

A

Mini-Project Report on  
**Facial emotion detection for personalized song  
recommendations**

Submitted in partial fulfillment of the requirements of the degree of

**BACHELOR OF ENGINEERING**

**IN**

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**Artificial Intelligence & Machine Learning**

by

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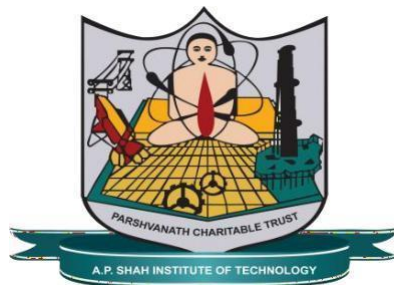
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# CERTIFICATE

This is to certify that the Mini Project 2B entitled “ **Facial emotion detection for personalized song recommendations**” is a bonafide work of “**Himanshu Rajput (21106055), Harsh Kokitkar (21106029), Vinayak Kokare (21106052), Nehali Palkar (21106057)**” submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of **Bachelor of Engineering in Computer Science & Engineering (Artificial Intelligence & Machine Learning)**.

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## Project Report Approval for T.E.

This Mini project report entitled **Facial emotion detection for personalized song recommendations** by *Himanshu Rajput, Harsh Kokitkar, Vinayak Kokare and Nehali Palkar* is approved for the degree of *Bachelor of Engineering in Computer Science & Engineering (Artificial Intelligence and Machine Learning) 2023 – 2024*.

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Place:

## **Declaration**

We declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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## **Abstract**

To improve user experiences and engagement on music streaming services, this study investigates the incorporation of facial expression detection technology into the field of personalized music suggestions. Taking into account the inherent relationship between musical tastes and emotions, we present a novel method that uses facial expression analysis to dynamically modify song recommendations according to users' actual emotional states.

Using sophisticated computer vision algorithms such as Facial Emotion Detection, Music Recommendation, Machine Learning, Real-Time Adaptation, the system analyzes facial expressions to identify important emotional traits like happiness, sadness, enthusiasm, and tranquility. Each user is then given a unique emotional profile based on these emotional clues. As users engage with the site, the emotional profile is updated in real time, guaranteeing that music recommendations correspond with users' present emotional states. This study contributes to the intersection of emotion recognition, music recommendation systems, and user experience design. The integration of facial emotion detection into personalized song recommendations opens new avenues for creating emotionally intelligent and engaging music streaming platforms.

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**CHAPTER 1**

**Introduction**



## 1.1 Introduction

In the ever-evolving landscape of music streaming platforms, the quest for delivering a truly personalized and emotionally resonant user experience has driven innovative technological advancements. One such groundbreaking integration is the application of facial emotion detection for personalized song recommendations. Music has an inherent power to evoke emotions, and recognizing the importance of aligning music suggestions with users' real-time emotional states represents a paradigm shift in the way we interact with digital music libraries. This novel approach leverages computer vision techniques to analyze users' facial expressions, providing a dynamic and nuanced understanding of their emotional states. By seamlessly integrating this technology into the music recommendation process, platforms can transcend conventional algorithms, responding intuitively to users' changing moods. This introduction explores the transformative potential of facial emotion detection in redefining the user experience, going beyond historical listening patterns to create a musical journey that adapts and resonates with the ebb and flow of human emotions.

## 1.2. Problem Definition

Develop a system that presents a cross-platform music player, which recommends music based on the real-time mood of the user through a web camera using Machine Learning Algorithms.

## 1.3 Objectives

The primary objective of this research is to seamlessly integrate facial emotion detection technology into the domain of personalized music recommendations, addressing the limitations of traditional recommendation systems. The project aims to develop a robust facial emotion detection system using advanced computer vision techniques, enabling real-time capture of users' emotional states through facial expressions.

To achieve this, a diverse and representative emotional dataset will be curated and used to train a sophisticated machine learning model capable of recognizing nuanced emotional states. The system will dynamically update users' emotional profiles based on continuous facial emotion detection, ensuring adaptability to changes in emotional states during their interaction with the platform. The ultimate goal is to create a more personalized and emotionally resonant music experience by integrating users' emotional profiles with the music recommendation algorithm.

The project will also evaluate the system's performance through rigorous testing, considering metrics such as user satisfaction and engagement. Additionally, a focus on ethical considerations, including privacy and consent, will be paramount, and the project aims to contribute valuable insights to the fields of emotion-aware computing and personalized recommendation systems.

## 1.4 Scope

This project seeks to revolutionize the landscape of music streaming platforms by integrating facial emotion detection technology into the process of personalized song recommendations. The primary scope involves the development of a sophisticated facial emotion detection system using advanced computer vision techniques. This system aims to dynamically capture users' real-time emotional states by interpreting their facial expressions.

A crucial aspect of the project is the training of a machine learning model that recognizes nuanced emotional cues, ensuring adaptability to individual differences and cultural variations. The real-time updating of users' emotional profiles will be a key feature, allowing the system to seamlessly adjust to changes in emotional states during user interactions. The integration of these emotional profiles with the music recommendation algorithm is expected to enhance the user experience, providing dynamically personalized song suggestions aligned with users' current emotional states.

Evaluations will be conducted to measure the accuracy and effectiveness of the system, considering user satisfaction and engagement metrics. Ethical considerations, including privacy and consent, will be addressed, and the project aims to contribute valuable insights to the fields of emotion-aware computing and personalized recommendation systems. Overall, the project's scope encompasses technical development, user experience enhancement, ethical considerations, and a significant contribution to advancing the understanding of integrating facial emotion detection in enhancing music streaming platforms.

## **CHAPTER 2**

# **Literature Surve**

## 2.1 History

Facial emotion detection technology has been an evolving area within the broader field of computer vision and artificial intelligence. Early research in facial expression analysis dates back to the late 20th century, where initial attempts were made to recognize basic emotions from static facial images. The field gained momentum with the advancement of machine learning techniques, particularly with the development of deep learning models.

In recent years, the integration of facial emotion detection technology into various applications has become more prevalent. Industries such as marketing, healthcare, and gaming have explored the potential of leveraging facial emotion analysis to understand user behavior and improve user experiences. However, the direct integration of this technology into music recommendation systems appears to be a relatively novel concept.

The idea of incorporating emotion into music recommendation systems aligns with the growing emphasis on creating personalized and emotionally resonant user experiences. Music streaming platforms have traditionally relied on user listening history, preferences, and collaborative filtering algorithms. The introduction of facial emotion detection aims to take user personalization to a new level by dynamically adapting recommendations based on users' real-time emotional states.

The evolution of this concept likely involves advancements in computer vision, machine learning models for facial emotion recognition, and the integration of these technologies into the infrastructure of music streaming platforms. The historical development of facial emotion detection technology, in general, has paved the way for innovative applications across various domains, and its incorporation into personalized song recommendations reflects a continued trend towards enhancing user experiences through emotion-aware computing.

## 2.2 Survey

**Wayadande, Kuldeep, Parth Narkhede, Srushti Nikam, Nikita Punde, Sejal Hukare, and Rohit Thakur. "Facial Emotion Based Song Recommendation System." In 2023 International Conference on Computational Intelligence and Sustainable Engineering Solutions (CISES), pp. 240-248. IEEE, 2023.**

The impact of Song on human emotions and behavior is a well-established field of study, and there is growing interest in developing systems that can recommend music based on a person's current emotional state. This paper proposes a system that uses computer vision techniques to analyze a person's facial expressions and recommend music that matches their emotional state. The system uses an in-built camera to capture the person's facial expressions, and the captured data is processed using a machine learning algorithm that has been trained on a dataset of facial expressions and corresponding emotional states. The algorithm is designed to predict the person's emotional state based on their facial expressions and recommend music that corresponds to that emotional state. The system's accuracy rate in identifying a person's emotional state and recommending music based on their facial expressions is 84.82%, indicating that it is a reliable and effective tool for recommending music. The system is also convenient and easy to use since it does not require separate hardware for capturing facial expressions, as the camera is already integrated into the device. The proposed system has the potential to be used in a wide range of applications, such as be utilized many different applications call for such as personalized Song recommendations for individuals, Song therapy, and even in public spaces such as shopping malls or airports, where music can be used to improve the mood of the people present.

Overall, the proposed system represents an innovative approach to personalized music recommendations,

**Mahadik, Ankita, Shambhavi Milgir, Janvi Patel, Vijaya Bharathi Jagan, and Vaishali Kavathekar. "Mood based music recommendation system." INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) Volume 10 (2021).**

The music has special connection with emotion of the person. One's mood can be improved by it in a special way. The classification of the emotion of music is a difficult research area because human perception is subjective. The emotional response of the user is closely related to the music recommendation system because most music is selected based on the listener's mood. Many studies have been conducted to determine how to identify emotions using various methods. These techniques have been useful in evoking the subject's feeling using a variety of devices and other hardware that can be quite expensive and inaccurate. On the other hand, observing the person's facial expression can be quite helpful in accurately identifying their mood or feeling. Hence the main goal of the proposed system is to identify an individual's facial emotions effectively in order to make appropriate music recommendations. The proposed system makes use of Convolutional Neural Networks (CNN) to train facial dataset to recognize various emotional reactions. This trained model is used to detect mood of the person based on facial expressions and recommend song related to that emotion. The proposed system is also optimizing the results using fuzzy classification. The results demonstrate the effectiveness of the proposed methodology.

**Sharma, Vijay Prakash, Azeem Saleem Gaded, Deevesh Chaudhary, Sunil Kumar, and Shikha Sharma. "Emotion-based music recommendation system." In 2021 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions)(ICRITO), pp. 1-5. IEEE, 2021.**

Music is the form of art known to have a greater connection with a person's emotion. It has got a unique ability to lift up one's mood. If a user receives a recommendation based on his preference, it will also improve his listening experience. Music recommendations have existed for a long time. Still, in most scenarios, the recommendation is decided after learning the user preferences over time, like looking at their past song preferences, the amount of time they listen to the music, etc. This paper suggests a neural network-based approach to song recommendation where their facial expressions detect a person's mood. This approach is more efficient than the existing ones and eases users' work of first searching and creating a specific playlist. Facial expressions play a crucial role in detecting a person's mood. A webcam or camera is used to picture a face, and input is extracted from that picture. This input is also used for determining an individual's mood.

**Gilda, Shlok, Husain Zafar, Chintan Soni, and Kshitija Waghurdekar. "Smart music player integrating facial emotion recognition and music mood recommendation." In 2017 international conference on wireless communications, signal processing and networking (wispnet), pp. 154-158. IEEE, 2017.**

Songs, as a medium of expression, have always been a popular choice to depict and understand human emotions. Reliable emotion based classification systems can go a long way in helping us parse their meaning. However, research in the field of emotion-based music classification has not yielded optimal results. In this paper, we present an affective cross-platform music player, EMP, which recommends music based on the real-time mood of the user. EMP provides smart mood based music recommendation by incorporating the capabilities of emotion context reasoning within our adaptive music recommendation system. Our music player contains three modules: Emotion Module, Music Classification Module and Recommendation Module.

The Emotion Module takes an image of the user's face as an input and makes use of deep learning algorithms to identify their mood with an accuracy of 90.23%. The Music Classification Module makes use of audio features to achieve a remarkable result of 97.69% while classifying songs into 4 different mood classes. The Recommendation Module suggests songs to the user by mapping their emotions to the mood type of the song, taking into consideration the preferences of the user.

**Deore, Shalaka Prasad. "Enriching Song Recommendation Through Facial Expression Using Deep Learning." *Ingénierie des Systèmes d'Information* 28, no. 1 (2023).**

The music recommendation systems are highly linked with the emotional response of the user as the majority of the music is based on the mood of the listener. A large number of researches have been performed for the detection of emotion through the use of a variety of different techniques. These approaches have been helpful in achieving the emotion of the subject using various devices and other hardware which can be highly expensive with very low rates of accuracy. Whereas the detection of expression of the subject can be useful in determining the mood or the emotion with a considerable degree of accuracy. Therefore, to achieve the effective identification of emotion of an individual for effective music recommendation has been proposed in this research paper. The presented approach utilizes image normalization and Convolutional Neural Networks (CNN) which are trained on a dataset consisting of a number of different emotional responses. This trained model is then used to determine the mood of the individual and recommend music based on the detected mood. The experimental evaluation of the approach is performed to determine the accuracy of the emotion recognition which has resulted in highly accurate results. We achieved 62.88% testing accuracy with MSE and RMSE values of 8.5 and 2.9 respectively. The obtained results are promising and show that the fuzzy classification technique optimizes the outcomes.

**Annam, Sai Teja, Jyostna Devi Bodapati, and RajaSekhar Konda. "Emotion-Aware Music Recommendations: A Transfer Learning Approach Using Facial Expressions." In *International Conference on Data & Information Sciences*, pp. 1-11. Singapore: Springer Nature Singapore, 2023.**

The influence of music on mood and emotions has been widely studied, highlighting its potential for self-expression and personal delight. As technology continues to advance exponentially, manually selecting and analyzing music from the vast array of artists, songs, and listeners becomes impractical. In this study, we propose a system called the “emotion-aware music recommendations” that leverages real-time facial expressions to determine a person’s emotional state. Deep learning models are employed to accurately detect facial emotions, leveraging the principles of transfer learning. By combining the model’s output with the mapped songs from the dataset, a personalized playlist is created. The main objective of the study is to effectively classify user emotions into six distinct categories using pre-trained models. Experimental studies conducted on the proposed approach employ the RAF-ML benchmark facial expression dataset. The findings indicate that the model outperforms existing approaches, demonstrating its effectiveness in generating tailored music recommendations.

**Chopra, Dhruv, Ansh Rastogi, Neeraj Garg, and Neelam Sharma. "Feel-Tunes: An Emotion-Driven Music Recommender System." Available at SSRN 4629086 (2023).**

Facial emotion recognition is an active research field in computer vision and has numerous practical applications in various domains, including healthcare, security, marketing, and entertainment. In this project, we propose a system that detects human emotions and recommends personalized songs based on the detected emotion. The system uses a convolutional neural network (CNN) to analyze facial expressions and identify one of the six basic emotions: anger, fear, sadness, happiness, surprise, and being neutral.

The CNN model is trained using a dataset of facial images with labeled emotions. Once the emotion is detected, the system queries the Spotify API to suggest songs that match the user's emotional state. The system's accuracy is evaluated using a test set of facial images, and the results demonstrate the system's high accuracy in detecting human emotions and recommending suitable music playlists.

**Kadam, Kalyani, Rutuja Kadam, Pooja Bagane, Akshansh Sourabh, Saakshi Jha, Srushti Nagrale, and Saumya Pandey. "Sentiment Sounds: Orchestrating Emotions with Machine Learning for Personalized Song Recommendations." *International Journal of Intelligent Systems and Applications in Engineering* 12, no. 13s (2024): 239-245.**

Music has a major impact on emotions and mood management, and it frequently helps people cope with the obstacles they face on a daily basis. Finding music that perfectly captures one's present mood might be difficult, though. Currently available music recommendation systems generally rely on user preferences and listening history, which may not be useful for users looking for music to match their current feelings. This study suggests a brand-new method of providing personalised song recommendations by analysing facial expressions to ascertain the user's current mood. The system seeks to give a more individualised and organic way to finding music that corresponds with the user's emotions by utilising computer vision and machine learning techniques. Furthermore, as music may be a useful tool for self-soothing and emotional control, this technique may be especially helpful for people who are struggling with mental health concerns. In order to provide a reliable and robust music listening experience, the efficacy and accuracy of the proposed system will be thoroughly tested and user feedback on a large dataset of facial expressions and song suggestions will be collected.

**CHAPTER 3**

**Technology Stack**



## Chapter 3

Python is one of the most popular programming languages for machine learning projects due to several reasons; with the primary one being ease of use and a rich ecosystem of libraries and tools for scientific computing, data manipulation, and visualization, such as NumPy, Pandas. Python is known for its simple and readable syntax, making it easy to understand and write code. It has a large number of libraries and frameworks specifically designed for Deep learning, machine learning, such as TensorFlow, Keras, Flask, openCv and scikit-learn, which provide high-level APIs for building machine learning models and handling data.

The Technologies we've used for our project are:-

1. NumPy and pandas for data manipulation
2. Streamlit for GUI
3. Computer Vision: Keywords: OpenCV, Dlib.
4. Natural Language Processing (NLP)
5. Flask for server side scripting
6. Scikit-learn for machine learning algorithms
7. Keras for neural networks

## **CHAPTER 4**

# **Benefits and Applications**

## 4.1 Benefits

The integration of facial emotion detection for personalized song recommendations offers several notable benefits, enhancing both user experience and the overall effectiveness of music streaming platforms:

### **Personalized Music Recommendations:**

Users receive song recommendations dynamically tailored to their real-time emotional states, creating a more personalized and resonant music experience. This level of personalization goes beyond traditional algorithms that rely solely on historical preferences.

### **Enhanced User Engagement:**

The technology fosters increased user engagement by providing music suggestions that align with users' current moods and emotions. This dynamic adaptation ensures that users remain immersed and satisfied with the platform, leading to prolonged usage.

### **Improved Well-being and Emotional Connection:**

By aligning music recommendations with users' emotions, the platform has the potential to positively impact users' well-being. Music has therapeutic qualities, and recommending songs that resonate with users' emotional states can enhance their emotional connection to the music.

### **Real-time Adaptation to Changing Moods:**

The system's ability to capture real-time facial expressions allows for immediate adjustments in song recommendations as users' moods evolve. This real-time adaptation ensures that the platform stays responsive to users' changing emotional states.

### **Therapeutic Music Listening:**

Leveraging facial emotion detection for personalized song recommendations can contribute to the creation of a therapeutic environment. Users may find solace, motivation, or relaxation in music that aligns with their emotional needs, potentially enhancing their mental health and mood.

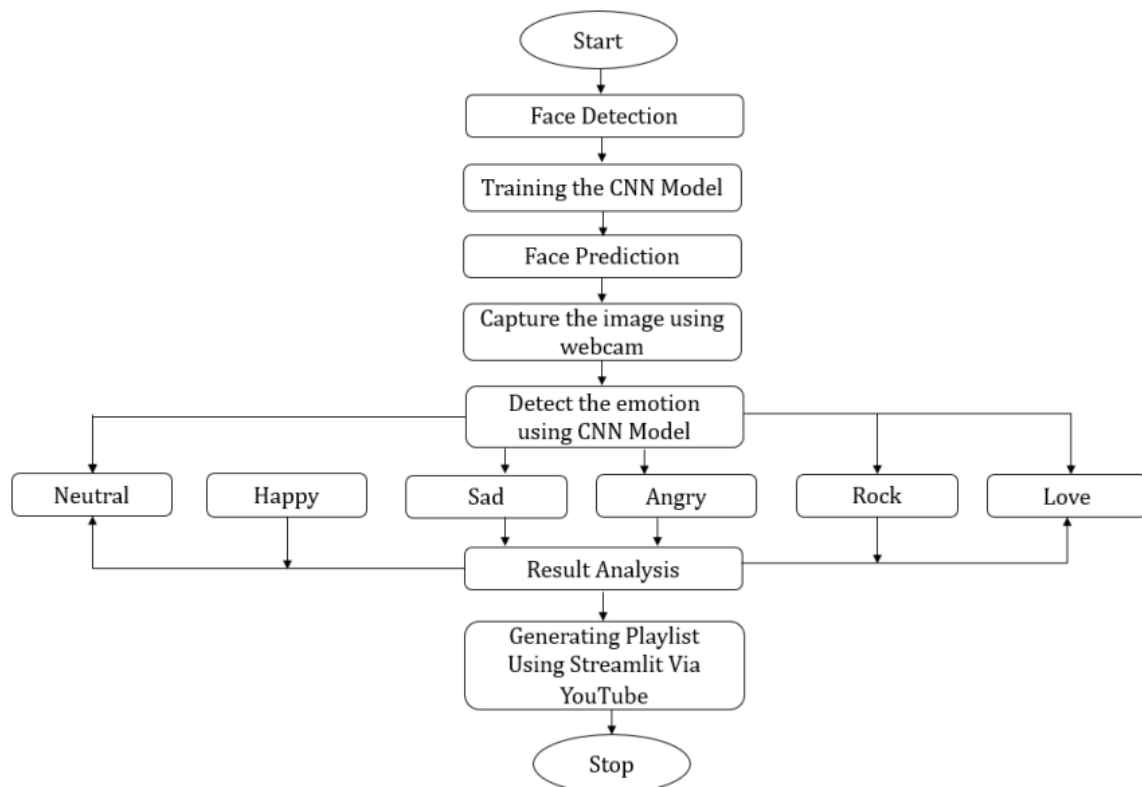
### **User Satisfaction and Retention:**

Providing an emotionally intelligent and personalized music experience contributes to higher user satisfaction. Satisfied users are more likely to continue using the platform, contributing to improved user retention rates.

## 4.2 Applications

The application of facial emotion detection in the context of personalized song recommendations represents an innovative intersection of computer vision, emotion analysis, and music recommendation systems. This technology introduces a dynamic dimension to the user experience by capturing real-time facial expressions and translating them into emotional cues. One prominent application lies in enhancing the personalization of music recommendations based on users' emotional states. As users engage with the platform, the facial emotion detection system continuously analyzes their expressions, creating a nuanced emotional profile. This profile serves as a dynamic input for the music recommendation algorithm, enabling the platform to adapt song suggestions in real time. For instance, joyful expressions might prompt the system to recommend upbeat and energetic tunes, while a more contemplative mood could lead to suggestions of calming melodies. Beyond the personalized music experience, this application holds potential in positively impacting user well-being and mental health, leveraging the therapeutic effects of music aligned with users' emotional needs. The integration of facial emotion detection in personalized song recommendations thus represents a forward-thinking approach to creating immersive and emotionally resonant music streaming platforms.

## 4.3 Flowchart



**Fig4.1 : Flow Chart**

## **CHAPTER 5**

# **Implementation & Results**



**Fig 5.1 Main Page of our Project**



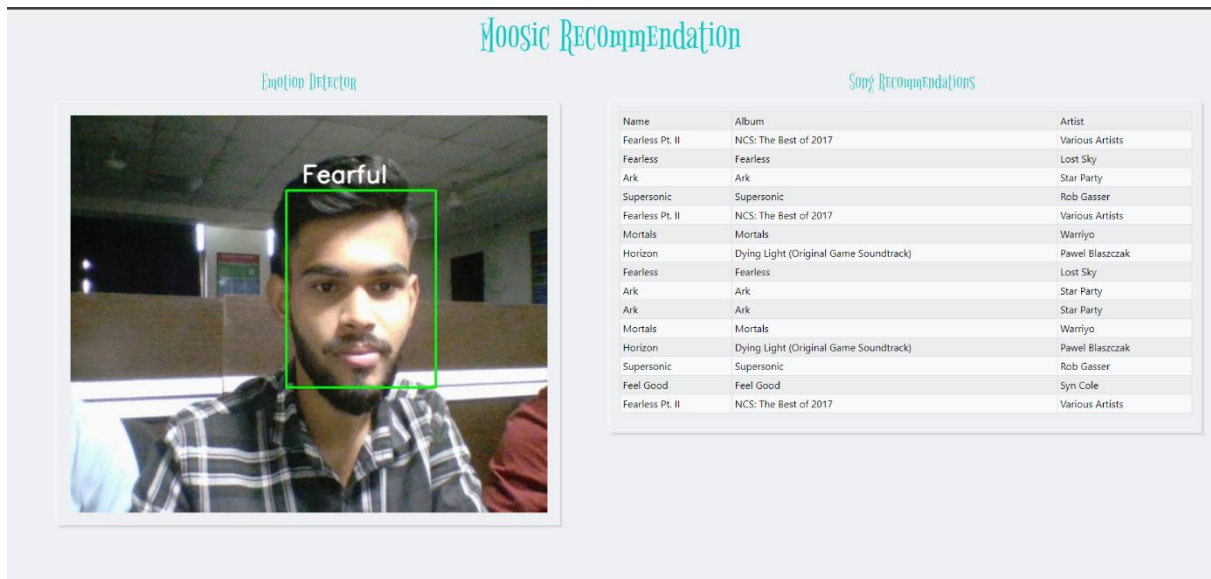
**Fig 5.2 Happy Emotion**



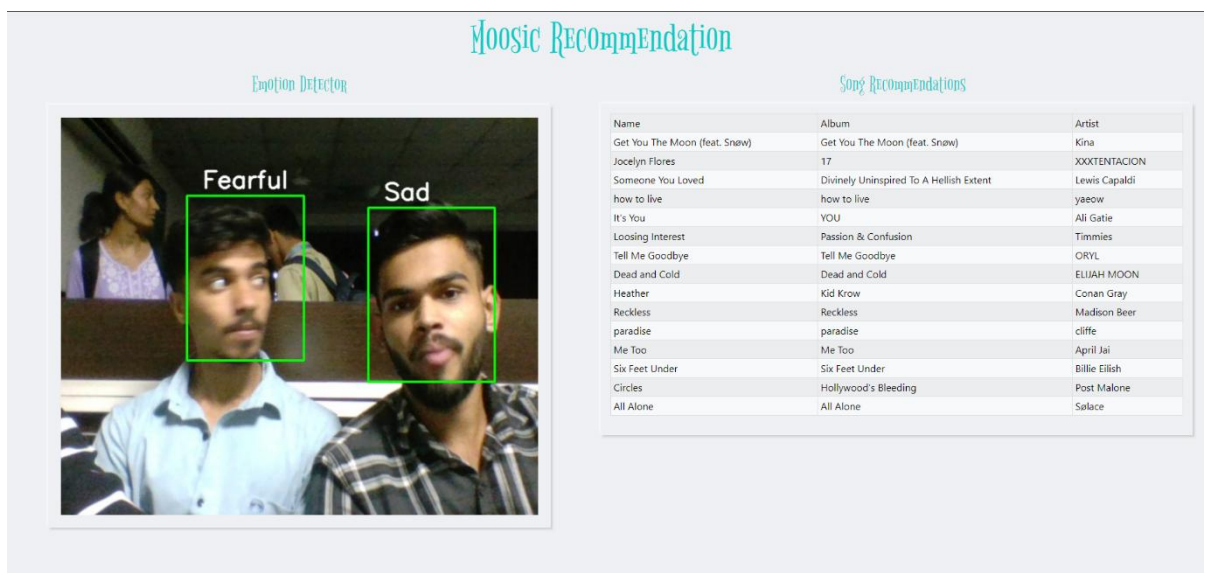
**Fig 5.3 Sad Emotion**



**Fig 5.4 Fearful Emotion**



**Fig 5.5 Fearful Emotion**



**Fig 5.6 Sad & Fearful Emotion**





**Fig 5.7**Surprised Emotion

**CHAPTER 6**

**Conclusion**

## Chapter 6

In conclusion, the project on facial emotion detection for personalized song recommendations has reached its completion milestone. we have successfully crafted a system capable of analyzing users' facial expressions in real-time to discern their emotional states. Leveraging this insight, personalized song recommendations are intelligently generated, offering users a tailored and immersive music listening experience. The culmination of this project marks a significant achievement in bridging the gap between emotion and music, enriching user engagement and satisfaction.

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