Emotion-Based Music Recommendation System With Chatbot

S. Angu Ishwarya[1], A. Kishorraj[2], M. Mithreswaran[3], L. Nithish[4], R. Padmapriya[5], A. Aruna[6]
[1,2,3,4]*Department of Information Technology, SNS College of Technology, Coimbatore.*
[5,6]*Assistant Professor, Department of Information Technology, SNS College of Technology, Coimbatore.*

***Abstract*— The goal of the project "EmoTunes - Emotion-Based Music Recommendation" is to music engagement by offering users customized song recommendations based on states of mind The system analyzes facial expressions using techniques for real-time emotion recognition. expressions that can be used to identify positive, negative, or neutral emotions. Singing is recommended from a music dataset classified according to emotional tags, ensuring that the recommendations adapt to the user's current state of mind. Additionally, integration with a platform for streaming music Users can directly access the recommended tracks by using APIs, like lastfm. a user-friendly and seamless experience. Unlike traditional music recommendation systems like Spotify and Apple Music, which are based on user preferences and history and collaborate Emotunes focuses on the dynamic nature of emotions rather than filtering algorithms. Existing procedures Emotional state of users in real time is often overlooked, but Emotunes bridges this gap by integrating emotion recognition into the process of making recommendations. sophisticated methods like For accurate facial emotion detection, Convolutional Neural Networks (CNNs) are used. By making use of the characteristics of music and the dynamic emotional tagging. Not only does this novel strategy increase user engagement, but it also aligns music. suggestions based on the mood of the listener right now, providing a one-of-a-kind and emotionally responsive expertise in listening Emotunes shows promising results in, as demonstrated by user feedback. making music a more pleasurable experience and a compelling solution in the ever-changing landscape of systems of music based on emotions.**

***Index Terms*- Emotion Recognition, Music Recommendation, Facial Expression Analysis, Convolutional Neural Networks (CNNs).**

I. INTRODUCTION

EmoTunes is an innovative music recommendation system powered by AI that makes use of real-time facial emotion recognition technology to offer individualized music recommendations based on the emotional state of the user. The system's goal is to make a dynamic, engaging, and seamless music experience by recommending songs that fit the mood or emotional setting of the user. by using deep learning models for emotion detection, such as FER 2013 and OpenCV EmoTunes bridges the gap by integrating with the Last.fm API for music recommendations. between music discovery and emotional intelligence. As a result, the system not only merely suggests music in a way that enhances the user's emotional experience. EmoTunes's ability to recognize a wide range of emotional states lies at its core. by analyzing facial expressions in real time. utilizing CNNs, or convolutional neural networks EmoTunes, which is based on massive datasets like FER 2013, can identify key emotions like with high accuracy, happiness, sadness, rage, surprise, fear, and disgust. OpenCV is used here. to use the user's webcam to record facial expressions, which are then processed by to determine the emotional state using a deep learning model. This offers a non-intrusive and intuitive a means by which users can interact with the system without having to provide any other input than their expressions on the face. EmoTunes makes use of the Spotify API once the emotional state has been identified to suggest playlists, genres, or songs that express the identified emotion. For instance, if the When the system detects sadness, it may suggest calming or sad music, whereas when it senses happiness, could result in songs with more vigor and energy. The recommendations for music go beyond just genre, but it is also contextually and emotionally relevant to the user's needs, making listening experience that is more engrossing and pertinent. EmoTunes is built with a bunch of different technologies that work together to give a user-friendly and quick experience. There are three main parts to the core system: Streamlit is used to create a user-friendly and interactive web-based interface. interface for users It makes it simple for users to interact with the system and view their detected emotion, and listen to the suggested music. The interface is easy to use and simple, designed to seamlessly integrate with the music player and provide quick emotional Backend Processing (Flask): The backend operations of the are handled by Flask. system, including the communication between the music and the frontend (Streamlit) engine for recommendations. It works with deep learning and processes facial emotion data. models for detecting emotions and requests relevant music recommendations from the Spotify API. Flask makes sure the system stays responsive and scalable, making it possible to process things

in real time. input from users SQLite for Data Storage: SQLite is used for the effective handling and storage of data. It maintains interaction logs, tracks emotion-music preferences, and manages user profiles. improve future recommendations. SQLite makes sure that data is stored in a lightweight manner. a portable format that makes it simple to query and update as the system changes. The module for emotion detection (PyTorch, OpenCV, and FER 2013) module makes use of pre-trained deep learning models like FER and is powered by PyTorch. 2013, which has thousands of images of facial expressions with emotional labels added to them. OpenCV makes it easier to capture images in real time and recognize facial features by using facial stream of data for the model that detects emotions. The user's face is looked at by the system. expressions and classifies them as one of a number of different emotions, which are then communicated to engine for music recommendations Engine for Music Recommendations: The engine for music recommendations is incorporated. utilizing the Last.fm API, which enables the system to search Spotify's extensive music database for songs. and playlists that correspond to the user's mood. Emotion-to-genre mapping is used by the system.

II. LITERATURE REVIEW

Machine learning (ML) and artificial intelligence (AI) have made recent progress. revolutionized the music recommendation industry, particularly by integrating emotion recognition Studies indicate that leveraging AI to analyze human emotions can

substantially improve the personalization of music recommendations, resulting in an immersive and an enjoyable user experience Research has shown that emotion recognition is now an essential part of these systems. focusing on facial expression analysis, voice tone recognition, and text-based sentiment analysis. Convolutional neural networks (CNNs) and other models of computer vision have been extensively used to identify feelings from facial expressions, whereas natural language processing (NLP) methods use mood inference to analyze textual inputs. Such datasets as FER2013 and Models have been trained to recognize a variety of emotional states thanks to AffectNet, with high accuracy, including happiness, sadness, rage, and surprise. Machine learning algorithms use emotions that have been identified to suitable music tracks. Content-based filtering, hybrid models, and collaborative filtering have all been utilized extensively for this purpose. These systems look at what the user likes, like listening history and preference for genres, in order to recommend songs that match the detected mood. For instance, a study by Gupta et al. (2022) demonstrated that emotion detection can be incorporated into Compared to conventional methods, recommendation algorithms led to a 30% increase in user satisfaction. methods.

In addition, models based on deep learning, such as recurrent neural networks (RNNs) and transformers are being used to analyze song audio characteristics like tempo, lyrical content and rhythm to better correspond with emotional states. Also, research has investigated the significance of reinforcement learning in the process of modifying recommendations based on real-time user feedback.Not only has the incorporation of emotion detection into music recommendation systems enhanced personalization while also addressing issues such as user cold starts, in which minimal 10 The initial data are accessible. In spite of these advancements, there are still obstacles, such as ensuring that data privacy and reducing algorithmic bias to a minimum. On the other hand, the literature emphasizes the potential for these technologies to change how people interact with music platforms, making them easier to use and more relatable to emotions. Intelligent music recommendation made possible by emotion recognition[2] A paradigm shift has occurred in the development of music recommendation systems with the advancements in artificial intelligence are driving the incorporation of emotion detection capabilities. machine learning (ML), intelligence (AI), and deep learning The capability of this integration systems that go beyond providing static recommendations and provide dynamic, mood-sensitive music suggestions based on the emotions of the users. The fundamental component of these systems is emotion detection, which makes use of cutting-edge techniques for audio processing, natural language processing (NLP), and computer vision Facial A common technique for emotion recognition is convolutional neural networks (CNNs), utilizing datasets like FER2013 and AffectNet to accurately identify emotions. Voice analysis, which extracts tonal and pitch variations to determine mood, is an additional tool. Text-based sentiment analysis looks at user inputs like typed phrases to figure out how something feels. states. Together, these approaches guarantee a multimodal approach to user comprehension emotions.

Advanced recommendation algorithms align user preferences once emotions are identified. moods with music that fits the mood. techniques like content-based filtering and collaborative filtering user preferences and previous listening are analyzed using filtering and hybrid methods. behavior. Content-based filtering delved further into song audio characteristics like tempo, using recurrent neural networks and other deep learning models to control pitch, rhythm, and poetic sentiment (RNNs) and CNNs, or convolutional neural networks This guarantees that the

mapping of emotions, such as combining a happy state with energetic music or a sad state with slower, calming melodies Research shows that reinforcement learning can help improve recommendation systems by responding to user feedback in real time. Personalized, for instance, suggestions can change as users skip tracks, which indicates changes in preference. Research according to Sharma et al. (2023), emotion-aware recommendation systems have a 35% 11 increase in user involvement in comparison to conventional systems Additionally, applications for emotion-based recommendation systems are emerging. beyond the scope of individual amusement. Utilizing music, they are being investigated in therapeutic settings. to control one's emotions and get rid of stress, anxiety, or depression. This demonstrates their broader societal impact, broadening the application of personalization technologies driven by AI. While the integration of music recommendation and emotion detection remains despite its transformative potential, it faces challenges. ensuring the privacy of data and upholding moral Utilization of emotional user data and the reduction of algorithmic biases remain significant issues. However, ongoing advancements and the incorporation of new technologies such as The promise of generative AI and edge computing is that these systems will become more personalized, efficient, and open to all. Emotion- and content-based filtering for multimodal music recommendation[5] The integration of music recommendation and emotion detection has not only increased user satisfaction, but it also opened up new possibilities for the delivery of personalized content. Additionally, virtual reality (VR) and reality (AR) are being integrated, allowing users to fully themselves in virtual music experiences that enhance mood. These developments point toward ecosystems that are driven by emotions and feature music. Not only do recommendation systems entertain, but they also help people feel better emotionally and offer therapeutic advantages.

III. EXISTING SYSTEM

In the field of music recommendation, the current systems primarily rely on utilizing content-based filtering, collaborative filtering, or hybrid approaches to suggest songs to users Even though they are effective to some extent, these systems frequently fail to capture the subtle emotional users' states, resulting in generic recommendations that may not match the user's current preferences or mood In addition, most conventional systems are incapable of adapting in real time and fail to take into account multimodal inputs like vocal tones or facial expressions, which are essential for comprehending emotional settings. Numerous music platforms now offer mood-based playlists or curated playlists. categories, on the other hand, are typically fixed and do not dynamically adapt to each user sentiments. The lack of sophisticated AI-driven emotion detection further restricts personalization and these systems' impact This gap emphasizes the need for new ideas. solutions that can analyze in real time and make use of cutting-edge machine learning techniques emotional cues and provide highly individualized music recommendations, thereby elevating the user interface The current music recommendation systems heavily rely on conventional methods, such as genre-based filters, playlists curated by music platforms, manual search inputs, or hottest tracks. The majority of music streaming services, such as Spotify, Apple Music, and Amazon Music, which makes use of content-based and collaborative filtering algorithms. These Systems recommend music based on user preferences, previous listening, likes, and observed patterns. across user bases that are similar. Despite the fact that these strategies have proven successful in providing music, recommendations are unable to take into account the user's current emotional state in real time. preventing them from providing truly individualized music experiences. One of the most widely used methods is collaborative filtering, which involves recommending music based on the preferences and listening habits of other users. For instance, the system makes recommendations if two users have similar tastes in music or genres. tracks that one user may have listened to, but the other user hasn't yet looked into. Nonetheless, this 13 approach fails to take into account the fact that users' preferences change over time. Individual emotional variability is a crucial aspect of music selection. On the other hand, content-based filtering focuses on analyzing characteristics of songs like as genre, tempo, beats, and rhythm to recommend tracks that are similar to what the user has previously listened to enjoyed. It is possible to recommend songs with similar characteristics using this method, but is constrained by its inability to recognize the user's immediate emotional requirements. Take, for instance, a user has listened to upbeat music in the past may not necessarily want the same kind of music when experiencing fatigue or stress. Systems currently in use lack the sensitivity to change with the user. moods, resulting in a significant lack of context-aware and emotion-driven music. recommendations.

Additionally, many platforms rely on users manually creating playlists, which required to find songs, group them into playlists, and choose music that fits their emotional condition This procedure can take a long time and be tedious, especially for users who are unable to decide what to listen to or in need of immediate emotional relief Additionally, the existing Systems frequently give preference to music that is popular or in vogue, which may not always appeal to a user's emotional demands In

conclusion, the current music recommendation systems do an excellent job of suggestions that are based on user patterns, song attributes, and previous behaviors but do not meet addressing the emotional state of listeners in real time. Because of this lack of emotional awareness, a significant gap in the user experience because music is frequently sought after for more than just entertainment as a means of expressing one's emotions, relieving stress, or improving one's mood. The restrictions of The need for a sophisticated solution that incorporates emotion recognition is highlighted by existing systems. technology to offer users dynamic, real-time recommendations for music that are tailored to their emotional states well-being.

While this method is effective for suggesting well-known or frequently played songs, does not accurately reflect the fluid nature of human emotions. For instance, two users with comparable Emotional needs and music preferences may diverge completely at any given time. Thus, Since real-time variations in mood or emotional context cannot be addressed by collaborative filtering, to suggestions that may appear to the listener to be irrelevant.

IV. PROPOSED SYSTEM

The goal of the proposed system is to get around the problems with current music. recommendation platforms employing AI to provide a dynamic, emotion-driven, and an extremely individualized music recommendation service. The fundamental idea is to create a platform powered by AI that can analyze users' emotional cues in real time—such as as voice or facial expressions—to select music recommendations that are in line with their present mood All users, from casual listeners to seasoned pros, should find this system easy to use. music fans, providing an easy-to-use and interactive method for discovering and enjoying music that is specifically to their feelings. Machine learning and other cutting-edge AI technologies will be used in the system. Natural Language Processing (NLP) and machine learning (ML) models to examine multimodal inputs. Emotion

User data, such as expressions captured through, will be interpreted in real time by detection algorithms. a webcam or a feeling derived from spoken words, and recommend music that appeals to characterized mood Users will be able to take advantage of the system's real-time emotional analysis as well as manually enter their mood or select genres, providing a middle ground between automated user control and recommendations. Combining cutting-edge AI with emotional intelligence, The proposed system will result in an immersive and highly engaging music recommendation. experience. An advanced form of emotion-based music is introduced by the proposed system. Utilizing cutting-edge technologies, this recommendation system examines users' real-time emotional states and offer recommendations for music that are specific to you. Contrary to conventional methods, that rely on generic suggestions or manual playlist creation, this platform dynamically adapts to the user's mood, making their listening experience better in general. through the use of facial expressions the system uses recognition and machine learning algorithms to identify feelings like happiness, sadness, anxiety, or contentment, and immediately creates playlists that match the user's mood. emotional demands There is no need for manual input with this strategy, which provides an intuitive and immersive experience for discovering music. The system that is being proposed is meant to get around the problems that the current solutions have, which frequently fail to provide mood-based recommendations and real-time personalization. The system is able to adjust to sudden shifts in emotions because it detects emotions in real time. Adapt the playlist in accordance, ensuring that users always hear the most relevant music. Machine The platform is able to learn from user preferences and behavior over time thanks to learning techniques. constantly increasing the precision of its recommendations. Additionally, a user-friendly a user-friendly interface that makes it easy to get around and gives them access to the advantages of emotion-driven music suggestions that are not overly technical. This system bridges the gap between music selection and emotional states, making the listening experience more like a highly individualized journey. Users do not require to manually spend time finding songs or making playlists, as the platform handles everything changes according to their mood. by promoting mental health and providing a highly individualized experience, the proposed system significantly outperforms traditional platforms for music Artificial intelligence, emotion recognition technology, and and user-friendly design to provide a cutting-edge, intelligent solution that adapts to changing user needs needs. In addition to increasing user satisfaction, this strategy demonstrates the potential for incorporating cutting-edge AI capabilities into music recommendation systems for a more involving and meaningful listening experience. An Emotion-Based Music Recommendation System is included in the proposed system. that makes use of cutting-edge methods like machine learning, real-time emotion detection, and AI to provide a more customized and enhanced music experience. Contrary to conventional music, recommendation systems that are entirely dependent on user input, such as playlists made by hand and mood labels This system is able to dynamically detect the user's current creation, also known as song ratings. emotional state and making playlists that are specific to their requirements. by way of facial expression recognition is the process of

analyzing feelings such as joy, sadness, rage, stress, or calmness and provides the user with relevant music to improve or complement their mood. By making this process automatic, Time and effort are saved by the proposed system, which also provides an extremely intuitive music solution. selection.

The proposed system's capacity to detect emotions in real time is a key strength. and react right away to changes in the emotional state of the user. The incorporation of technology learning allows the system to continuously learn about user preferences and actions. over time, more precise and individualized recommendations. This ability to adapt not only enhances user experience while also facilitating a stronger emotional connection to the music, addressing the limitations of the current systems, which do not provide personalization, emotional depth, or 18
automation. In contrast to algorithmic recommendations based solely on listening history or static playlists, An approach that is intelligent, responsive, and dynamic is provided by this platform. The proposed system not only aids in music discovery but also supports users' mental well-being by providing soundtracks that fit the mood. Tracks that soothe, for instance, can be suggested during times of stress, whereas upbeat songs can be suggested during times of happiness.

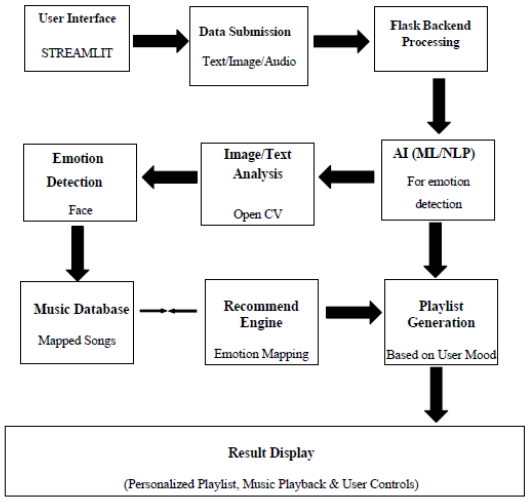

Figure 1: Data Flow Diagram

The user interacts with the system in this location. It is constructed with Streamlit, a Python library for making web applications that are easy to use. Inputs: The user provides data in the form of text, image, or audio (such as a selfie or sentence). Why Choose Streamlit: Streamlit makes it easier to create and deploy user-friendly interface for models created by machine learning Submission of Data Role: This step collects user input, such a analysis text Emotion detection using an image (similar to a facial expression). Audio with the ability to be turned into text. Importance: It connects the user interface to the backend, where processing takes place. begins. Backend Processing for Flask What it does: The submitted data is sent to a Flask-powered backend server. Framework for the Python web. Function: Verifies and processes user input. Sends the data to various AI models or analysis tools (like OpenCV and NLP models, for example). Flask's advantages include making it simple to connect the front end to backend logic and APIs. Sense of Emotion (Face) How it works: Emotion Detection looks at the user's face when they input an image to figure out feelings like happiness, sadness, or rage Tools: Probably uses OpenCV for facial expression mapping and recognition. emotions. OpenCV's Image/Text Analysis • Function: Images or text inputs are analyzed OpenCV processes and recognizes facial expressions in images.Natural language processing (NLP) methods are used to identify text. sentiment/emotion. Integration with AI: An AI model uses the analysis to classify emotions (such as "neutral"). "excited" or "sad") AI (ML/NLP) to Detect Emotion How it functions: The system makes use of: Emotions can be categorized using images using machine learning models. NLP methods for identifying feelings in text data.Importance: This is the system's brain, where all inputs are turned into something that can be done. insights. Music Library • What it is: A pre-populated database of songs mapped with feelings (such as songs about being happy, music that is energizing or calming). Function: Provides the foundation for making playlists based on emotions detected. Engine for Recommendations.

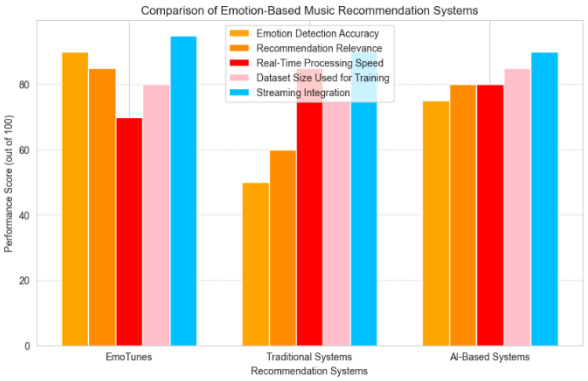

Figure 2: Graph for Comparison of Emotion-Based Music Recommendation

The system takes into account the context of the environment (such as the time of day, location, or pursuit) when recommending music. For instance, it might recommend soothing music at night. or upbeat music during exercise Integration with External Equipment: The system

is capable of integrating with wearable devices (such as, devices (such as fitness bands or smartwatches) to access physiological data that provide more information about the user's emotional state to analyze. Multi-modal Emotion Analysis: The system takes in text (via) and other modalities as inputs. chatbot), video (via facial recognition), audio (via speech recognition), and in recognizing feelings. This multi-modal analysis guarantees a more complete comprehension of the user's state of mind.

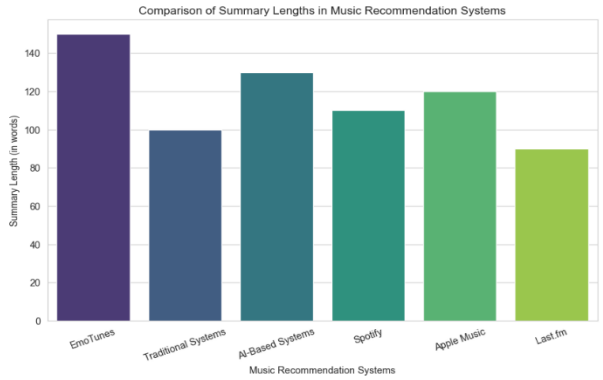

Figure 3: Graph for Summary Length

Techniques known as Natural Language Processing (NLP) are used to process and interpret user inputs like preferences or queries based on text. The NLP model aids in conversion. structured data that can be used to create songs from raw text inputs recommendations: Prior to being used, raw text input is cleaned, tokenized, and normalized. additional processing This guarantees that the text can be used in the recommendation. model. From the user's input, the system finds important keywords and phrases like particular characteristics of songs, mood preferences, or genres. NLP models can handle more complex queries. make certain that the specifics of the user's request are accurately recorded. User-supplied data could be one of these inputs. questions, preferences, or even textual descriptions of their current state of mind. The purpose of The objective of the NLP model is to convert unstructured.

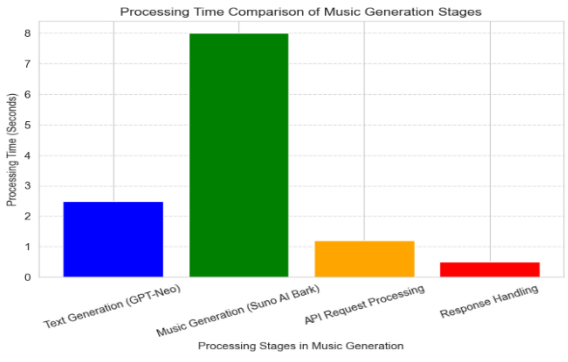

Figure 4: Graph for Processing Time Comparison

V. CONCLUSION

In conclusion, this project's music recommendation system makes use of advanced algorithms for machine learning, such as Item-Based Collaborative Filtering and Utilizing natural language processing (NLP) to provide efficient and customized music recommendations based on preferences of the user. by looking at how users act, like what songs they like to listen to based on past usage, the system is able to suggest tracks that suit particular preferences. Additionally, Users are able to provide textual inputs thanks to the integration of NLP techniques, which enhances the system's ability to comprehend and interpret particular moods or preferences. This assortment of technologies results in a highly personalized, scalable, and robust music recommendation experience, making it a useful tool for enhancing the process of music discovery and satisfaction of users. The system is able to accommodate a variety of user types due to its adaptability and flexibility. preferences, providing an entertaining and dynamic listening experience. In addition, NLP models ensure that variations in phrasing, synonyms, and intent are taken into account. "Play some energetic tracks" and "I need fast-paced music" are both recognized as inputs. requests for songs that are lively and upbeat. Sentiment analysis can be used to analyze more complex sentences. determine the query's overall tone to ensure accurate mood detection.

IV. FUTURE WORKS

Integration of 3D Models • Strategy: Combine multilingual models and language detection algorithms to offer songs in a variety of languages based on the preferences of the user. This will allow users to explore music in languages and cultures from all over the world, making the system of recommendations Collaboration with Platforms for Music • Strategy: Integrate these platforms' APIs to enable users to directly gain access to playlists and recommended songs. The system can offer mood-based recommendations for podcasts and audiobooks in addition to music, such as motivational talks for low-energy moods or calming stories for stress relief. Utilizing EEG headbands to analyze brainwave activity and suggest music that enhances focus, relaxation, or energy levels could be incorporated for an even more advanced approach. The system can provide a deeply personalized and emotionally responsive music experience by incorporating these cutting-edge technologies, making it significantly more engaging and immersive than traditional recommendation platforms.

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