International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 06 | June - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Chatbot: Music Recommendation System Using Emotion Detection

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Abstract -In the age of personalized entertainment, traditional music recommendation systems often overlook the emotional context of the user. This paper presents an AI-powered chatbot-based music recommendation system that suggests songs dynamically based on the user's emotional state. The system utilizes Natural Language Processing (NLP), sentiment analysis, and optionally facial and voice inputs to detect emotions such as happiness, sadness, or relaxation. A machine learning model classifies the emotional state, and suitable songs are retrieved from a music database accordingly. The chatbot allows user interaction for refining preferences, including language and artist selection. Built using Python, Flask, and Firebase Firestore, the system supports real-time feedback to improve recommendation accuracy over time. This approach enhances music discovery by aligning songs with the user's current mood and promotes emotionally adaptive AI. The system demonstrates potential applications in entertainment and wellness, with scope for future upgrades such as deep learning-based emotion detection and multi-modal recommendation strategies for immersive user experiences.

Key Words: NLP, Emotion Detection, Chatbot, Music Recommendation, Machine Learning, Real-Time Personalization

1. INTRODUCTION

In recent years, Artificial Intelligence (AI) and Machine Learning (ML) have played a transformative role in personalizing digital experiences across various domains. Music, being closely tied to human emotions, offers a unique opportunity to leverage emotion-aware systems for deeper user engagement. Traditional music recommendation platforms primarily depend on user preferences, listening history, or genre-based filtering, which often fails to adapt to a user's real-time emotional context. This limitation necessitates the development of intelligent systems that can dynamically detect and respond to emotional cues.

In this project, we propose an AI-powered chatbot-based music recommendation system designed to address this challenge. The system integrates Natural Language Processing (NLP), sentiment analysis, and optionally, facial emotion recognition, to interpret a user's current mood from text or facial expressions. Emotions such as happiness, sadness, relaxation, anger, or surprise are classified using machine learning models. Based on this analysis, the system recommends songs that correspond to the detected emotional state, improving the relevance and resonance of the music suggestions.

A Flask-based chatbot interface facilitates user interaction, allowing individuals to converse naturally and receive curated playlists or specific tracks. For instance, when a user expresses feelings of sadness, the system may suggest calming or uplifting songs, whereas an expression of joy would lead to recommendations of energetic or upbeat tracks. The backend is developed in Python, and Firebase Firestore is used to manage real-time music data. The chatbot also supports user preferences such as language and artist selection, enhancing personalization.

The system architecture includes modules for emotion detection, music mapping, and real-time audio playback. The chatbot continuously learns from user feedback to improve its recommendation accuracy over time. By leveraging AI-driven insights and cloud integration, the application demonstrates the growing potential of emotion-aware technologies in consumer-oriented platforms. The prototype showcases how AI, NLP, and music recommendation can be combined to create emotionally intelligent entertainment systems.

Although implemented as a functional prototype, the model is scalable and adaptable to commercial music platforms. It not only offers technical value but also contributes to mental wellness by aligning music choices with emotional needs. As emotion-based interaction becomes increasingly relevant, this system lays the groundwork for future applications in adaptive interfaces, mental health support and personalized digital experiences.

2. LITERATURE SURVEY

[2.1] Chatbot-Based Music Recommendation System

Focus: Music recommendation systems have evolved significantly with the integration of artificial intelligence (AI) and natural language processing (NLP). Traditional algorithms relied on user history and collaborative filtering, but modern approaches now incorporate contextual and emotional factors. This system uses external APIs and real-time data such as time of day or mood to recommend suitable music. NLP is used to interpret user emotions for more refined and dynamic suggestions. Although the system increases engagement by personalizing music based on user input, it depends on external data and real-time user

interaction, which may limit effectiveness if such input is unavailable.

[2.2] Music Recommendation Using Chatbot

Focus: This study introduces a chatbot that enhancespersonalization in music recommendations using sentimentanalysis and AI. The system classifies emotions such as happy,sad, or calm based on textual input using NLP, and thenprovides appropriate songsfrom an emotionally taggeddatabase. Technologies like TensorFlow, OpenCV, and SQLLite integrated, along with Spotify's API, for real-timeinteraction and improved user experience. While it offers ahigher degree of personalization than popularity-based models,it faces challenges such as dependency on third-party APIs andthe need for accurate sentiment interpretation from usermessages. Anyone from the project coordination can update on music and other technicalities of the system

[2.3] Chatbot Emotion-Based Song Recommender System

Focus: This paper presents a music recommendation system that incorporates user emotion recognition through NLP and sentiment analysis. It interprets user moods like joy, sadness, and relaxation to recommend music accordingly. The system ensures that song selections align with users' emotional context, enhancing listening experiences. It combines a vast song database with AI techniques for more nuanced music delivery. Challenges include the reliability of sentiment detection, especially from limited or ambiguous input. The study highlights the potential of emotion-aware music recommenders in areas beyond entertainment, such as mental health and interactive digital experiences.

3. PROPOSED SYSTEM

The proposed system is designed to enhance music recommendation by dynamically adapting song suggestions based on the user's real-time emotional state detected through facial expressions. The system integrates deep learning-based facial emotion recognition with a personalized music recommendation engine that learns individual preferences.

The core components of the proposed system are as follows:

Real-Time Facial Emotion Detection: A webcam captures live video of the user's face. The captured footage is processed by a convolutional neural network (CNN) model trained on facial emotion datasets. The model detects and classifies emotions such as happiness, sadness, anger, and neutrality in real time.

Emotion Analysis and Classification: The system analyzes the detected emotions to determine the user's current emotional state. The classification is continuously updated to reflect dynamic mood changes, enabling the system to respond promptly.

Personalized Music Recommendation: Based on the detected emotion, the system matches songs from a personalized music database. The recommendation engine learns from user feedback and listening history, adapting song suggestions to fit individual tastes rather than using generic emotion-to-music mappings.

Local Processing and Privacy: All facial emotion recognition and data analysis occur locally on the user's device to ensure privacy and reduce latency. This avoids sending sensitive facial data to external servers, protecting user information.

Music Playback Integration: The system supports both streaming platforms and local music libraries, allowing users to play recommended songs regardless of internet connectivity. This ensures seamless and flexible music listening.

The system, implemented as a prototype application, demonstrates the feasibility of an AI-driven, privacy-conscious, and adaptive music recommendation platform. By integrating real-time emotion detection with personalized learning, the system aims to deliver a more engaging, accurate, and user-friendly music experience.

4. MODULE DESCRIPTION

The project comprises several key modules, each performing specific functions that work together to provide a smooth and effective user experience. The Facial Emotion Detection Module captures real-time facial expressions using OpenCV and applies a Convolutional Neural Network (CNN) to classify emotions such as happy, sad, angry, neutral, surprise, and fear.

The Music Recommendation Module uses the detected emotions to map to predefined playlists and retrieves the most suitable songs from the Firebase Firestore database, enabling dynamic and real-time music selection. The Database Management Module stores detailed song information including title, artist, file path, and associated emotion, allowing efficient retrieval and updates based on user preferences.

The User Interface (UI) Module, built with Flask, provides a web-based platform for users to interact with the system, view detected emotions, and control music playback. The Audio Playback Module manages controls like play, pause, and stop, utilizing Pygame or an HTML5 audio player for smooth streaming.

To improve emotion detection accuracy, the Preprocessing and Feature Extraction Module processes facial images and extracts key facial landmarks. Finally, the Cloud Integration Module connects the system to Firebase, supporting database operations, cloud storage, and enhancing scalability and accessibility.

5. TECHNOLOGIES USED

Python: Python is the core programming language used for building the system. It provides powerful libraries for machine learning, data processing, and web development.

Flask: Flask is a lightweight web framework used to develop the backend of the application. It helps handle user requests, API calls, and database interactions efficiently.

Firebase Fire store: Firebase Fire store is a NoSQL cloud database used for storing and managing music data. It ensures real-time data updates and seamless integration with the application.

OpenCV: OpenCV (Open-Source Computer Vision Library) is used for image processing and facial emotion detection. It helps in extracting facial features and recognizing emotions from images.

Deep Learning (TensorFlow/Keras): A deep learning model trained using TensorFlow/Keras is used for emotion recognition. It processes facial expressions and categorizes them into different emotions like happy, sad, angry, etc.

HTML, CSS, JavaScript: These technologies are used for the frontend of the web application. HTML structures the web pages, CSS enhances the design, and JavaScript ensures interactivity.

Bootstrap: Bootstrap is used to create a responsive and user-friendly interface for the application.

JavaScript (AJAX & jQuery): JavaScript libraries like jQuery and AJAX help in making asynchronous requests, improving user experience by enabling dynamic content updates.

Media Handling (Pygame/HTML5 Audio): Pygame (for Python-based applications) or HTML5 Audio (for web-based applications) is used to play the recommended music.

GitHub: GitHub is used for version control and collaborative development, ensuring smooth tracking of changes and updates.

Hardware

The hardware requirements for this project include a few essential components to ensure smooth development and user interaction. A laptop or PC is used for the development, testing, and deployment of the system, serving as the primary platform for coding and running the application. A webcam is necessary to capture real-time facial expressions, enabling accurate emotion detection through the facial emotion recognition module. Additionally, headphones or speakers are required to play the recommended music, providing users with an immersive and personalized audio experience based on their detected emotions.

6. SYSTEM DESIGN

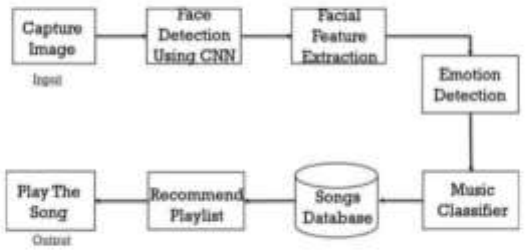

Figure 1 : Block Diagram of the proposed system

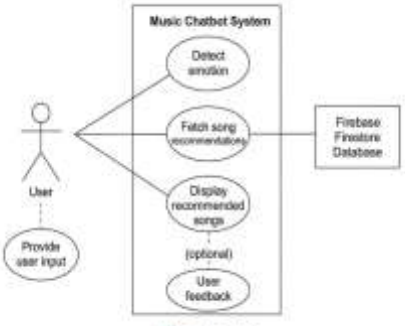

Figure 2 : Use Case

7. RESULTS

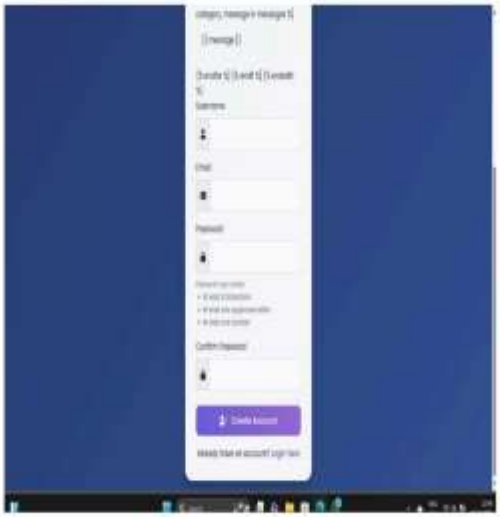

Figure 3: Sign Up

Figure 4: Login Page

Figure 5: Emotion Detection

Figure 6: Manual Select

Fig

Figure 7 :Add Song

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8. DISCUSSION AND ANALYSIS

8.1. ADVANTAGES

Personalized Music Experience:

Recommends songs based on real-time detection of user emotions, creating a highly personalized and engaging listening experience.

Real-Time Emotion Detection:

Uses facial emotion recognition to dynamically adapt music suggestions, reflecting the user's current mood accurately.

Improved User Engagement:

By responding to emotional states, the system enhances user satisfaction and encourages longer interaction with the chatbot.

Privacy-Preserving Processing:

Emotion recognition is performed locally on the user's device, reducing privacy concerns and minimizing latency for faster recommendations.

8.2. FUTURE WORKS

The music chatbot with emotion-based recommendations offers vast potential for further enhancement. Future developments can focus on improving emotion detection, expanding AI capabilities, and enriching user experience. Key areas for extension include:

1. Multi-Modal Emotion Recognition:

Incorporate facial expression analysis, voice tone detection, and biometric signals such as heart rate to improve real-time emotion accuracy. Machine learning models like CNNs and RNNs can be utilized for enhanced detection.

2. Integration with Music Streaming Platforms:

Enable direct playback and playlist management by linking with Spotify, YouTube Music, Apple Music, and SoundCloud through their APIs, allowing seamless synchronization and song previews.

3. Conversational AI and Voice Assistant Integration:

Integrate advanced NLP models (e.g., GPT-based AI) for natural interactions and connect with voice assistants like Google Assistant, Alexa, or Siri for hands-free music recommendations that adapt to user mood.

4. AI-Based Personalized Music Recommendations:

Implement reinforcement learning to track user preferences over time, build adaptive profiles, and combine collaborative and content-based filtering for more nuanced song suggestions.

5. Multilingual and Cross-Cultural Support:

Expand language processing capabilities to support multiple languages and regional music preferences, providing a culturally personalized experience worldwide.

6. Mental Health and Well-Being Applications:

Extend features to recommend music for stress relief, relaxation, or motivation, incorporating therapeutic AI elements and collaborating with mental health professionals for curated playlists.

7. Mobile App and Smart Device Integration:

Develop a dedicated mobile app for improved accessibility and offline use. Integrate with smart home devices, wearables, and car systems to offer emotion-driven music recommendations anytime, anywhere.

8. Community and Social Features:

Enable sharing of mood-based playlists on social media, foster community-driven recommendations, and create collaborative playlists that respond to group emotions in real time.

9. CONCLUSION

The music chatbot with emotion-based recommendations represents a significant advancement in the integration of artificial intelligence, sentiment analysis, and personalized entertainment. By detecting user emotions in real-time and mapping them to suitable music choices, the system creates a highly engaging and emotionally responsive experience. Leveraging tools like Firebase Fire store for efficient data management and NLP techniques for emotion recognition, the chatbot delivers context-aware recommendations that reflect the user's current mood.

Throughout development, challenges such as achieving accurate emotion classification, ensuring real-time responsiveness, and optimizing database performance were effectively addressed. The chatbot illustrates how emotion-aware systems can bridge the gap between human emotions and digital interactions, offering a more immersive and human-centric approach to music discovery.

As AI and emotional intelligence technologies continue to evolve, this project lays a strong foundation for future enhancements, such as multi-modal emotion recognition, integration with popular music streaming platforms, and applications in mental well-being. Ultimately, the chatbot exemplifies how emotionally intelligent systems can redefine user engagement and interaction in the entertainment industry.

ACKNOWLEDGMENT

We would like to express our sincere gratitude to our Mentor Dr. Shaji B for his invaluable guidance, encouragement, and continuous support throughout the development of this project. Hir expertise and insightful feedback played a crucial role in enhancing our understanding and improving the project's quality. We are also thankful to Nehru College of Engineering and Research Centre, Thiruvilwamala, for providing the necessary resources and a conducive learning environment, enabling us to explore and apply our technical knowledge effectively. Finally, we deeply appreciate the unwavering support and encouragement from our family and friends, whose motivation kept us inspired throughout this journey. This project has been a significant learning experience, and we are truly grateful to everyone who contributed to its successful completion.

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