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Music Recommendation System Based on Facial Emotion

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Abstract: ***Now-a-days people are crazy about music, people used to listen music in different aspects of life. Most of the people listens to music to cherish their mood and to keep themselves motivated.Good Music connects us with the environment and boosts our mood. Every individualwants to listen music according to his/her state of emotion at that time. Listening music according to his/her state of emotion will really givespeace to mind and soul. This can be possible only with the facial expressions of the individuals. Facial expressions denote an individual state of emotion at that time. In Proposed System, Person's facial expressions can be captured by the camera and by applying Machine Learning techniques it analyzes person's expression can suggests a playlist. One such technique is MobileNet model with Keras.***

Keywords: Face Recognition, Image Processing, Computer Vision, Emotion Detection.

1. INTRODUCTION

Human emotions are classified as fear, disgust, rage, surprise, sad, glad, or neutral. This emotional umbrella includes a wide range of different emotions, such as cheerful (a modification of glad) and scorn (a modification of disgust). These are mild feelings.
Facial muscle contortions are quite tiny, and recognizing them can be challenging because even minor variations result in distinct expressions. Furthermore, because emotions are largely context dependent, expressions of different or even the same persons for the same feeling may differ. Also, because emotions are very context dependent, expressions of various or even the same people may change for the same feeling.
While the focus may be on the areas of the face that convey the greatest emotion, such as around the mouth and eyes, how these motions are extracted and classified remains an

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important topic. These tasks have been completed successfully using neural networks and machine learning. Machine learning techniques have been quite useful in pattern identification and classification, and can thus be used to detect mood.

With the evolution of technology in digital music, the creation of a personalised music recommendation system that offers music to consumers is crucial. Making recommendations based on the large amount of data available on the internet is a significant issue. Companies such as Amazon and eBay provide customized suggestions to individuals based on their tastes and history, whilst Spotify and Pandora provide relevant recommendations using Machine Learning and Deep Learning approaches. Personalised music recommendation can be approached in two ways. Content-based filtering is one way, which evaluates the content of music that people have previously liked and recommends music with relevant content.

The model is able to generate recommendations according to the user's existing interests, which is the biggest downside of this strategy. In brief , the model's potential to build on existing user interests is limited. The collaborative filtering strategy, on the other hand, suggests music that was loved by a peer group with same preferences. Both recommendation systems depends on the user's listening behavior and preferences. The main disadvantage of this strategy is the popularity bias problem, which occurs when popular (i.e., often rated) items receive a lot of attention while less popular items are under-represented in the suggestions. In general, a hybrid method is adopted, which combines both content and collaborative procedures to maximise accuracy and mitigate the limitations of both types.

The goal of this project is to develop a music recommendation system that can recognise a user's face, detect their facial emotion, and then offer a playlist according to the detected emotion.

Literature Survey

Shantha Shalini K [1] presented the theoretical concept of a mood-based music recommendation technique. The song is chosen for you based on the genre it belongs to. This is done mechanically and does not take into account individual feelings. The proposed algorithm offers music based on the genre and tone of the music, and when it matches the user's listening habits, the music list is amended and accepted. This post will show you how to create an autonomous music player based on user click trends in movie music. In this article, they propose a music suggestion pattern based on consumer behaviour.They employed association rules to determine the relationship between emotion and song. The experimental results show an 80% accuracy on the outcome, however because human emotions change over time, complicated assessment and recognition of human emotion is a critical component in music recommendation systems.

Renuka R Londhe et al [2] conducted an investigation into changes in the curvatures of the face and the brightness of the associated pixels. The author used Artificial Neural Networks (ANN) to categorise the emotions. The author also shared several playlist-creation techniques. Zheng et al. classified facial feature extraction into two categories: appearance-based feature extraction and geometric-based feature extraction, which included extraction of various critical parts of the face such as the lips, eyes, and brows. An emotion-based music player reduces the user's time complexity. Most people have a large number of songs on their playlist. Randomly playing music does not satisfy the user's mood. This technology allows

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users to have songs played automatically based on their mood. The web camera records the user's image, which is saved. The pictures are first converted from RGB to binary format. A feature-point detection method is used to express data in this manner. This process can also be performed with Open CV's Haar Cascade technology.

Tanvir Ahmed [3] compared four convolution neural network-based facial recognition models using a personalised dataset of faces, namely AlexNet, VGG16, VGG19, and MobileNet, along with their training and validation outcomes. Face recognition has been a difficult task since the beginning.

When compared to previous neural networks, Convolutional Neural Network is a relatively new established competent image recognition system that uses local receptive fields like neurons in the brain, weights sharing and linking information, and considerably reduces training constraints. Facenet has been utilised recently for facial recognition and clustering. To discern emotion in video, CNN-RNN and c3D hybrid networks were utilised. As efficient approximations to typical convolutional neural networks, Binary-Weight-Networks and XNOR-Networks have been developed.The introduction of deeplearning with VGGNet and GoogLeNet has substantially advanced facial recognition.

Sharmeen M [4] used deep learning to analyse and describe the numerous multimodal identification of human emotions. The findings suggest that emotion detection can be done more precisely and effectively by employing a multimodal method based on biological cues to determine emotional states. Emotion influences practically all aspects of human speaking, including facial expression, movement, stance, voice tone, sentence collection, breathing, skin temperature and clamminess, and so on. Emotions greatly affect the message: it is often not what has been said, but how it has been conveyed, that is most important. Faces are the most visible means of communication between emotions. However, unlike the voice and other means of speech, they are frequently easily modified in response to varied social situations. However, emotional alterations in physiological signals might be noticed for a relatively little time of roughly 3- 15 seconds. As a result, extracting specifics on the moment of emotional response would yield better outcomes. This will necessitate a window-dependent strategy throughout the process of the various physiological signals.

2. METHODOLOGY

a. Proposed System

- This system comprises 1 major module.
- The user needs to complete the registration first to access the system. If the user forgets their password, the system will send an OTP via email and they can reset the password. They can sign in using their credentials. They profile can be managed and the password can be changed if they want. The user can choose an emoji and the system will play the song according to the chosen emoji. The system canalso capture the user’s facial emotions through the camera and play a song according to the detected emotion.
- The face emotions detection will be done using Mobilenet and Keras or either OpenCV. For both cases, data is trained and the model is created. The facial emotions are detected using Google Vision and Machine Learning algorithms. And the songs are uploaded to the Firebase storage and Firebase real-time database will be used. The song links will be

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accessed from there.

- For this project, XML is used on the front end and the backend is developed through Firebase. The programming language is Java. The IDE used is Android Studio.

The scope of the music recommendation system based on users' facial emotion is to provide personalized music recommendations to users according to their current emotional state as detected through facial recognition technology.
The goal of this system is to enhance the user's music listening experience by playing music that corresponds to their present emotional state. The technology can help users regulate their moods and improve their overall well-being by recommending music that matches their feelings. Additionally, the system can also be used to introduce users to new music that they may not have otherwise discovered.

b. Design
System Architecture

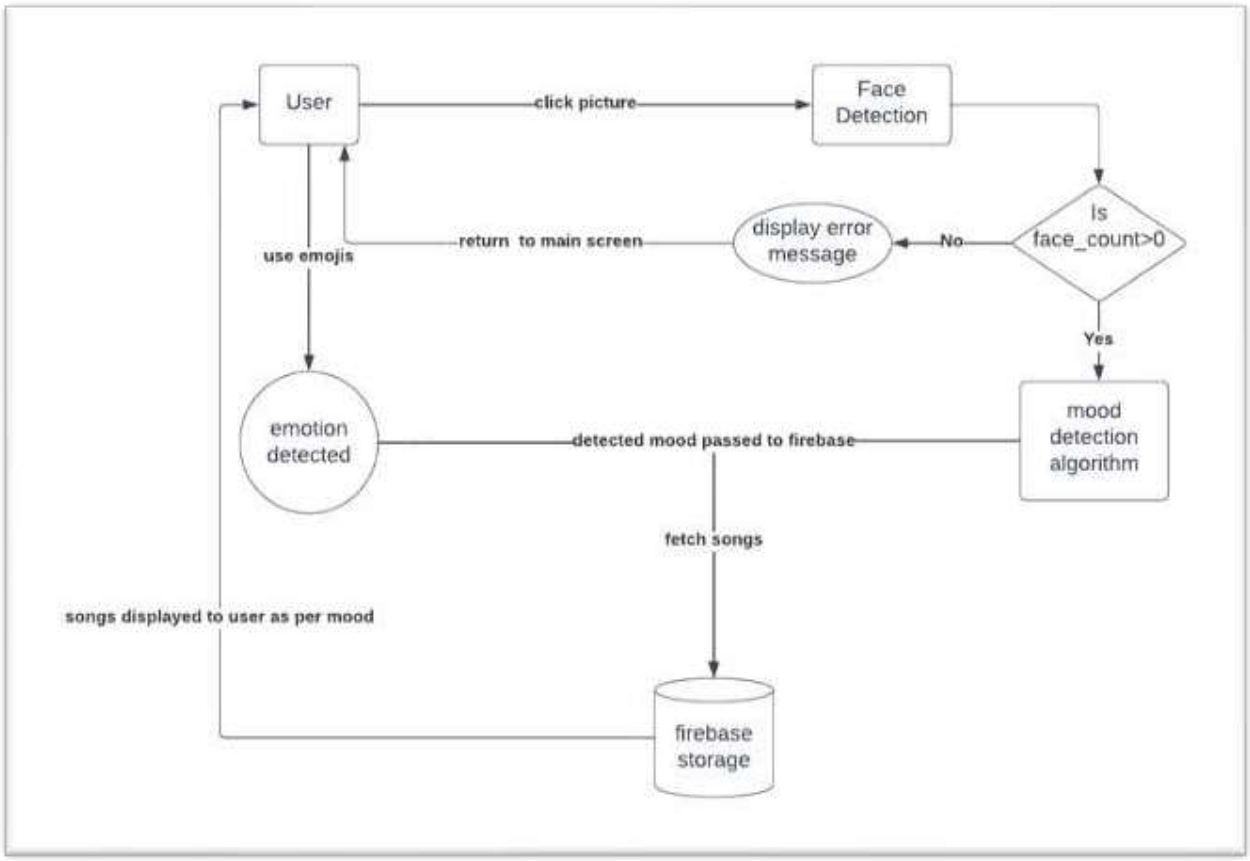

Fig 1: System Architecture

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Data Flow Diagram

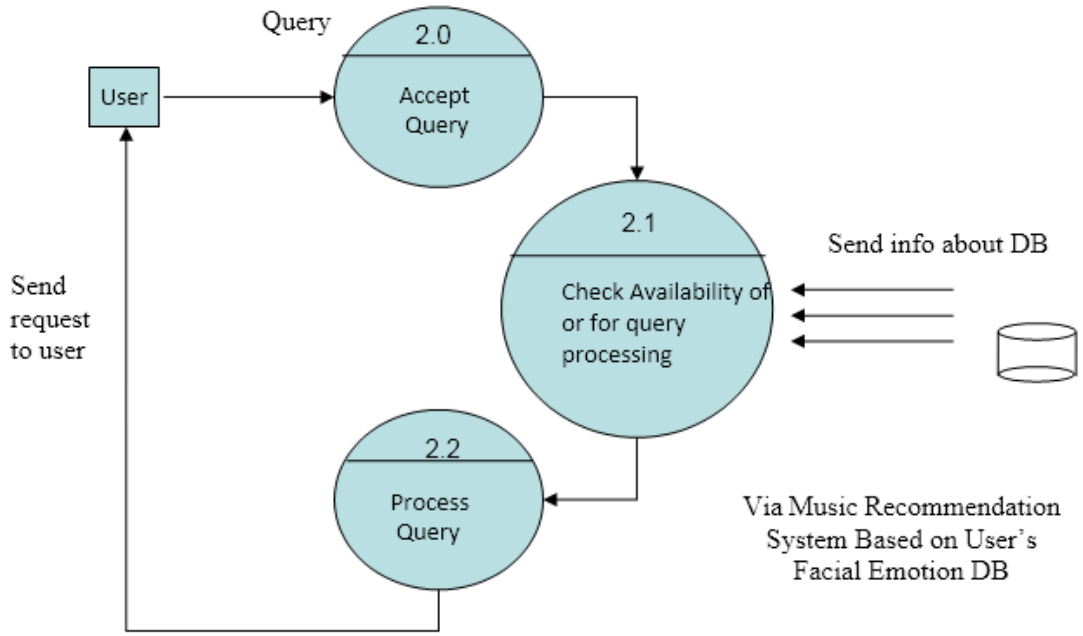

Fig 2: Data Flow Diagram

Use Case Diagram

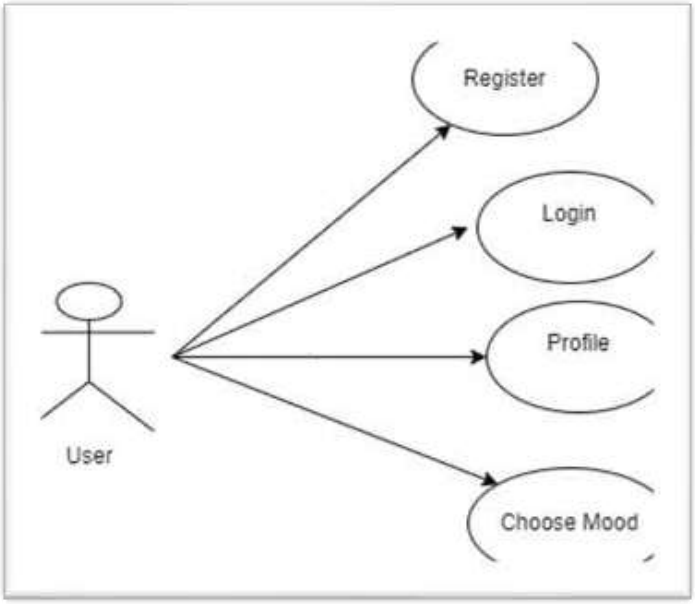

Fig 3: Use Case Diagram

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c. Modules and their Description

The system is made up of two major modules and their sub-modules, which are as follows:

❖ **User:**
In the user module, the user needs to complete the registration using the credentials. If the user forgets their password, an OTP will be sent through email to reset the password. The user can log inusing their credentials. The user also has an option to manage their profile. The user can changetheir password if they want.

❖ **Choose Mood:**
After the user successfully logins, the user has option to choose either emoji option or face capture. If the user chooses emoji option, songs will be played based on that emoji. If the user choose face capture option, the system will identify the emotion of the user captured by the camera. Accordingly, the system plays songs based on their detected emotion.

3. RESULT ANALYSIS

a. Home Activity

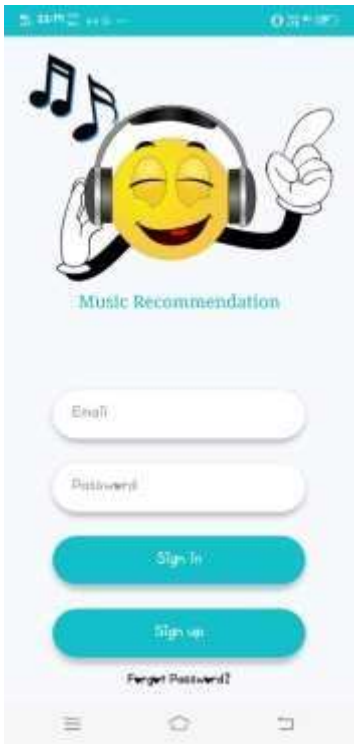

Fig 4: Home Activity

This is the home activity of the application, where the user has to sign in to their account if the account already exists. If the user is new to the application he needs to sign up first to use

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the application. An option to set a new password has also been provided incase if user forgot the password.

b. After Successful login of the user

Fig 5: Activity after successful login of the user

After the user successfully logins, an activity like this appear.

c. Emoji option

Fig 6: The screen where the user can create a playlist using emojis.

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If the user is in a place where there is no light, he can use of the emoji option to tell his currentemotion to the application.If the user selects an emotion, a playlist of songs related to the chosen emotion are displayed and played.The player has options such as pause, previous, next.

d. Detecting Face Emotions and Playing Songs

Fig 7: Happy emotion detected

Fig 8: Disgust emotion detected

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Fig 9: sad mood detected successfully

Fig 10: Playlist for "Happy" mood

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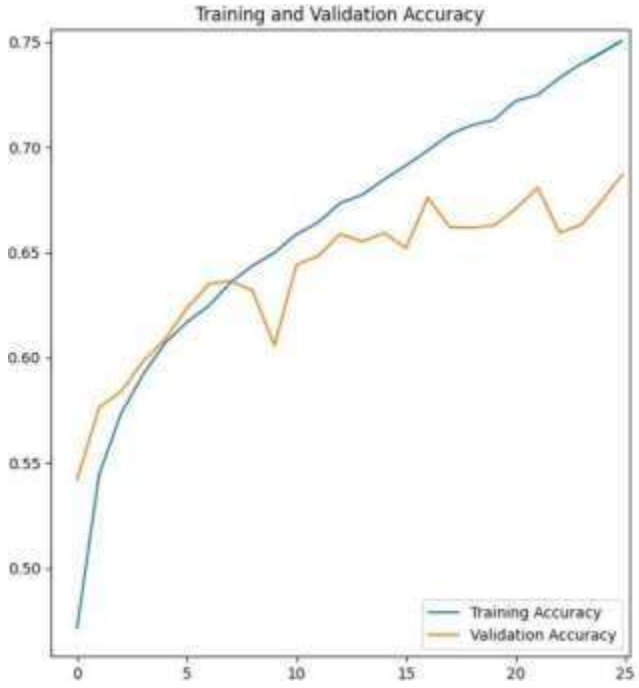
e. Training and Validation Accuracy



The graph depicts our model's accuracy, with the X-axis indicating the number of iterations and the Y-axis indicating the accuracy. Our model obtained roughly 75% accuracy, as seen in the picture. It understands emotions in the manner in which it has been trained because it is fully computer-based.

f. Accuracy Comparison

The table below compares the accuracy of various existing systems and tools to our proposed system.

SI.No	Existing Systems and Tools	Accuracy (%)
1	Keras-based face recognition through deep learning	88
2	Music suggestion using a hybrid method	80.7
3	Viola Jones' framework for object detection	86
4	Music.AI	78.84
5	Music Recommendation System based on Facial Emotion	75

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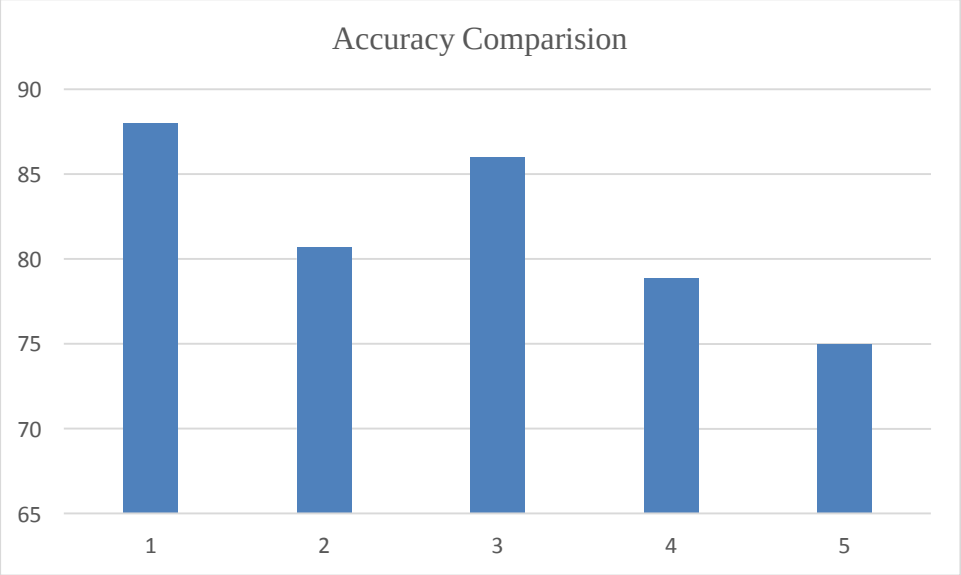

The above figure represents graphical representation of the above shown accuracy comparison table. Here X-axis represents Existing systems and tools and Y-axis represents accuracy percentages.

4. CONCLUSION

Even though human's facial emotions are complicated and subtle, a model can be built using machine learning and can be trained to detect various facial expressions. The emotion on a person's face can be utilized to detect their mood, and after a mood is discovered, music according to the person's detected mood can be recommended and played. Our model, with an accuracy of about 75%, can detect seven different moods accurately, viz, anger, disgust, fear, joyful, sad, surprise, and neutral; and our android application can play music according to the discovered mood. So, this was our system design for a music recommendation system based on user's facial emotion recognition.

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