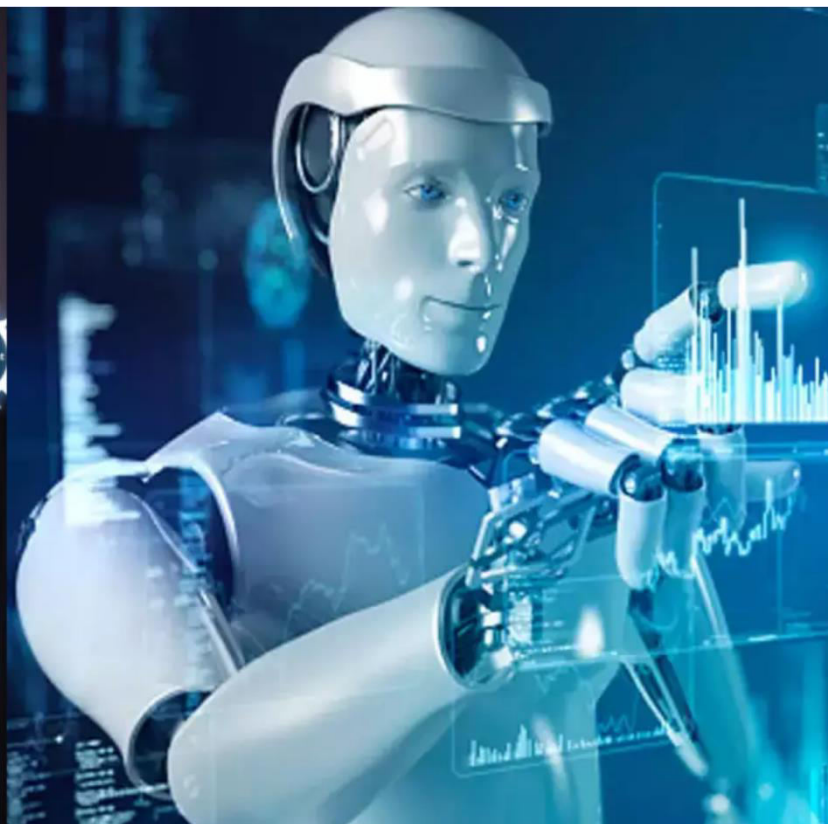




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AI-Powered Emotion-Based Music Recommendation System

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ABSTRACT: The AI-Powered Emotion-Based Music Recommendation System enhances user experience by suggesting music based on real-time emotions. It uses computer vision and deep learning to detect emotions like happiness, sadness, anger, and more through facial expressions captured via a webcam. The image is processed using OpenCV, and emotions are predicted using a TensorFlow/Keras model.

Based on the detected emotion, the system recommends suitable music playlists (e.g., uplifting songs for sadness). Built with Streamlit, the application provides an interactive interface with Spotify integration for direct music playback. It also includes a short quiz to improve user engagement. This project demonstrates how AI can personalize content based on human emotions, supporting entertainment and mental well-being.

I. INTRODUCTION

In today's digital era, music plays a vital role in influencing human emotions and mental well-being. With the increasing use of online music platforms, recommendation systems have become essential for enhancing user experience. However, most traditional recommendation systems depend on past listening history, user ratings, or playlists, which may not accurately represent the user's current mood.

Human emotions are dynamic and change frequently based on situations and environments. Therefore, there is a need for intelligent systems that can understand and respond to real-time emotional states. This project introduces an AI-based system that detects user emotions using facial expressions and recommends music accordingly.

By combining computer vision, deep learning, and recommendation systems, the project aims to create a personalized music experience. The system improves user engagement, supports mental wellness, and demonstrates the practical application of AI in entertainment and emotional analysis.

II. EXISTING SYSTEM

The existing music recommendation systems primarily suggest songs based on user preferences, listening history, search patterns, genres, or trending content. These systems rely on techniques such as collaborative filtering and content-based filtering to provide recommendations. However, users often need to manually select songs or playlists according to their mood, which reduces convenience and personalization.

A major limitation of these systems is that they do not consider the user's real-time emotional state. They lack emotional intelligence and cannot dynamically adapt to changes in user mood. As a result, the level of personalization is limited, and the overall music listening experience becomes less engaging and less responsive to the user's current feelings.

III. PROPOSED SYSTEM

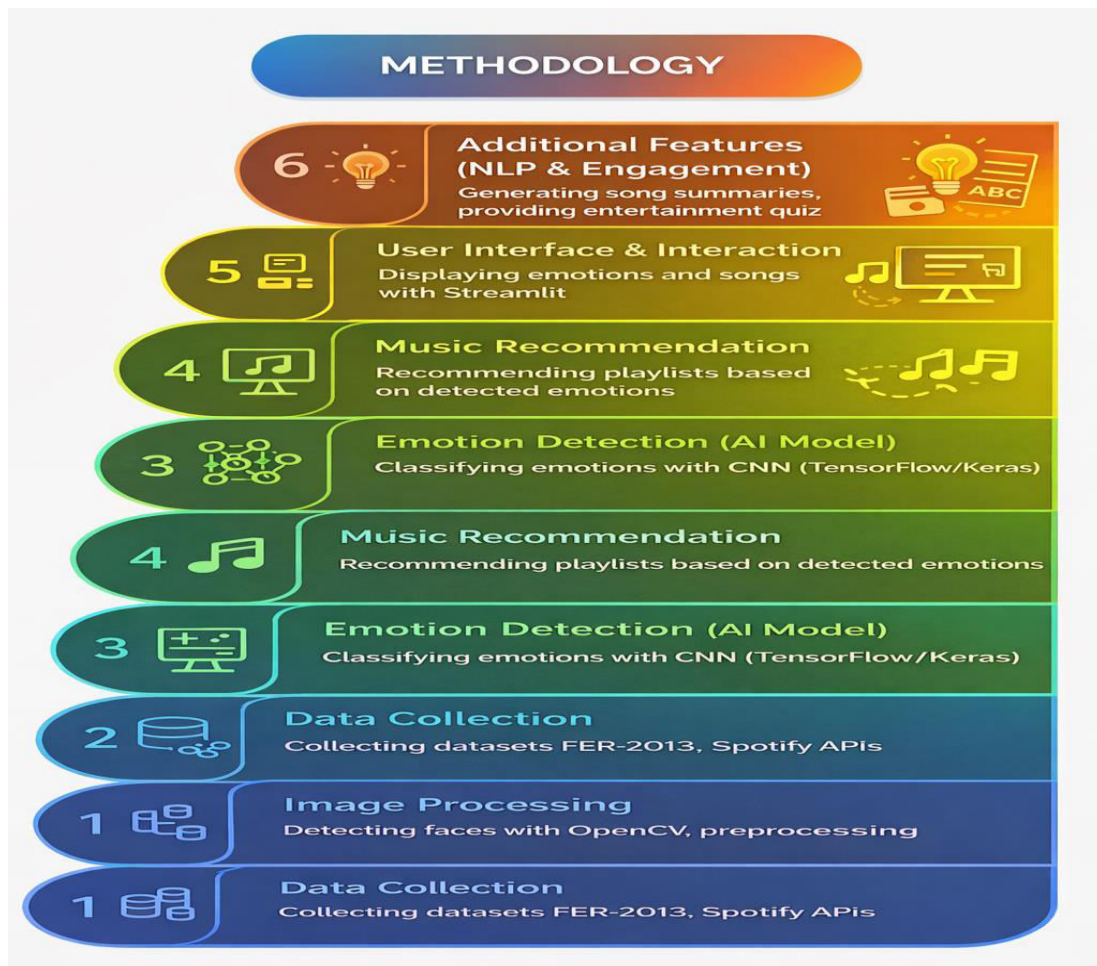
The proposed system introduces an intelligent and automated approach to music recommendation by detecting the user's emotions in real time using facial expression recognition. The system utilizes computer vision and deep learning techniques to analyze facial expressions captured through a webcam.

Based on the detected emotion, the system automatically recommends suitable songs without requiring manual input from the user. In addition to music recommendation, the system also generates short song summaries using Natural Language Processing (NLP), helping users understand the theme or mood of the song.

The system provides an interactive and user-friendly interface using Streamlit, ensuring ease of use and real-time responsiveness. By combining emotion detection, music recommendation, and content understanding, the proposed system delivers a more personalized, engaging, and emotionally adaptive music experience compared to traditional systems.

IV. METHODOLOGY

The methodology of the proposed system consists of multiple stages that work together to detect user emotions and provide personalized music recommendations.



i. Data Collection

This stage involves collecting datasets required for training and testing the system. Facial expression datasets such as FER-2013 are used to train the emotion detection model. Additionally, music datasets or Spotify APIs are used to map emotions to appropriate songs and playlists. The data collected is structured and prepared for further processing.

ii. Image Processing

In this stage, the system captures real-time images using a webcam. OpenCV is used to detect the human face in

the captured frame. The detected face is then preprocessed by resizing, normalization, and noise reduction to make it suitable for the deep learning model.

iii. Emotion Detection (AI Model)

The processed facial image is passed to a Convolutional Neural Network (CNN) model built using TensorFlow and Keras. The model analyzes facial features and classifies emotions such as happy, sad, angry, and neutral. This stage is the core component of the system, enabling real-time emotion recognition.

iv. Music Recommendation

Based on the detected emotion, the system recommends suitable music playlists. For example, happy emotions trigger energetic songs, while sad emotions result in calming or uplifting songs. The system can use predefined datasets or integrate with Spotify APIs for real-time music suggestions.

v. User Interface & Interaction

The system uses Streamlit to provide an interactive and user-friendly interface. Users can view their detected emotions, recommended songs, and play music directly through the interface. This stage ensures smooth interaction and enhances user experience.

vi. Additional Features (NLP & Engagement)

The system also includes additional features such as generating short song summaries using Natural Language Processing (NLP). It provides a small entertainment quiz to increase user engagement. These features make the system more interactive and informative.

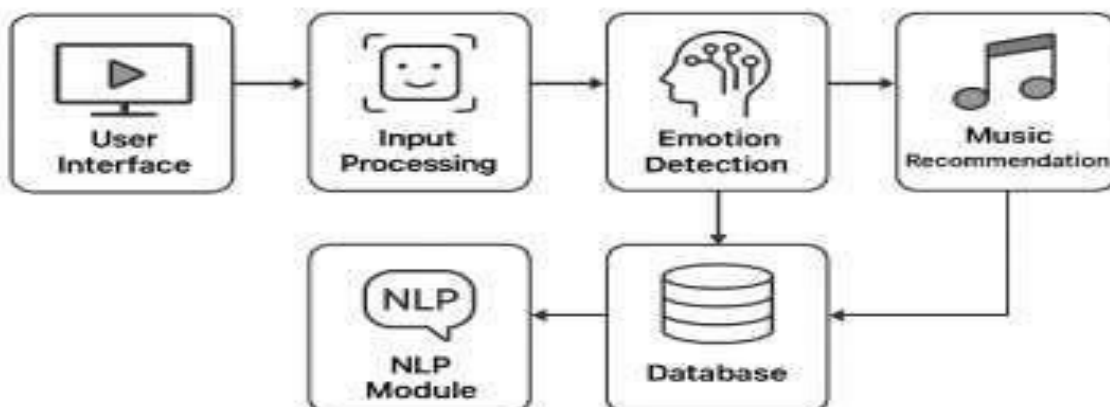
V. SYSTEM ARCHITECTURE

The system design of the AI-powered emotion-based music recommendation system explains how different components work together to detect user emotions and suggest suitable music. The process begins with a webcam capturing the user's facial image in real time. This image is processed using a deep learning model (CNN) to classify emotions such as happy, sad, angry, or neutral.

Once the emotion is detected, it is sent to the recommendation engine, which selects songs based on mood, audio features, and user preferences. The system also includes an NLP module to generate short song summaries and a feedback module to improve future recommendations.

All components are connected through a backend server and supported by databases for storing songs and user data. This design ensures real-time processing and provides a personalized music experience.

AI-Powered Emotion-Based Music Recommender



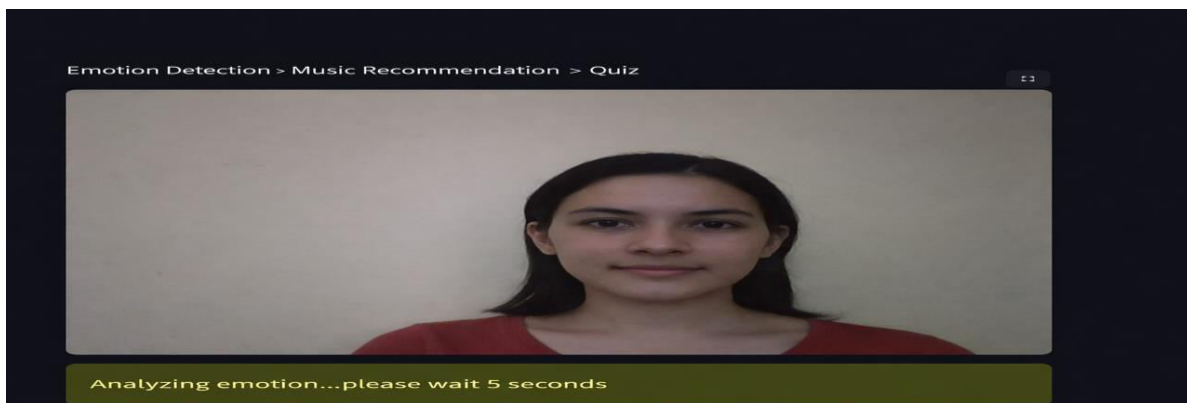
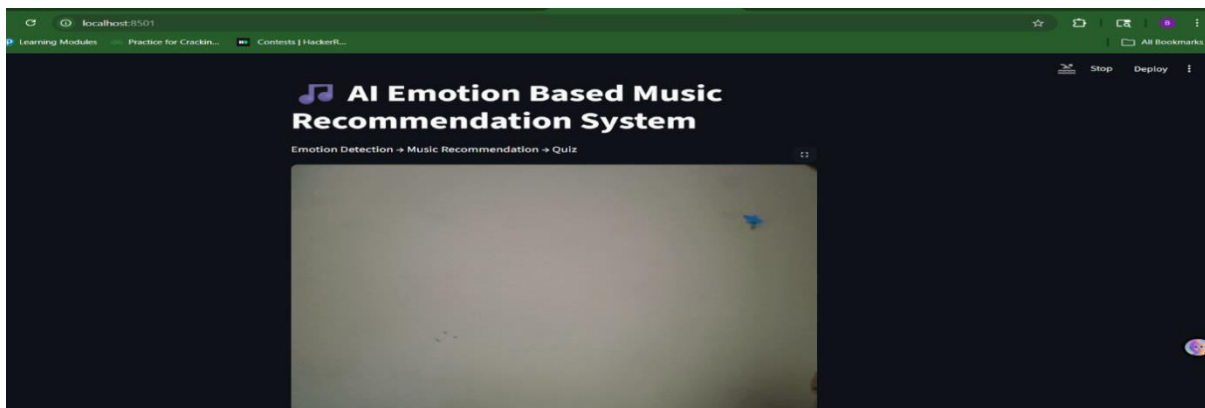
The diagram illustrates the architecture of an AI-powered emotion-based music recommendation system designed to provide personalized music suggestions based on real-time user emotions. The process begins in the Input Layer, where the user's facial image is captured through a webcam. This real-time image data contains facial features that are used as input for the emotion detection model. The captured image is then processed in the Image Processing Layer using OpenCV, where face detection, resizing, and normalization are performed to prepare the image for analysis.

The processed image is then passed to the Emotion Detection Layer, where a deep learning model based on Convolutional Neural Networks (CNN) analyzes facial expressions and classifies the user's emotion into categories such as happy, sad, angry, or neutral. Once the emotion is identified, it is forwarded to the Recommendation Layer, where the system selects suitable songs from the music database based on mood tags, audio features, and user preferences.

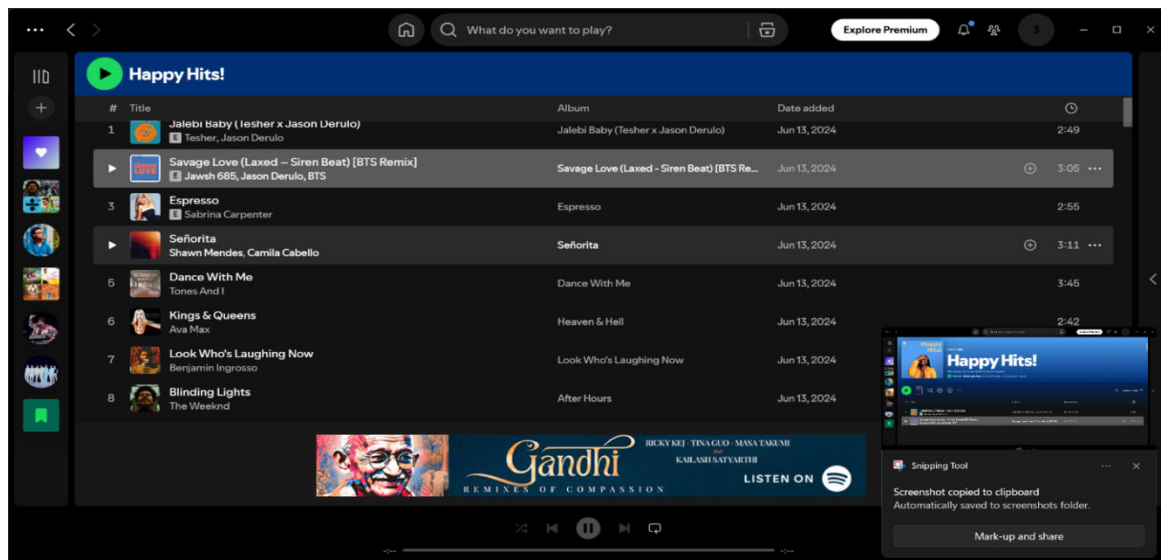
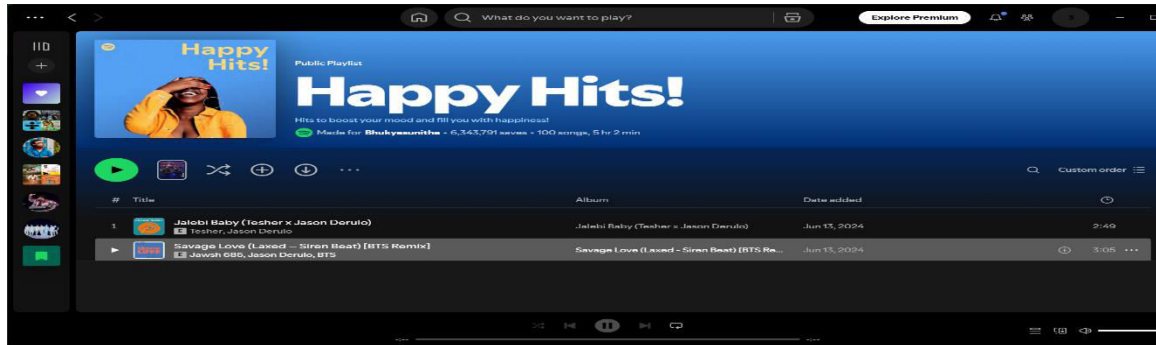
The recommended results are then sent to the Application Layer, which includes the backend server and Streamlit interface. This layer manages communication between the emotion detection model, recommendation engine, and user interface, ensuring smooth data flow and real-time response. Additionally, the system integrates an NLP Module that generates short summaries of songs using lyric analysis, helping users understand the theme or mood of the recommended music.

Finally, the User Interface Layer allows users to view their detected emotion, listen to recommended songs, and interact with the system. The architecture also includes a feedback mechanism where user interactions such as likes or skips are stored in the database and used for improving future recommendations. This design ensures real-time emotion detection, intelligent music recommendations, and a personalized, engaging user experience.

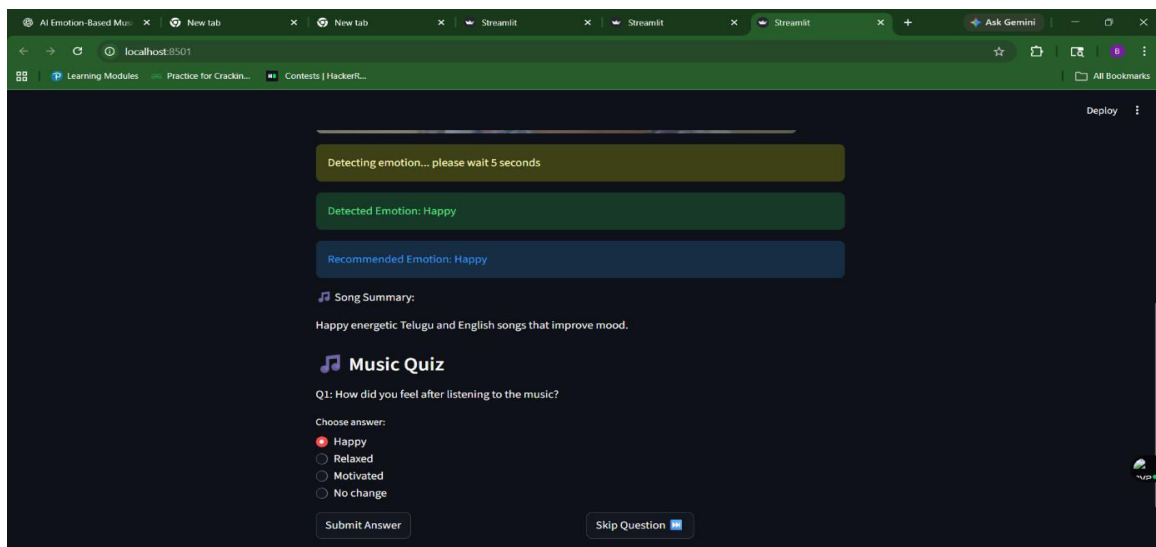
VI. RESULTS AND OUTPUT



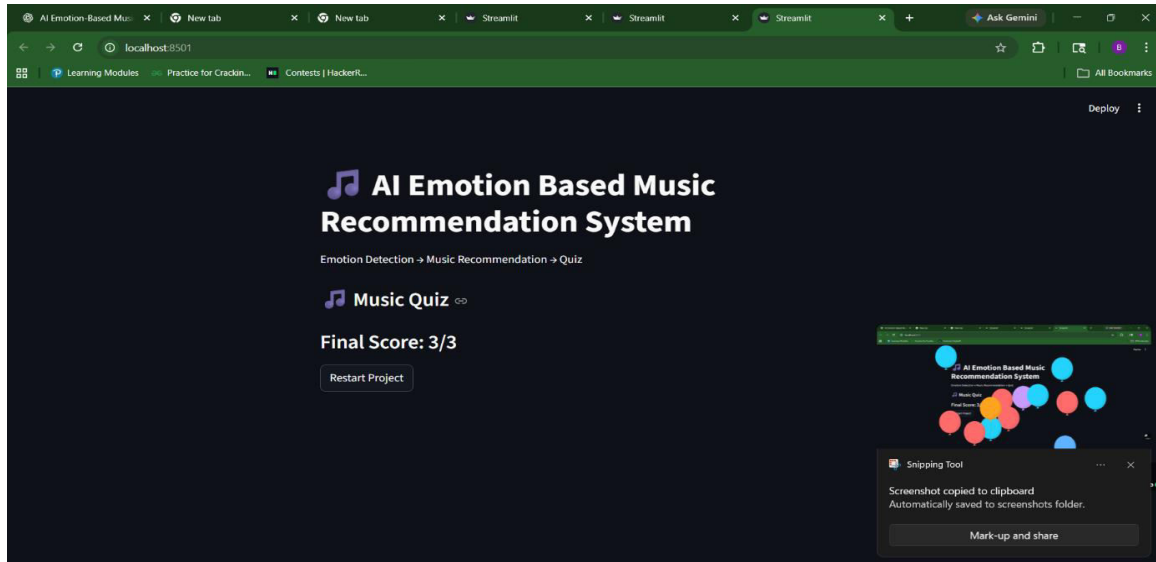
Emotion Detection



Spotify PlayList



Song Summary and quiz



VII. CONCLUSION

The “**AI-Powered Emotion Based Music Recommendation System**” successfully demonstrates the use of artificial intelligence and computer vision to enhance user experience in music selection. The system is capable of detecting human emotions in real time using facial expression analysis and recommending suitable music accordingly.

By integrating technologies such as OpenCV and deep learning models (CNN), the system provides an automated and personalized music experience without requiring manual input. It reduces the effort of searching for songs and ensures that users receive music that matches their current mood.

The system performs efficiently with good accuracy in emotion detection and provides quick responses for music playback. It is user-friendly, responsive, and suitable for real-time applications.

Overall, the project highlights the potential of combining AI and multimedia technologies to create intelligent, interactive systems. It can be further enhanced by improving model accuracy, adding more emotions, and integrating online music streaming platforms for better scalability and performance.

VIII. FUTURE SCOPE

The AI-Powered Emotion-Based Music Recommendation System can be further enhanced by improving the accuracy and robustness of the emotion detection model using larger and more diverse facial expression datasets. Advanced deep learning techniques such as CNN optimization and hybrid models can be applied to achieve better performance under varying lighting conditions and facial angles.

Future development can include integration with cloud-based services to enable faster processing, scalability, and real-time access to a large collection of songs. This will allow the system to support multiple users simultaneously and improve recommendation efficiency.

The system can also be extended by developing mobile applications for Android and iOS platforms, increasing accessibility and convenience for users. Integration with wearable devices such as smartwatches or smart glasses can provide a seamless and hands-free music experience.

In addition, incorporating multilingual support and regional music libraries (such as Telugu, Hindi, and English songs)

will make the system more inclusive and user-friendly. Enhancing the AI with advanced recommendation algorithms based on user behavior and listening history can further personalize the experience.

The system can also be expanded to include mood tracking, playlist generation, and integration with popular streaming platforms like Spotify and YouTube Music for a richer and more dynamic music experience.

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