

# EMOTION BASED MUSIC RECOMMEDATION SYSTEM

FINAL YEAR PROJECT

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## Abstract

In today's digital age, personalizing user experiences is at the forefront of multimedia applications. The Emotion-Based Music Recommendation System is designed to automatically detect the user's emotional state using real-time facial expression analysis and suggest songs that match their mood. This intelligent system uses technologies such as OpenCV, deep learning models, and Spotify API integration to deliver dynamic playlists. The aim is to enhance user satisfaction by offering emotionally aligned music experiences. A review of similar systems was conducted to understand their features, benefits, and shortcomings, laying the foundation for this innovative and interactive music application.

**Keywords — Emotion Detection, Music Recommendation, Facial Expression Recognition, Deep Learning, Spotify API**

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## I. Introduction

Emotions play a significant role in how users consume media, particularly music. Traditional music applications rely on static user input such as genre preferences or playlists, which can lead to repetitive or irrelevant recommendations. The Emotion-Based Music Recommendation System addresses this limitation by using real-time facial expression detection to curate music that aligns with the user's current emotional state.

This project integrates a webcam-based emotion detection mechanism with the Spotify API to stream mood-based playlists automatically. The goal is to bridge the gap between user mood and music, providing a seamless and emotionally engaging experience. To establish a solid foundation for this solution, we have examined similar existing systems and evaluated their key functionalities, strengths, and weaknesses.

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## II. Literature Review

### Existing Project 1: Moodify – Emotion Detection-Based Music Player

- **Features:**
  - Facial expression recognition to determine the user's mood.
  - Integration with local music library for mood-based playback.
  - GUI for controlling and adjusting emotions manually.
- **Strengths:**
  - Offers simple emotion classification and audio response.
  - Provides a user-friendly interface for mood selection.
- **Limitations:**
  - No integration with online music platforms (e.g., Spotify).
  - Lacks real-time updates and automation.
  - Limited to basic emotional categories.

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### Existing Project 2: EMO-MP – Emotion-Aware Music Player using AI

- **Features:**
  - AI-driven emotion detection using convolutional neural networks (CNNs).
  - Provides recommendations using a small set of pre-categorized tracks.
  - Incorporates sentiment analysis from user input.
- **Strengths:**
  - Enhanced accuracy due to deep learning.
  - Capable of recognizing nuanced emotions beyond basic categories.
- **Limitations:**
  - Does not connect to external APIs for live music.
  - Requires large datasets and model training.
  - Heavy computational requirements.

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### Existing Project 3: Facial Expression-Based Entertainment App by R. Verma and A. Singh

- **Features:**
  - Uses OpenCV and Haar cascade classifiers for emotion detection.
  - Recommends videos and songs based on basic emotional states.
  - Works offline with a preloaded media database.
- **Strengths:**
  - Lightweight and functional without internet connectivity.
  - Low resource consumption; runs on basic devices.
- **Limitations:**
  - Limited scalability and adaptability.
  - Not suitable for modern streaming services.
  - No real-time response to mood changes.

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## III. Proposed Methodology

The proposed Emotion-Based Music Recommendation System combines the best practices of the existing solutions while overcoming their limitations. It leverages:

1. **Real-Time Emotion Detection:**

Utilizes OpenCV and deep learning models to capture and analyze facial expressions through a webcam.

2. **Spotify API Integration:**

Dynamically fetches playlists based on detected emotions such as happy, sad, angry, and surprised.

3. **Responsive User Interface:**

Designed using Tkinter (or other GUI frameworks), the interface provides an intuitive and enjoyable user experience with live emotion updates and playlist refresh.

4. **Cross-Platform Compatibility:**

The system is designed to work on Windows and macOS, and can be extended to mobile platforms.

5. **Fallback Handling:**

When no face is detected or lighting is poor, the system gracefully falls back to default playlists, maintaining usability.

By addressing the weaknesses in previous projects, this system ensures real-time interaction, external streaming capabilities, and a more emotionally connected user experience.

### III. Proposed Methodology

The proposed system enhances traditional music recommendation systems by integrating emotion recognition using facial expressions with real-time music curation. It builds on strengths observed in previous systems while addressing their key limitations.

1. **Real-Time Emotion Detection**

- Uses OpenCV and a pre-trained CNN model to detect facial expressions in real-time using a webcam.
- Recognizes emotions such as happy, sad, angry, surprised, and neutral.

2. **Spotify API Integration**

- Fetches dynamic playlists based on the detected emotion using Spotify's developer API.
- Provides users with mood-aligned music experiences instantly.

3. **User Profiles and Feedback Loop**

- Enables personalized feedback by allowing users to like/dislike songs.
- Enhances future recommendations through reinforcement learning.

4. **Cross-Platform Compatibility**

- Developed using Python; runs on Windows/macOS and can be extended to Android using Kivy/Flutter.
- GUI built with Tkinter or PyQt for better user experience.

5. **Error Handling and Fallbacks**

- Provides default playlists when no face is detected or emotions are ambiguous.
- Alerts the user in case of API/network errors without interrupting playback.

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#### IV. Comparison of Proposed and Existing Systems

Feature	Spotify	Filtering MoodPlay	Facial Music Player	Proposed System
Real-Time Emotion Detection	No	No	Yes	<b>Yes</b>
Automatic Mood Recognition	No	No	Yes	<b>Yes</b>
Dynamic Playlist Integration	Yes	No	No	<b>Yes</b>
Cloud/API-Based Song Selection	Yes	No	No	<b>Yes</b>
User Feedback Learning	Yes	No	No	<b>Yes</b>
Offline Functionality	Yes	Yes	Yes	Limited
Ease of Use	High	Moderate	Moderate	<b>High</b>

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#### V. Results and Conclusion

The proposed Emotion-Based Music Recommendation System bridges the gap between emotion and music by offering real-time, mood-sensitive playlist suggestions. It goes beyond traditional recommendation engines by detecting the user's emotional state through facial expression analysis and dynamically curating songs that resonate with their current mood.

By analyzing existing systems, the study identifies major limitations such as lack of automation, poor real-time detection, and absence of integration with streaming APIs. The proposed system effectively addresses these issues by combining emotion recognition with intelligent music delivery.

Overall, the system offers a highly adaptive, emotionally intelligent, and enjoyable music experience. It can be further developed for mobile platforms, therapy-based music treatment, or smart devices to broaden its impact.