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Moodsync Based Music System using Emotion Detection

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ABSTRACT

Facial expression is one of the most effective ways for human being to express their emotions and intentions. The development of machine learning has created new opportunities to address real-world issues. Machine learning is the key technology for detecting facial expressions, requiring a variety of algorithms and real-time applications. In this paper, the Moodsync based adaptive music system is designed to provide a complete solution for people who want to reduce stress and encourage relaxation. It includes a song recommendation system and mood lighting feature. This novel method utilizes a curated Indian-origin playlist by using YouTube API. The proposed method utilizes facial recognition to determine the user's emotional state and make appropriate music recommendations. Using DeepFace and OpenCV, the user's facial expressions are recorded and analyzed to choose a song based on the current mood. The song beats are synchronized with the room's lighting to enhance the listening experience. The system obtained 93% accuracy, which is higher than previous methods.

KEYWORDS

Machine learning, Emotion recognition, Music system, Youtube API, DeepFace with OpenCV.

1. INTRODUCTION

While individuals are increasingly knowledgeable about maintaining their physical well-being, they frequently overlook their mental health. The current generation is grappling with stress, anxiety, and sleep deprivation. Finding ways to detox or recharge is essential. Many techniques are available for reducing stress such as exercising, watching movies, meditating, and listening to music. Numerous studies have shown that music can help people focus and alleviate stress. However, the type of music that is most effective may depend on the listener's current emotional state. Therefore, it is crucial to choose the right song to reduce stress.

While there are many music player applications available, none of them can select songs based on the user's mood and the environment's lighting. This paper proposes a music player system that uses facial recognition to identify the mood of the user and then plays songs on the YouTube Application Programming Interface (API) accordingly also the system uses sensor-based technologies to provide a real time lighting experience. With a simple glance at their device's camera, listeners can receive instantaneous song suggestions tailored to their emotional state. This effortless interaction removes barriers making the process of finding music easy and enjoyable. YouTube API is an online platform that hosts videos, music, podcasts, and original content.

The platform categorizes songs based on various criteria, such as genre and popularity. The API allows us to fetch various types of data, including videos, songs, albums, artists, audio features, and more. This API includes songs from diverse sets it apart from other API's. The adaptive music system based on Moodsync is proposed in this paper as a way to alleviate tension and encourage relaxation. Its IoT-based approach, which incorporates a mood lighting feature and music recommendation system, is based on machine learning technology. Using the Youtube API, the suggested solution makes use of the curated playlist of Indian origin. The DeepFace with OpenCV algorithm is used to identify mood from facial expressions. A lighting arrangement is created that provides a real-time experience by matching the song's beats to a predetermined mood.

The rest of the paper is organized as follows. Section 2 offers a quick summary of all the reference papers. Section 3 elaborates on the functioning of the proposed system model. Section 4 describes the design and implementation of the system. All of the analysis and findings from the creation and configuration of the integrated system are compiled in Section

5. The results analysis and future scope are described in Sections 6 and 7.

2. OBJECTIVES

Moodsync based adaptive music system is a technology-driven system designed to provide a user-friendly and integrated setup for stress relief and relaxation. It is built around ML technology and an IoT-based model which includes a song recommendation system and mood lighting feature. The primary objective of Moodsync based adaptive music system is to serve as a comprehensive solution for individuals seeking to overcome stress and promote relaxation.

The major objectives of the system are:

1. Use curated Indian origin playlist by using Youtube API.
2. Implement DeepFace with OpenCV to identify mood from facial expressions.
3. Construct a lighting set up that gives real time experience by synchronizing the beats of the song with identified mood.

3. LITERATURE SURVEY

The system presented is employing the CNN to capture the user's face [1]. The system extracts facial features to identify the user's mood, enabling the playback of songs matching the detected mood through the YouTube API, including corresponding videos. However, it's worth noting that the system lacks a mood lighting feature, and the processing speed is relatively slow. Suggested model employs transfer learning to analyze user emotions and recommend songs accordingly [2]. This model enhances accuracy through data augmentation and image processing techniques. Additionally, the Spotify dataset is employed for song recommendations across seven emotions. In the paper, the authors Abutalib K, et al. [3] that automatically generates playlists using facial expression extraction, achieving an accuracy of 85-90% for real-time images and 98-100% for static images. However, the system may face challenges in accurately capturing subtle or complex emotional expressions.

The system presents a web-application with a facial recognition system that detects user emotions in real-time and recommends songs based on their mood [4]. It utilizes computer vision, machine learning, and a dataset of labelled facial images for training. However, the system's potential limitations in handling diverse emotional expressions need further exploration. The Haar Cascade Algorithm proposed to detect facial features and according to it, the user's mood determined [5]. The last step was to recommend songs to the user on the basis of the user's mood. Emotion Based Music Recommendation System is suggested using facial recognition to determine user mood and generate personalized playlists [6]. It aims to reduce manual playlist creation effort. However, a potential disadvantage is the ethical and privacy concerns associated with using facial recognition technology for mood detection.

The paper by Madhuri Athavle, et al. [7] introduces a system that enhances user-music player interaction by utilizing a camera to capture facial expressions. The captured images are processed through a CNN, predicting emotions and generating playlists tailored to specific moods such as happiness, sadness, neutrality, or surprise. Specifically, negative emotions trigger playlists aimed at improving the user's mood. Authors Ankita Mahadik, et al. [8] proposed a Mood-based Music Recommendation System that utilizes facial expression analysis to detect user moods and recommend suitable music. Achieving approximately 75% accuracy in detecting seven moods, the system integrates with Firebase for song data storage. However, its overfit model may lead to fluctuations in accurate mood detection. The paper presents a Facial Emotion Based Music Recommendation System that uses computer vision and machine learning techniques to recommend dynamic music based on human emotions [9]. However, the system only relies on facial expressions and does not consider other factors that may affect human emotions. Authors have devised a model employing image processing and segmentation techniques to capture and extract user facial expressions. The system has limitations in capturing all facial features, attributed to the limited availability of images and a requirement for well-lit environments [10].

The Authors Shivam Singh, et al. [11] proposed an automated face recognition system that uses various algorithms for face detection, feature extraction, and recognition. The technology has numerous applications in security systems, credit and debit card verification, and surveillance. However, poor lighting conditions can affect the system's performance. The system employs an IoT-based Smart band to record heart rate and capture facial images using Microsoft Azure's face detection API. Mood detection is facilitated through a mobile application. However, the heart rate recording is noted for its reduced accuracy due to a broad range [12]. The Authors have conducted a study on facial expressions to recognize user's mood which involves different algorithms such as KNN and the fisher face algorithm to train the model [13]. The system proposed in [14] is utilizing CNN for facial expression classification. The main drawback is that managing a large database could be a time-consuming procedure that slows down the retrieval of information. Authors Yang, J. Cao, et al. [15] employed the Back Propagation method for facial expression recognition, consisting of input, hidden, and output layers. The input layer multiplied with the hidden layer produces the output. However, the study acknowledges a drawback with increased noise and errors in the results.

The Authors explore how music is intricately linked to human emotions, serving as a tool for emotional regulation and expression across cultures and age groups. It discusses the perception and experience of emotions in response to music, highlighting the role of acoustic cues and cultural influences.

The study also delves into the complexity of mixed emotional responses to music and the ongoing debate on emotion induction mechanisms [16]. The authors used EchoNest to create an autonomously created playlist that analyzes user preferences and suggests songs for the Spotify app [17]. An hybrid approch is used by authors Cheng R. et al. [18] to measure the dynamic similarity of music. The method integrates audio features with user personalities using support vector machine. It is better than current models and techniques, but because it is content-based, it has limited ability to comprehend the interests and preferences of users. The author classified the most well-known DJs by retrieving their optimum sound using audio monitoring equipment from the recording studio [19]. These recording studio characteristics allow users to assign a song to a DJ through basic dimensionality reduction and machine learning. This approach is useful for music personalized recommendation. The authors Wafa Mellouk et al. [20] studied different architectures of CNN. It is required to generate powerful deep learning algorithm with large database to detect all primary and secondary emotions. As a result, facial expressions serve as emotional photographs.

Facial expressions, which account for 55% of total human communication, can't be neglected [21]. Especially in the application of Human-Computer interaction, it is critical to train computers to recognize human emotions from facial expressions.

4. PROPOSED SYSTEM MODEL

The proposed system helps us to understand the connection between the user, the music system and the mood lighting. The main purpose of Moodsync based adaptive music system is to capture the facial image of the user using the camera. The image captured is fed to a machine learning model which predicts the current emotion of the user. The recognized emotion is used as an input for the music system.

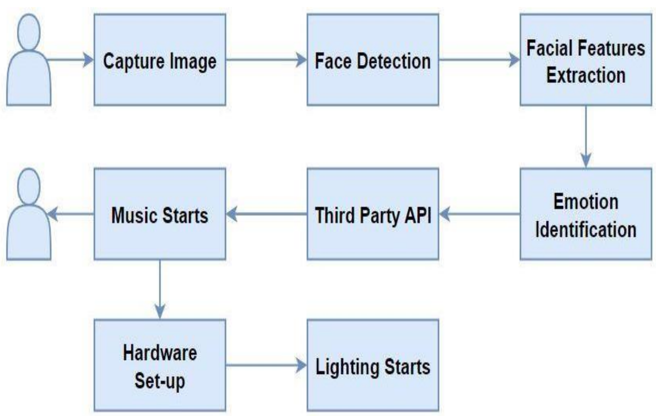

Fig. 1 Proposed System Model.

Figure 1 illustrates the proposed system model of the Moodsync based adaptive music system, providing a comprehensive overview of the hardware and software components involved. This visual representation guides users through the exploration of the system, that a user can follow and understand from both technical and practical perspectives.

The aim is to automatically generate songs tailored to suit the user's various moods including happy, sad, angry, neutral, surprised, disgust, and sleepy. The proposed system identifies emotions and predict songs based on their current emotion. If the subject exhibits negative emotion then a song from a tailored playlist will be presented that comprises of the most fitting music aimed at positively uplifting the individual's mood.

There are 5 components present in Moodsync based adaptive music system:

1. Real time image capture: This component involves accurately capturing the user's facial image.

2. Facial Recognition: This stage utilizes machine learning model to analyze the characteristics of the user's facial image.

3. Emotion Detection: This segment extracts features from the user's facial image to identify emotions and based on the detected emotion the system generates corresponding name of the emotion.

4. Music Recommendation: The recommendation module suggests songs to the user by correlating their emotions with the mood associated with the song.

5. Mood lighting setup: This is the last part of the proposed system where the lighting of the system starts simultaneously as the music starts playing.

5. DESIGN & IMPLEMENTATION

The Moodsync based adaptive music system is composed of both hardware and software features for which the respective components, tools, technologies, etc. used along with the implementation is as follows:

5.1 Emotion Detection Module

1. *Face Detection:*

Face detection is a crucial task in computer vision and image processing. It involves identifying and localizing human faces in digital images or videos. OpenCV, a popular open-source computer vision library, provides several algorithms for face detection. OpenCV provides two types of facial recognition algorithms: appearance-based methods (Eigenfaces, Fisherfaces, LBPH, HOG) that use face appearance to extract features, and deep learning-based methods (FaceNet, Deep Face Recognition, Dlib's HOG-based deep learning model) that use deep neural networks to learn features. The choice of method depends on the dataset size, diversity, computational resources, and desired interpretability. OpenCV is a computer vision library that supports real-time face detection in images and videos using classifiers like Haar Cascades and Local Binary Patterns (LBP). Haar Cascades is a popular classifier trained on varying face data to detect different faces accurately. LBP is a texture-based classifier that compares the intensity of a pixel to its neighbors. These classifiers are trained on a large number of images to improve accuracy. OpenCV supports programming interfaces for C, C++, Python, and Android and is released under a BSD license.

2. *Feature extraction:*

Feature extraction using 3D mesh for an emotion recognition system involves extracting useful features from 3D facial mesh data that can be used to recognize emotions. This is typically done using deep learning models that have been trained on large datasets of 3D facial mesh data. The feature extraction process involves applying the deep learning model to the 3D facial mesh data and extracting the output from a specific layer of the model. This output is a high-dimensional feature vector that represents the 3D facial mesh data. The size of the feature vector depends on the specific model used. 3D mesh data can capture more detailed and nuanced information about the face compared to 2D images. This can include information about the 3D shape of the face, as well as the position and movement of facial features. This can improve the accuracy of emotion recognition by providing more detailed and nuanced information about the face. Deep learning models trained on 3D mesh data have been shown to achieve higher recognition accuracy compared to traditional image-based CNN and other 3D CNNs.

3. *Emotion Detection:*

Emotion detection is a subset of facial expression analysis that aims to recognize and interpret human emotions based on facial features. DeepFace is a deep learning library designed for face recognition tasks. It provides a high-level interface that simplifies the process of working with pre-trained models for face-related applications. In the context of emotion detection, DeepFace includes models that have been trained on large datasets to recognize and categorize facial expressions.

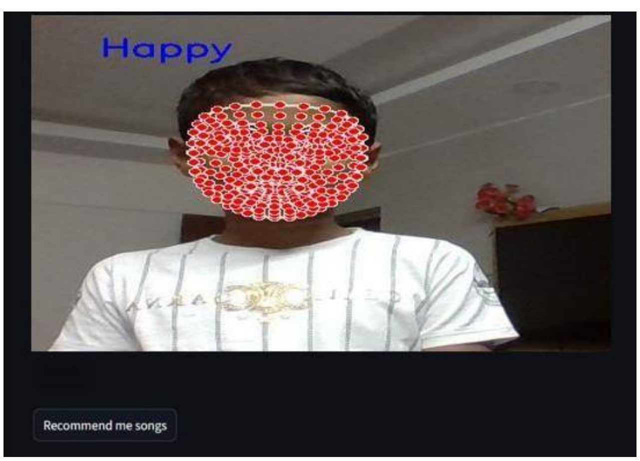

Fig. 2 Happy Emotion Identified.

Figure 2 indicates that Happy emotion is identified by extracting facial features using 3D mesh.

The initial step in emotion detection involves detecting and extracting relevant facial features from images or video frames. Common facial features include eyes, nose, mouth, and overall facial expressions. OpenCV, a computer vision library, is used for face detection to identify the regions of interest within an image. Given an input image or video frame with detected faces, the pre-trained deep learning model is employed to predict the associated emotions for each face. The model outputs probabilities or confidence scores for each emotion category and the emotion with the highest score is typically considered the predicted emotion for that face.

5.2 Music Recommendation System

Interfacing the YouTube API with an emotion detection system using the Streamlit platform involves using the YouTube API to search for and retrieve videos based on certain keywords, and then using an emotion detection system to analyze the emotions expressed in the videos.

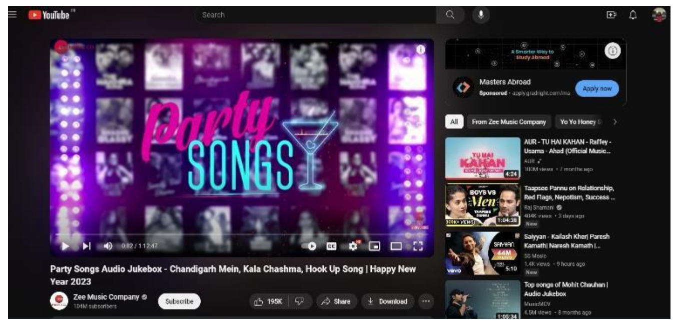

Fig. 3 Playlist Generated for Happy Mood

In figure 3, playlist for happy mood is generated by taking users facial expression as the input, which is then redirected to the YouTube API.
The emotion detection system is built on deep learning models, possibly utilizing pre-trained neural networks for facial expression analysis. These models can identify and categorize emotions in video frames, allowing for real-time or frame-by-frame emotion analysis. Streamlit is a Python library that simplifies the creation of web applications for data science and machine learning. It enables the development of interactive and customizable dashboards with minimal code. In this scenario, Streamlit serves as the interface between the YouTube API and the emotion detection system.

5.3 Hardware Implementation

The components utilized for creating a mood lighting environment include the ESP-32, Electronic spices microphone sound sensor, ARGB LEDs, jumper wires, breadboard, and Power supply. The ESP-32 serves the purpose of regulating an LED based on the sound captured by a sound sensor. When a specific level of sound is detected, the LEDs can be programmed to either illuminate or flicker. The sound sensor is employed to identify the music being played by the user. In the event that the sensor's front microphone detects any noise, a signal is initiated.

To control the lighting and movements of the ARGB LEDs, one can utilize either a WLED software or Application. The lighting feature of this system offers a wide range of patterns, including pulsating, checkered, zigzag, linear, and more. Furthermore, various color schemes can be displayed on the LEDs. Additionally, it possesses an integrated microphone that detects sound and can respond accordingly. ARGB (Addressable RGB) LEDs provide superior control and customization over traditional RGB LEDs. They can be individually addressed and controlled, allowing for more complex and dynamic lighting effects.

Fig. 4 Inside of Hardware System.

Figure 4 indicates the hardware prospects of the Moodsync based adaptive music system where it shows the hardware connections.

Fig. 5 Music System with Mood Lighting.

Figure 5 illustrates the entire working model with glowing LED's which are synchronized with the beats of the music.

ARGB LEDs are compatible with a wider range of devices and systems, and can be controlled using dedicated PC software for advanced lighting effects and synchronization across multiple components. As manufacturers prioritize ARGB compatibility in their products, ARGB technology is likely to supersede RGB components and accessories.

6 RESULT ANALYSIS

Moodsync based adaptive music system is an attempt to improve the user's mental wellbeing by enhancing the environment using music and lighting. Mood Lighting set up of the implemented model provides the user with a variety of lighting options to choose from and has an enhanced impact on the surroundings with the choice of hardware used.

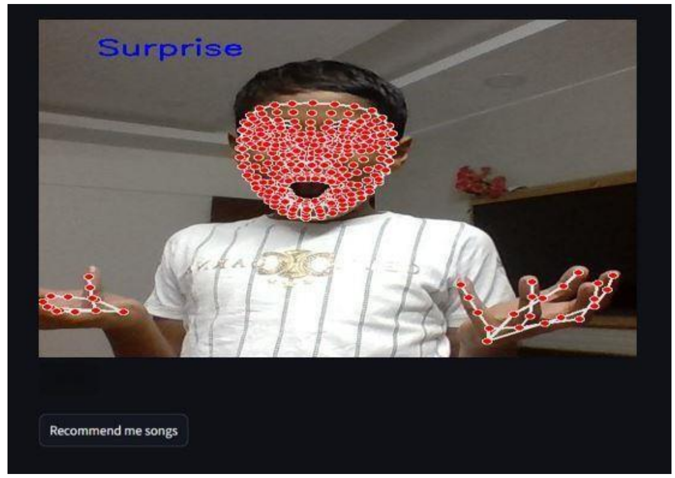

Fig. 6 Surprise Emotion Identified.

Fig.7 Software implementation process

Figure 6,7 depicts the software implementation process where mood of the user is detected in this case surprise, then mood is taken as an input and is sent to the Youtube API where a playlist is generated according to the mood.

The performance comparisons between various literature papers are shown in table 1.

Table. 1 Comparison between various literature papers

Reference	Dataset	Methodology	Accuracy (%)
[13]	DEAM	KNN	60.08
[12]	Average heart rate of each emotion	Microsoft Azure	63.75
[8]	FER2013	CNN	71
[7]	FER2013	OpenCV with CNN	75
Proposed system model	DeepFace	OpenCV with DeepFace	93

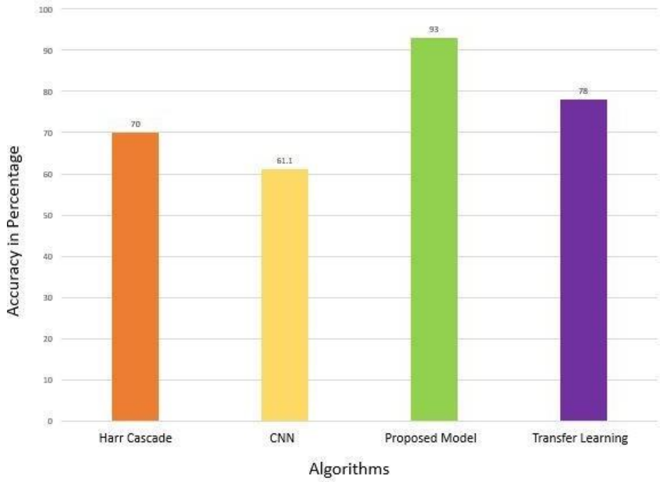

Fig. 8 Accuracy Comparison for Different Algorithm Graph.

Figure 8 shows that on implementing different machine learning algorithms to achieve maximum accuracy, we obtained 70% for Haar Cascade, 61.1% for Convolutional neural network based model, 78% for transfer learning and 93% for OpenCV with Deepface algorithm. Making OpenCV with DeepFace an ideal choice for the Moodsync based adaptive music system.

The intensity of one ARGB LED is very high in comparison with the brightness of a standard LED, and the LEDs blink in period with the beats, pitch, tone, and other musical parameters which gives the best results. The Electronic spices Microphone Sound Sensor being highly adjustable in terms of sensitivity functions perfectly to detect the rhythm of the songs played.

7 CONCLUSION

By adjusting lighting and music, the moodsync-based music system with emotion detection is a comprehensive environment enhancement system designed to elevate the user's mood. The Moodsync model targets a variety of music lovers, which may be achieved by using face recognition to identify a user's mood. A YouTube playlist of songs is then created, and the lighting in the room is synchronized with the beats of the songs.

A connected camera records the user's facial expressions, which a machine learning algorithm then analyzes. The model determines the user's present emotional state by analyzing the expressions. DeepFace and OpenCV are used to record and analyze the user's facial expressions in order to select a song that best suits their current mood. Using the pre-trained model Haar cascade, OpenCV first gathers video frames from the user's camera to identify the user's face. The next step is to obtain facial landmarks, specifically regions like the lips, brows, and eyes. The Haar cascade uses facial landmark analysis to ascertain the user's emotions. The lighting in the room is matched with the beats of the music to improve the listening experience. The system's accuracy of 93% is higher than that of earlier techniques.

The system of recommendations divides emotions into "happy," "sad," "angry," "surprised," "neutral," "disgust," and "sleepy." Additionally, by considering LED properties, the sound sensor music beats, and the lighting system, users of mood sync-based music systems enjoy a soothing experience.

8 FUTURE SCOPE

In order to improve the performance of the proposed system and also make it more enhanced, accurate, and user-friendly setup a few futuristic modifications is visualized such as:

1. HD camera can be installed in the system for better facial features extraction so that the lighting of the room does not hamper the mood recognition of the user.
2. Pulse rate of users can be also considered as an input for better accuracy at identifying the user current emotion along with facial expression.
3. Hand gestures of users can be considered for identifying their mood.

REFERENCES

1. Sunitha, S., Jyothi, V., Ramya, P. & Priyanka, S. (2023) Music recommendation based on facial expression using Deep Learning. *International Research Journal of Modernization in Engineering Technology and Science*. 2582- 5208. http://doi.org/DOI 10.56726/IRJMETS33034.
2. Krishna Kumar Singh, Dembla & Payal. (2023). A Study on Emotion Analysis and Music Recommendation Using Transfer Learning. *Journal of Computer Science.* 19. 707-726. 10.3844/jcssp.2023.707.726. https://api.semanticscholar.org/CorpusID:258975642
3. Abutalib, K., Amandeep, G., Aryan Khan, Manish Tiwari & Aditya Dayal Tyagi(2023). Facial Expression Based Music Recommendation System. *International Journal of Advanced Research in Science, Communication and Technology*. http://doi.org/10.48175/IJARSCT-9046316.
4. Syed Waheedulla, Prof.Harashleen Kour, Mulinti Meghanath Reddy, Sriramoju Nikhil Sai & Piyush Majumdar(2023). Facial recognition to detect mood and recommend songs. *International Research Journal of Engineering and Technology(IRJET)*.e-ISSN:2395-0056. https://www.irjet.net/archives/V10/i5/IRJET-V10I5163.
5. Manjushree, K., Shree Lakshmi Shetty, C., Spoorthi, M., Deeksha, R., Sahana, C. & Shekar (2022). Emotion Based Music Player. *International Research Journal of Engineering and Technology (IRJET).* https://www.irjet.net/archives/V9/i8/IRJET-V9I8117.
6. Sree Vani, M., Sree Divya, N., (2022, June) Emotion Based Music Recommendation System. *International Journal of Creative Research Thoughts (IJCRT).* Volume 10, ISSN: 2320-2882. https://ijcrt.org/papers/IJCRT22A6953.
7. Athavle, M., Mudale, D., Shrivastav, U., & M. Gupta, (2021,June) Music Recommendation Based on Face Emotion Recognition, *J. Infor. Electr. Electron. Eng.*, vol. 2, no. 2, pp. 1–11. https://doi.org/10.54060/JIEEE/002.02.018
8. Ankita Mahadik, Shambhavi Milgir, Prof. Vijaya Bharathi Jagan, Vaishali Kavathekar & Janvi Patel.(2021,June) Mood based Music Recommendation System. *International Journal of Engineering Research \& Technology (IJERT).* Volume 10 Issue 06.ISSN: 2278-0181. DOI : 10.17577/IJERTV10IS060253.
9. ShanthaShalini, K., Jaichandran, R., Leelavathy, S., Raviraghul, R., Ranjitha, J., Saravanakumar, N., (2021). Facial Emotion Based Music Recommendation System using computer vision and machine learning techiniques. *Turkish Journal of Computer and Mathematics Education.* Vol.12 No.1 (2021), 912-917
10. Matilda Florence, Mohan, S., & Uma (2020). Emotional Detection and Music Recommendation System based on User Facial Expression. *IOP Conference Series: Materials Science and Engineering*. **912** 062007. **DOI** 10.1088/1757- 9X/912/6/062007.
11. Shivam Singh, & Prof, Graceline Jasmine, S., (2019,May). Face Recognition System. *International Journal of Engineering Research & Technology (IJERT).* ISSN: 2278-0181.Vol. 8 Issue 05, May- 2019. DOI : 10.17577/IJERTV8IS050150.
12. Chankuptarat, K., Sriwatanaworachai, R. & Chotipant, S.(2019). Emotion Based Music Player. *2019 5th International Conference on Engineering, Applied Sciences and Technology (ICEAST)*,2019,pp.1-4.

http://doi.org/10.1109/ICEAST.2019.8802550.

13. Arora, A., Kaul & Mittal, V. (2019). Mood Based Music Player. *International Conference on Signal Processing and Communication*, pp. 333- 337. http://doi.org/10.1109/ICSC45622.2019.8938384.

14. Prof. Subhash Rathod, Akshay Talekar, Swapnil Patil, Prajakta Gaikwad, & Ruchita Gunjal. (2019) Face Emotion Based Music Detection System. *International Journal of Advance Scientific Research and Engineering Trends*, vol 4. ISSN (Online) 2456-0774.

15. BiaoYang, Jinmeng Cao, Rongrong Ni &Yuyu Zhang. (2017) Facial Expression Recognition Using Weighted Mixture Deep Neural Network Based on Double-Channel Facial Images. *IEEE Access*, vol. 6, pp. 4630–4640, 2017. https://doi.org/.10.1109/ACCESS.2017.2784096

16. Swaminathan, Swathi, & Glenn Schellenberg, E. (2015). Current emotion research in music psychology. *Emotion review 7.2* (2015): 189-197. https://api.semanticscholar.org/CorpusID:13457365

17. Germain, A. & Chakareski, J.(2013). Spotify Me: Facebook-assisted automatic playlist generation. *IEEE 15th International Workshop on Multimedia Signal Processing (MMSP)*, 2013, pp. 025-028. http://doi.org/ 10.1109/MMSP.2013.6659258.

18. Cheng, R. & Tang, B. (2016). A Music Recommendation System Based on Acoustic Features and User Personalities. In: Cao, H., Li, J., Wang, R. (eds) Trends and Applications in Knowledge Discovery and Data Mining. PAKDD 2016. *Lecture Notes in Computer Science*, vol 9794. Springer, Cham. https://doi.org/10.1007/978-3-319-42996-0_17

19. Tim Ziemer, Pattararat Kiattipadungkul & Tanyarin Karuchit (2020). Music recommendation based on acoustic features from the recording studio. *Journal Acoust. Soc. Am.* 148, 2701 (2020), https://doi.org/10.1121/1.5147484

20. Wafa Mellouk & Wahida Handouzi. (2020). Facial emotion recognition using deep learning: review and insights. *Procedia Computer Science* 175 (2020): 689-694. https://doi.org/10.1016/j.procs.2020.07.101

21. Singh, V., Singh, R.K. &Tiwary, U.S. (2023). Emotion Classification Through Facial Expressions Using SVM and Convolutional Neural Classifier. *Intelligent Human Computer Interaction. IHCI 2022. Lecture Notes in Computer Science*, vol 13741. Springer, Cham. https://doi.org/10.1007/978-3-031-27199-1_13.

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