A Survey on Emotion or Weather Based Music Recommendation System

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ABSTRACT:Emotion or weather based music based music recommendation system is a personalized music recommendation system that provides music recommendation based on our emotional or weather conditions for a better listening experience.The user can choose emotion detection or weather detection based on their preference. By analyzing facial expressions,it can accurately detect the user's current emotional state and suggest songs that resonate with their mood. Incorporate real-time weather updates to recommend playlists that fit the mood of the day. For instance, on a sunny day, the system might suggest upbeat and energetic tracks, while on a rainy day, it might opt for more mellow and reflective tunes.The inside-outside perspective of music choice, which takes into account the mood of the user and outside weather conditions, is meant to provide music choices that resonate well with the experience of the listener in general. To make music have an emotional effect, the system means creating a relation between the music selected for a particular day with the mood of the user and the weather during that day to make a part of their daily life more engaging and fun. It regularly updates live data playlists so that the musical items stay relevant and apt at all times of the day. As such, if it suddenly changes from being sunny to stormy, the system would be able to shift organically into another set of tracks better fitting the changed atmosphere. Such a functional ability enables smooth coordination with the user's inner self and thus with the outer world also.The system gives a mix of mood and weather recommendations, thus augmenting the listener's sense of intimacy with their environment and with their own emotions, and leads to a richer and more dynamic music experience. It is through this innovative method that music becomes that very much stronger tool for emotion expression and environmental interaction, which surprisingly improves the listener's daily routine and overall well-being. It promises, therefore, to change the way we relate to music as it will become an integral and responsive part of our lives.

INDEX TERMS: Music Recommendation System, Emotion-Based Music, Weather Detection, Mood-Based Playlist, Adaptive Recommendations, User-Centered Music, Real-Time Emotion Analysis

I.INTRODUCTION

Music influences emotions and even our actions so much. A great playlist can improve a person's mood, maintain concentration at the hours when it is especially necessary, or really calm him down after a stressful day. Most of the existing music recommendation systems rely on more or less.
simple methods: either collaborative filtering or content-based filtering. These approaches tend to overlook minute specifics, such as a user's current mood or outside influences, like the weather, that impact their music choice for a particular time.

A completely new system is hereby introduced, which integrates the capability for the analysis of weather with emotion detection to build more personalized listening experiences.Emotions are detected from reading facial expressions and then being able to decode emotions.Using the facial recognition

technology, that is considered to be of the most advanced type, the system decodes various emotional clues. For instance, it might ascertain if a user happens to be happy, sad, relaxed or even slightly angry. This emotional data is, afterwards, analyzed in order to make recommendations of music in alignment with the mood of the user. For example, if it feels the user may be depressed, it would suggest those songs that might help make the user somewhat happy or cheerful. If it identifies the mood of the user as relaxed, the system might suggest calm and relaxing tracks for the user so that he or she maintains this state of relaxation. In addition to emotional evaluation, the system makes use of real-time weather analysis to fine-tune its suggestions.

The system will be able to tailor playlists based on the weather and atmosphere details it has gathered. For example, on a rainy day, it may suggest songs that are quiet and reflective, casting a befitting mood with the normally introspective day most people experience when it rains. Conversely, on a sunny day, it could suggest bright, energetic tracks that match the lively and cheerful nature of the day. This is a two-pronged approach: emotion detection and weather analysis; it's a ubiquitous understanding of the context of a user, in terms of both the inner and outer directions. It's more sophisticated than traditional recommendation systems, in terms of how fluid and multi-faceted human experience is.

Human beings are not static in music preferences; they are dynamic because of multifaceted reasons, for example, mood and environment. By recognising and incorporating such parameters, our system generates a more riveting and enjoyable listening experience. Moreover, the adaptability of such a system to real-time changes in the environment ensures that its recommendations will be relevant throughout the day. For example, if it changes from sunny to stormy, the system could immediately make adjustments in the playlist to suit the new conditions. Even if something strange swings the mood of a user, this system can then update its suggestions for such a user.

Through continuous adaptation, it ensures that there is a harmonious connection between the inner feelings of a user and the outer world. Another is the vast scope for application that this system can be applied to outside of its personal uses; it may find application in streaming apps, smart home devices, and in pubs, coffee shops, and retail outlets more generally. In this way it can amplify the general ambience by providing music congruent with the collective mood of a space or group of people. This system uses both emotional and environmental cues to give a truly customized music experience. The sections that follow explain more about how it works, covering everything from detecting emotions to analyzing the weather and picking the right music.

Mixing emotion detection and weather into music recommendation systems opens up some really exciting ways to make music feel more personal. If the system can tell how you're feeling, it can suggest songs that can cheer you up, help you chill out, or give you that extra boost of energy—basically making you feel better overall. Plus, by matching music to the weather, the system can make the listening experience even more immersive and enjoyable.

This explores how practical and effective such a system could be. We'll look into the technical details of how emotion is detected, how weather data is gathered, and how music recommendations are made. In addition, we'll evaluate the system's performance through user surveys and data analysis to see how well it matches users' music preferences.

II. LITERATURE SURVEY

Ankita Mahadik, Shambhavi Milgir, Janvi Patel, Vijaya Bharathi Jagan, Vaishali Kavathekar [1] discusses how a user's emotion or mood can be detected by his/her facial expressions. These expressions can be derived from the live feed via the system's camera.THe system introduces a cool music player that picks songs based on how you're feeling. It uses a camera to read your facial expressions and figure out your mood—like if you're happy, sad, angry, or neutral. This way, the music is more personal because it matches the songs to your emotions in real-time.

The system relies on machine learning, specifically the MobileNet framework with Keras, to accurately recognize facial expressions. MobileNet's lightweight design makes it suitable for mobile devices, ensuring smooth performance without draining too much battery. MobileNet is ideal here because it's designed for lower-power devices, so it doesn't drain battery or slow down the user's experience. Once

it detects the mood, the app suggests playlists that match or balance how the person is feeling, creating music recommendations that really resonate.

This combination of AI-driven mood recognition with music streaming is a big leap in personalizing content. The developers even point out how this kind of system could help with mood regulation, since music has a big impact on mental health. By reading a user's emotions through facial expressions and adjusting the playlist to fit, the system aims to boost user satisfaction and keep people engaged. All in all, this project blends facial emotion detection with music recommendations to create a unique streaming experience that adapts to each user's mood.

Figure 1 explains how the system works. The system works with two main parts: mood detection and music recommendations. First, the mood detection part takes a real-time picture of the user and looks at their facial features using MobileNet, a lightweight neural network designed for mobile devices. The model was trained on big datasets like FER 2013 and MMA Facial Expression Recognition, which have over 40,000 images. This helps the system figure out emotions like happiness, sadness, anger, fear, and surprise with about 75% accuracy.

The second part, the music recommendation system, uses mood-labeled song datasets to suggest playlists that match the user's mood. Firebase helps store and retrieve songs, making it work smoothly with the Android app. Plus, if facial recognition isn't possible, the app lets users choose their mood using emojis.

To make sure the music recommendations are on point, the system combines two methods: content-based filtering and collaborative filtering. Content-based filtering looks at the user's past music preferences, while collaborative filtering looks for patterns from other users who have similar tastes. This way, the recommendations feel personal and match both the user's mood and their music style.

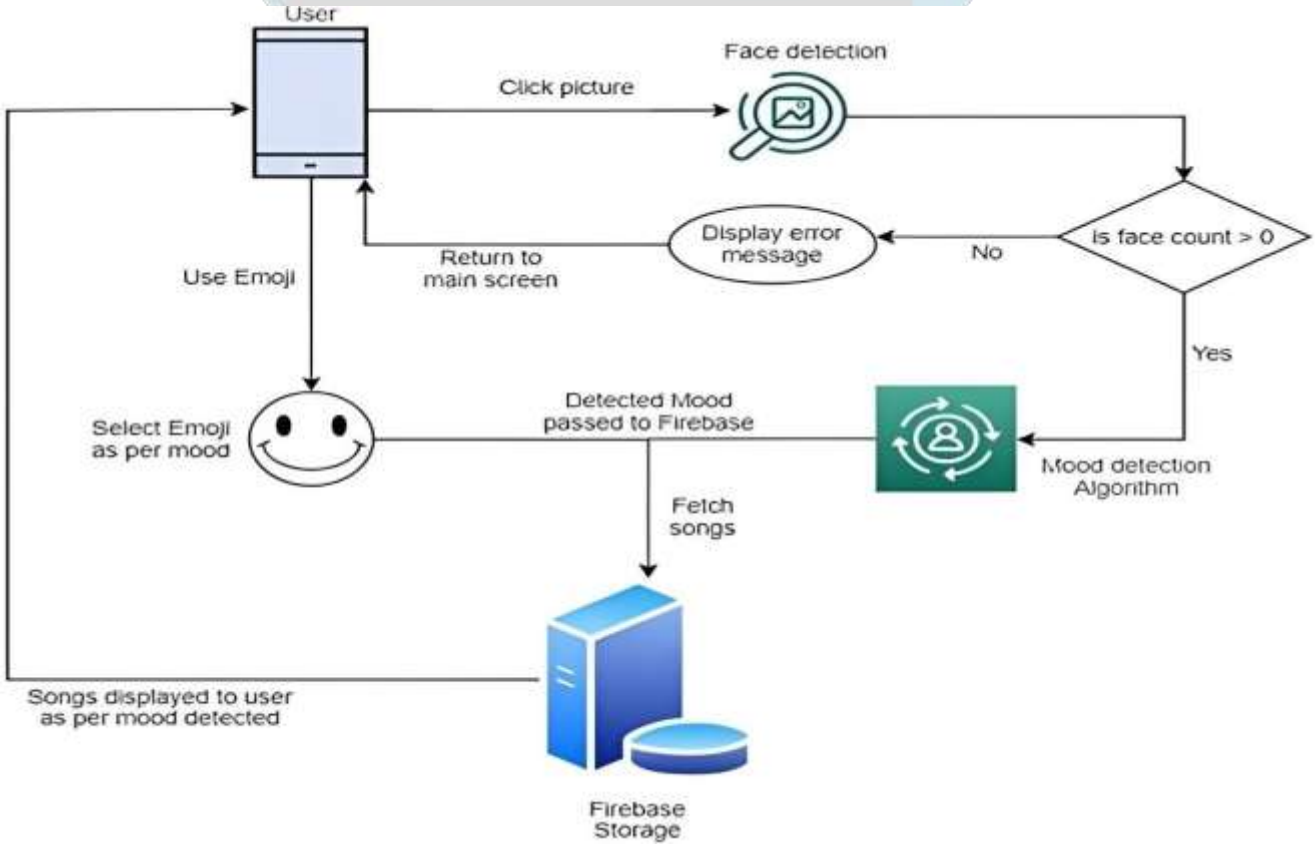

Figure 1: System Architecture Diagram [1]

Matthias Braunhofer,Marius Kaminskas,Francesco Ricci [2] discusses the idea of using contextual information, specifically the user's location, to improve the personalization of music recommendations.Music recommender systems have become crucial tools, available, especially with the huge amount of digital music making it harder for users to discover new tracks. Typically, these systems suggest similar songs or artists based on the user's preferences. But traditional systems often miss important context like the

user's mood or location, which can play a big role in how much they enjoy the music. Context-aware music recommendation is a way to fill in this gap by adjusting suggestions to match the user's current situation. For example, music could change depending on where the user is or what they're doing.

This research focuses on creating a system that matches music to specific places of interest (POIs) based on emotional tags. The system uses emotional indexes like "joyful" or "nostalgic" to link music tracks with specific places of interest . By matching the emotional vibe of a location with the mood of a song, the system can suggest music that fits the atmosphere of different spots. In an initial online test, users felt that this method was a great way to pair music with places. Building on that, a mobile app was created to give real-time, location-based music recommendations to tourists as they explore a city.

The PlayingGuide app uses GPS to track your location and plays music that matches the mood of where you are. It was tested in Bolzano, Italy, with real people to see how well it worked. During the tour, the app played music that fit the vibe of each place they visited. After each stop, users rated the music and said if they felt it suited the location's atmosphere.

The results showed that users really liked the music when it was connected to the location, proving that having the music match the mood of the place made the experience way better. People also gave higher ratings to the music when it was tied to the spot, compared to when there was no connection. The app got good feedback for being easy to use and for making the tour more fun. This study shows that location-based music could seriously improve how people enjoy real-world experiences. In the future, they could make it even better with automatic tagging and updates to help it work on a bigger scale.

S. Metilda Florence and M. Uma [3] introduces a super cool system that picks music based on how you're feeling, which is a game-changer for anyone who loves music. We all know how tough it can be to find the right song, especially when there are so many options.This system makes it so much easier by capturing your face to figure out your mood, and then automatically suggesting songs that perfectly match you current emotion from facial expression.

Here's how it works: The system uses a webcam to capture a picture of your face, then it processes the image to figure out your emotions based on your facial features. Once it knows how you're feeling, it suggests songs that fit that vibe.The goal is to help you feel better—whether that's cheering you up or just setting the right mood.The system uses databases like Cohn-Kanade (CK+) and HELEN to teach it how to read facial expressions and figure out how you're feeling.The working of this system is illustrated in Figure 2.

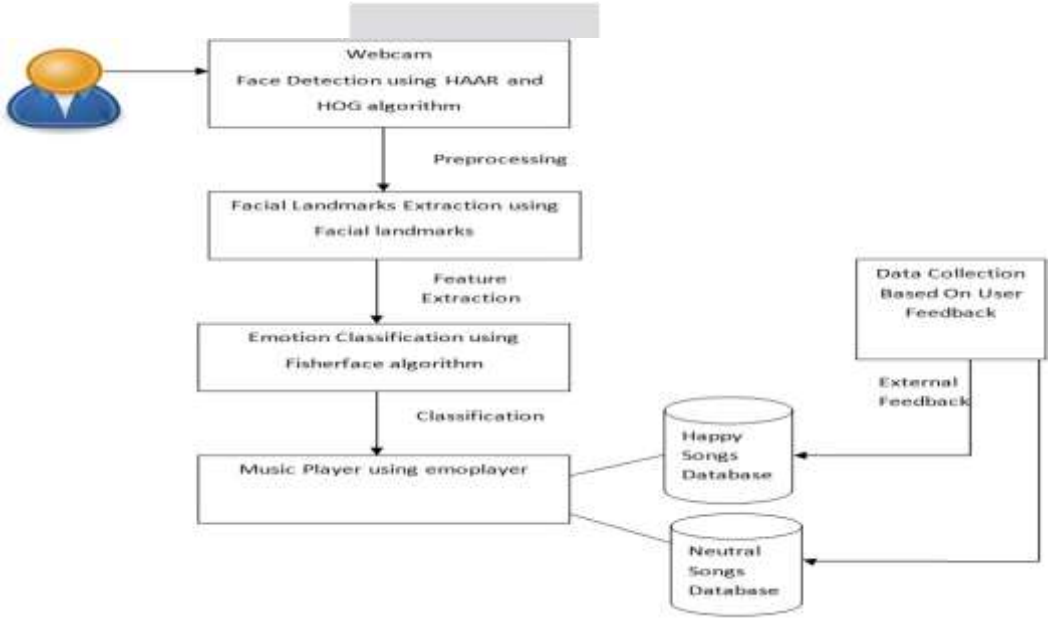

Figure 2: System Architecture Diagram [3]

The system has three main parts: Emotion Extraction, Audio Extraction, and Emotion-Audio Integration. First, Emotion Extraction turns your face image into grayscale and uses feature extraction to spot your emotions. Then, Audio Extraction finds the right songs, and Emotion-Audio Integration puts everything together, showing the right playlist , using PHP, MySQL, and JavaScript. It's pretty

accurate, with over 80% accuracy in most tests, but it works best when there's good lighting. Plus, it gets smarter over time by remembering the songs you've liked before.

In the experiments, the system did a good job matching songs to emotions, but there are still some challenges. For example, it needs clear, well-lit images to work its best. The researchers suggest they could improve it by using EEG signals (brainwaves) for better emotion detection and making the system train faster.

Sonika Malik [4] presents a system that suggests music based on your facial expressions. A lot of people use music to match their mood or to change it, but finding the right song can be tough. This system makes it way easier by using your face to figure out your current emotions and then recommend songs that matches that mood.

The system uses Convolutional Neural Networks (CNN) to analyze your facial expressions and recognize emotions and categorize it into seven different emotion: happy, angry, sad, disgusted, fear, surprise, and neutral. It uses a five-layer CNN model to process images and pick up on features in your face. Each emotion then links to a playlist, helping you save time and stress by matching music to how you feel.

For teaching the model, the study used a dataset of grayscale images which will show variety of emotions. Since the original dataset wasn't accurate , they used data augmentation to improve it and make the model more accurate. The CNN model has layers for convolution, ReLU activation, pooling, and fully connected layers, finishing with a softmax layer to predict the most likely emotion.

Figure 3: Dataset Images [4]

This model approximately has 78.63% efficiency with a batch size of 8 . This system works specifically in four steps: face detection, emotion detection, emotion recognition, and song playing. Face detection is done using the Dlib library and OpenCV, which normally uses tools for facial recognition. Emotion detection uses CNN to analyze your face in real time, making it possible to recommend songs based on what your face is showing right then.

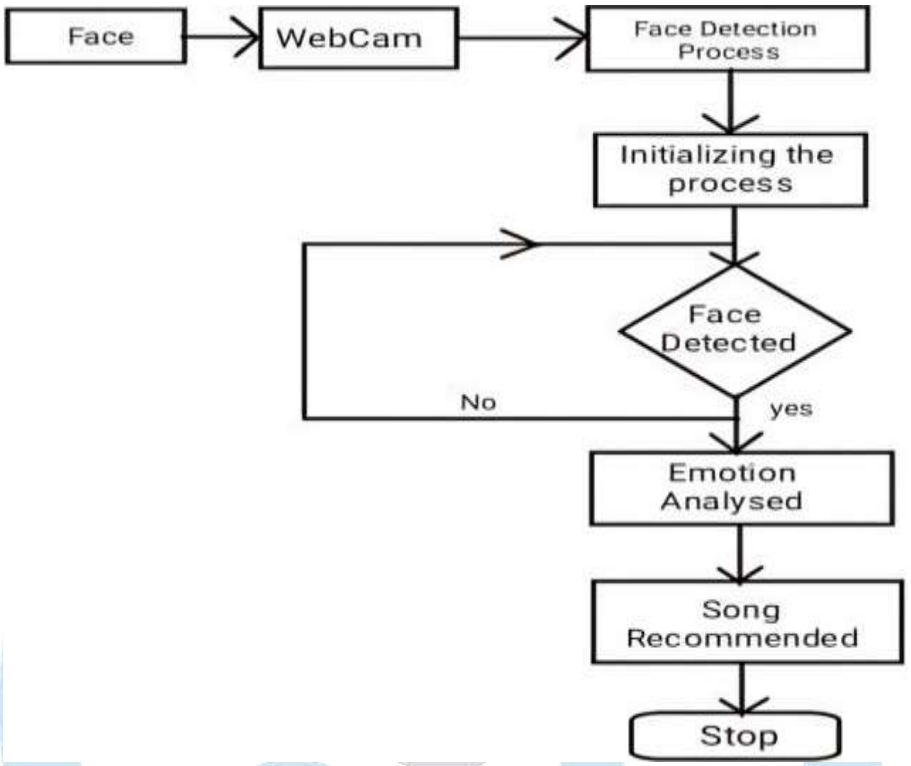

Figure 4: Flowchart of the Working Model [4]

Experiments showed that the system could figure out emotions pretty well, but there's still room for improvement. The authors suggest that changing the model and adding more information about the technology could improve the efficiency . They specify that this technology could be used in various fields like improving human-computer interactions and detecting the behavior which is dubious. The system brings a new way to recommend music by utilizing emotional features from your face, making it a exciting feature for anyone looking to get the right song based on their current mood. In addition , they have a thought about using EEG to make the detection of emotions more accurate and expand the system to capture more facial expressions and complex feelings.

Mayur Hiwale ,Rohit Chilhorkar, Ankeet Upadhyay, Siddharaj Yadav, Dr. Latika Desai[5] about a cool new way to pick music based on the weather and air quality outside. Basically, it's meant to help people listen to music that matches the vibe of the day, whether it's sunny, rainy, or even if the air quality is bad. So, not only does it give you the right playlist, but it also helps you stay aware of the environment.

The idea behind ClimaSound is that weather affects our mood, and that mood affects what kind of music we want to hear. ClimaSound uses sensors to check things like temperature, humidity, and air pollution levels, and then saves this data for analysis. It looks at these weather details and uses different recommendation techniques to suggest music that matches the scene outside. So, if it's a sunny day, it might recommend happy, upbeat songs, while if it's rainy, it could suggest something more chill. It's like your playlist is personalized not just for you but also for the weather!

The system has different parts: collecting the data, storing it, analyzing it, and then showing it to the user. For the music, it connects with Spotify's API, and for weather and air quality info, it uses OpenWeatherMap and AirNow. ClimaSound uses something called fuzzy logic to match the weather details with the mood of the songs, like how fast or energetic they are. Through an interface built with React.js, users can set their music preferences, see the current weather, and get a playlist that fits.

One of the coolest features is that it has real-time air quality monitoring. If pollution is high, ClimaSound will alert you, so you know if it's safe to go outside. Plus, it has charts and maps that show weather and air quality trends over time. In the future, the system could even be used for things like tourism, where the music suggestions change depending on the weather in different places, or for transportation, where routes change based on air quality.

Of course, there are some challenges, like keeping user data safe and making sure the weather info is accurate, but ClimaSound has a lot of potential. It's a mix of personalized music and environmental

awareness that could really make a difference in people's everyday lives.

Ranran Wang, Xiao Ma, Chi Jiang, Yi Ye, Yin Zhang[6] discusses about a new music recommendation system called the Heterogeneous Information Network-based Music Recommendation System (HIN-MRS) It's designed to make music recommendations better for mobile users by considering not only what people usually like but also factors like time, place, and even the weather. Most music recommendation systems just look at the basics—like which songs someone has listened to before or the general types of music they enjoy. This can limit how personal the recommendations feel. HIN-MRS, though, takes a more advanced approach by using a special network called a Heterogeneous Information Network, which allows it to consider a lot more about the person and their surroundings.

HIN-MRS has two main parts: one that figures out the kind of music the user might be in the mood for right now, and another that recommends specific songs. To identify the user's current mood, it looks at details like the time of day and where the user is. This lets it zero in on music that matches the vibe, making recommendations faster and more tailored to what the user might actually want. For picking songs, HIN-MRS uses a graph-based method to study the relationships between things like playlists, songs, artists, and albums. This method makes the recommendations more accurate since it can find connections in the data that simpler systems might overlook.

One cool feature of HIN-MRS is that it works even if the user doesn't have any playlist history—a problem known as the "cold start" issue. By using the context data alone, it can still suggest songs that fit the user's current environment. HIN-MRS also uses a Python tool called Hyperopt to fine-tune how much each factor should affect the recommendations, making them even more precise.

When they tested HIN-MRS with Spotify playlists, it outperformed older recommendation systems, especially when it came to metrics like Mean Average Precision (MAP) and Normalized Discounted Cumulative Gain (NDCG), which measure how well the recommendations match what users would actually enjoy. It was especially good at making recommendations when the user didn't have any playlists.

In general, HIN-MRS is great for mobile music recommendations because it can handle different types of data and combines them in a way that makes sense. By capturing complex connections within the music data and using context from the user's environment, HIN-MRS provides a flexible, powerful, and easy-to-understand recommendation system for mobile users.

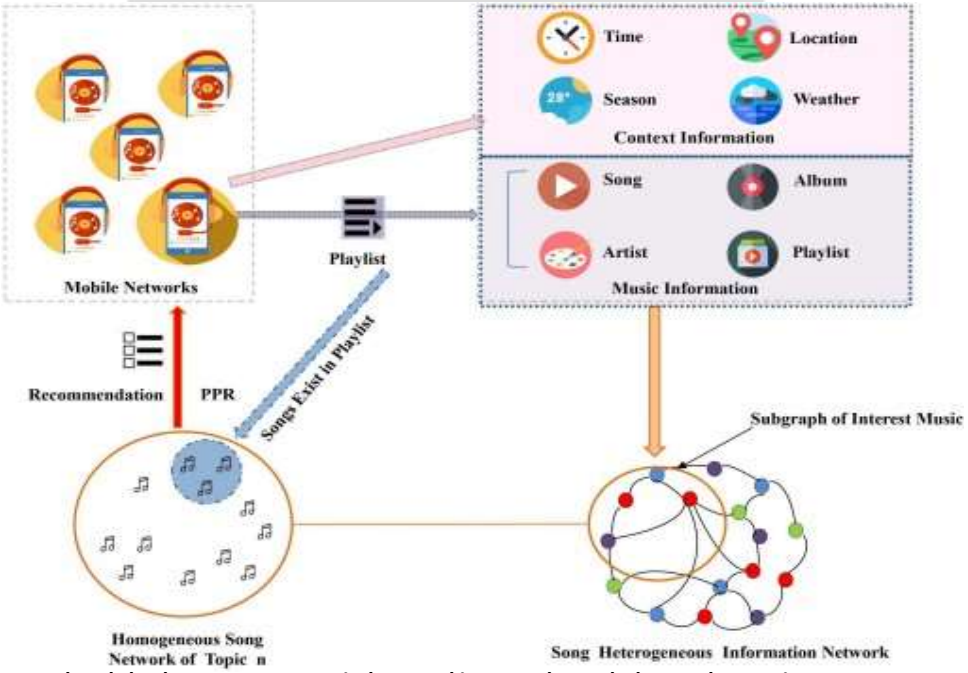

Figure 5: Framework of heterogeneous information network-based music recommendation system [6]

Jiayu Li, Zhiyu He, Yumeng Cui, Chenyang Wang, Chong Chen, Chun Yu, Min Zhang, Yiqun Liu, and Shaoping Ma[7] discusses play an increasingly important role in the music scenario.Recommender systems have really improved and become very important in the music world, changing how people find and listen to music on different apps and platforms. They're especially good when they can give you

personalized suggestions based on what you like. But most of the usual systems only use stuff like your search history and user profile, which doesn't really show what's happening with you in real life. So, researchers are trying something new by using data from devices like smart bracelets to make music recommendations even better. These bracelets can track things like your heart rate, what the weather is like, where you are, and how active you are. By adding this kind of data to music recommendation systems, researchers are hoping to figure out how things like your mood and what's going on around you impact the music you want to listen to.

In a study with 30 people, researchers found that music preferences are totally connected to emotion, what you're doing, and your environment. For example, your music taste can change depending on whether you're happy, sad, working out or just chilling. The bracelets even picked up on heart rate, and while it mattered a little less, it still helped shape music choices. The researchers came up with a cool new system called the Multi-task Ubiquitous Music Recommendation model, or MUMR for short. This model takes all the information from the smart bracelets and uses it to predict what kind of music you'll like at any given moment. It's a better way to recommend songs because it doesn't just guess based on what you listened to before—it uses real-time data about how you're feeling and what's going on around you. The model improves music recommendation performance by incorporating bracelet-collected context as an input and mood prediction as an auxiliary task. This approach not only enhances the personalization of music recommendations but also shows how wearable technology can bridge the gap between digital systems and real-world experiences.

The MUMR model, tested through experiments on the field study data, improvements in music recommendation accuracy compared to other models . The model was able to predict music preferences with higher accuracy from the data collected from smart bracelets, showing that it is possible to perform personalized recommendations even with low-cost devices. In the study, participants wore smart bracelets for a week while receiving personalized music recommendations and rating their experiences. During this period, the smart bracelets continuously gathered data on users' physical conditions like heart rates, activity levels, and environmental conditions. The results showed that the use of bracelet-collected significantly improved the model's ability to predict users' preferred music. One interesting finding from the study was that, mood which is normally difficult to capture, played a strong role in music preference. The study's analyses revealed that mood is a latent factor that influences music preference, and it can be inferred from the data collected by the bracelets. The MUMR model took advantage of this by predicting mood a task, which further improved the recommendation performance. Overall, the study highlights the ability to integrate devices into recommender systems, making personalized music recommendations more efficient and specific.

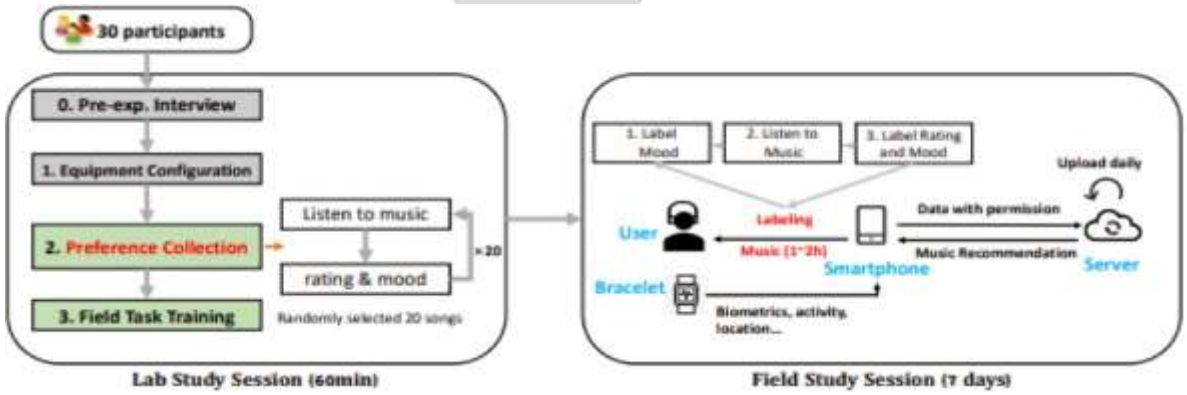

Figure 6: Illustration of user study procedure [7]

Prof. R. K. Sahare, Isha Bhoyar, Diksha Borkar, Amruta Shedame, Achal Deotale, Sheetal Mistry[8]dicusses an innovative solution designed to elevate user experience by automatically creating music playlists that reflect the user's emotions. Unlike traditional music players that come with features like

shuffle and playback speed controls, this new approach sidesteps the need for manual playlist creation, which can be both time-consuming and less in sync with how the user feels. Instead, this music player leverages facial expression analysis to detect the user's mood and selects songs accordingly, all without the need for user input.

The system utilizes a HAAR cascade classifier alongside the COHN-KANADE dataset to identify facial features, allowing it to recognize emotions like happiness, sadness, or neutrality. When a neutral expression is detected, the player can even adapt the playlist based on context, such as gym surroundings, to make the selection more relevant. By removing the need for additional hardware like EEG sensors, this solution is both budget-friendly and accessible, working seamlessly on standard computers.

The core of this technology lies in image processing and machine learning. Facial images captured by a webcam are processed using the Viola-Jones algorithm, which isolates the face for feature analysis. From there, a Support Vector Machine (SVM) model classifies these features to identify the user's emotional state. The player's library includes playlists for different moods, which it matches with the detected emotion. This design not only saves users the time they'd spend searching for songs, but it also improves song selection by learning which songs the user frequently skips, refining future recommendations.

In addition the paper outlines exciting possibilities for the technology. Future enhancements could expand compatibility to mobile devices and additional operating systems, integrate music therapy features to aid mental health, and adjust for low-light settings. By connecting music to emotions, this innovation has the potential to reshape how people interact with digital music, making it more emotionally intuitive and applicable in therapeutic contexts as well.

Table 1: Technologies Used

	Deep Learning	Support Vector Machine	Decision Tree
[1]		✓	
[2]	✓		
[3]			✓
[4]	✓		
[5]	✓		
[6]	✓		
[7]	✓		
[8]		✓	

III. CONCLUSION

In conclusion, our music recommendation application, which leverages weather conditions and user emotions, demonstrates a novel approach to enhancing the user experience in music streaming. By detecting emotional states through facial analysis and gathering real-time weather data, the application can recommend playlists that resonate with the user's current mood and environment. This context-aware recommendation system not only increases engagement by delivering more relevant content but

also aligns with the growing trend towards personalized AI-driven solutions. Future enhancements could include refining emotion-detection accuracy and integrating more diverse weather-based responses to further improve the precision and versatility of recommendations, ultimately creating a more immersive and responsive music experience for users.

IV. REFERENCES

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[3]"Emotional Detection and Music Recommendation System Based on User Facial Expression" by S. Metilda Florence and M. Uma

[4]"Music Recommendation Based on Facial Emotion" by Sonika Malik

[5]"CLIMASOUND: A Weather-Based Song Recommendation System with Air Quality Monitoring" by Mayur Hiwale,Rohit Chilhorkar, Ankeet Upadhyay, Siddharaj Yadav, Dr. Latika Desai

[6]"Heterogeneous Information Network-based Music Recommendation System in mobile networks" by Ranran Wang, Xiao Ma, Chi Jiang, Yi Ye, Yin Zhang

[7]"Towards Ubiquitous Personalized Music Recommendation with Smart Bracelets" by Jiayu Li, Zhiyu He, Yumeng Cui, Chenyang Wang, Chong Chen, Chun Yu, Min Zhang, Yiqun Liu, and Shaoping Ma

[8]"Emotion Based Music Player" by Prof. R. K. Sahare, Isha Bhoyar, Diksha Borkar, Amruta Shedame, Achal Deotale, Sheetal Mistry