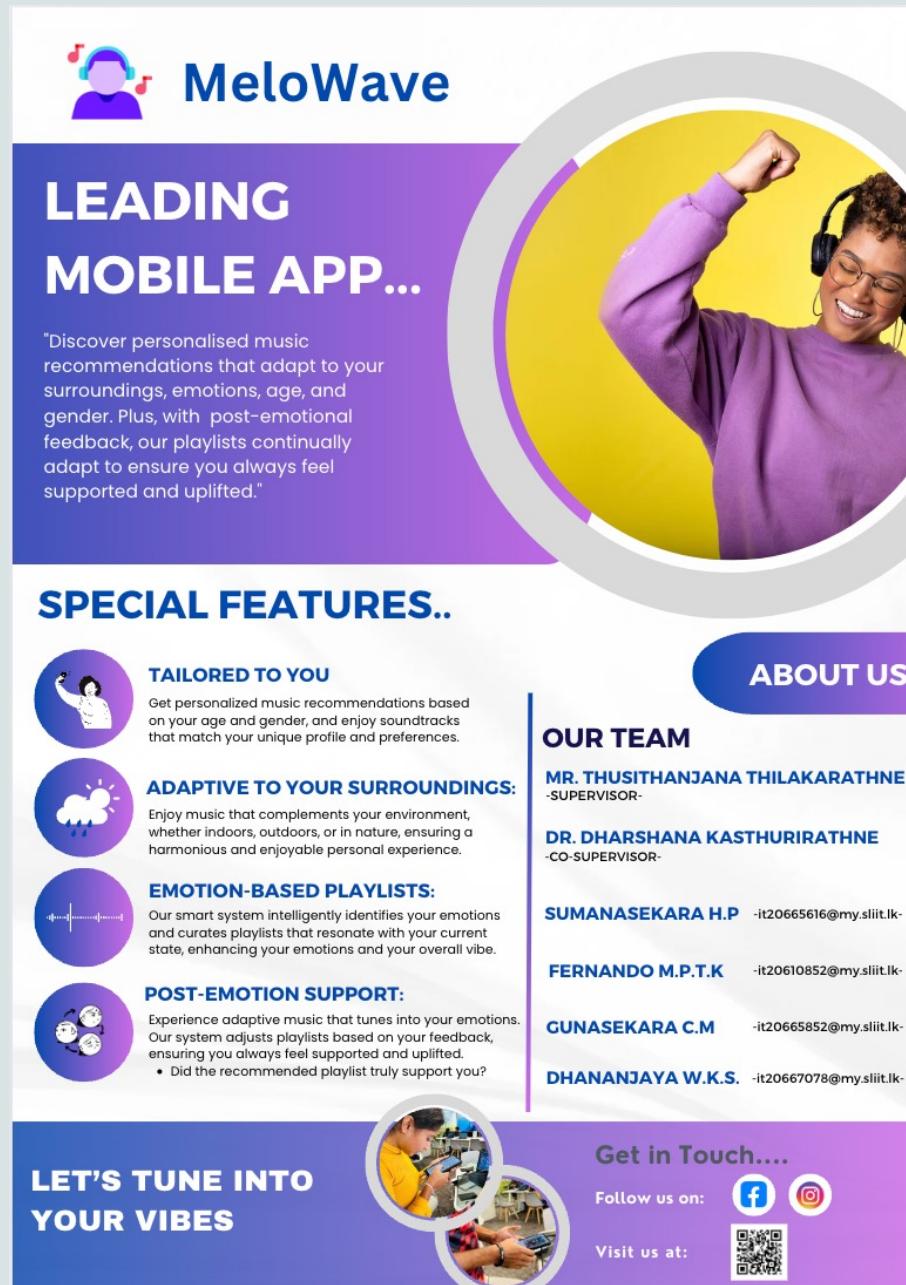
Layer (type)	Output Shape	Param #
=====		
lstm (LSTM)	(None, 256)	264192
dropout (Dropout)	(None, 256)	0
dense (Dense)	(None, 128)	32896
dropout_1 (Dropout)	(None, 128)	0
dense_1 (Dense)	(None, 64)	8256
dropout_2 (Dropout)	(None, 64)	0
dense_2 (Dense)	(None, 7)	455
=====		
Total params:	305799 (1.17 MB)	
Trainable params:	305799 (1.17 MB)	
Non-trainable params:	0 (0.00 Byte)	

Sample UIs..



Commercialization

- Use leaflets for marketing purposes.
- Offering free and paid both version of mobile Applications.
- Integration with social media platforms for wider reach.



The image shows the MeloWave mobile application's landing page. At the top left is the MeloWave logo, featuring a stylized person with headphones and musical notes. To the right of the logo, the word "MeloWave" is written in blue. Below the logo, the text "LEADING MOBILE APP..." is displayed in large white letters on a purple background. To the right of this text is a circular image of a woman with curly hair, wearing headphones and smiling, with her right arm raised in a fist. Below the main title, there is a quote: "Discover personalised music recommendations that adapt to your surroundings, emotions, age, and gender. Plus, with post-emotional feedback, our playlists continually adapt to ensure you always feel supported and uplifted." On the left side of the page, under the heading "SPECIAL FEATURES..", there are four circular icons with corresponding text: "TAILORED TO YOU" (a person icon), "ADAPTIVE TO YOUR SURROUNDINGS" (a sun and cloud icon), "EMOTION-BASED PLAYLISTS" (an audio waveform icon), and "POST-EMOTION SUPPORT" (two people talking icon). To the right of these features is a blue button labeled "ABOUT US". Further down the page, under the heading "OUR TEAM", there are five entries, each with a name, title, and email address:

- MR. THUSITHANJANA THILAKARATHNE** -SUPERVISOR-
- DR. DHARSHANA KASTHURIRATHNE** -CO-SUPERVISOR-
- SUMANASEKARA H.P.** -it20665616@my.sliit.lk-
- FERNANDO M.P.T.K.** -it20610852@my.sliit.lk-
- GUNASEKARA C.M.** -it20665852@my.sliit.lk-
- DHANANJAYA W.K.S.** -it20667078@my.sliit.lk-

At the bottom of the page, there is a call-to-action "LET'S TUNE INTO YOUR VIBES" with two small circular images of people using phones. To the right of this, there is a section titled "Get in Touch...." with icons for Facebook and Instagram, and a QR code. The footer also includes the text "Follow us on:" and "Visit us at:".

Future Plans..



Improve User Experience.



Publishing in App Store and Play Store.



Improve Maintainability.

Achievements..

- Our research was successfully submitted to the Moratuwa Engineering Research Conference 2024 (**MERCon 2024**) is the 10th international conference organized by the Engineering Research Unit, University of Moratuwa.

Any Questions..

Thank You...