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MOOD WAVES: Chatbot Song Recommender System

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Abstract: In today's digital age, understanding and responding to human emotions play a crucial role in enhancing user experiences. This research aims to develop a personalized music recommendation system by analyzing the user's emotional state through a chatbot interface. Leveraging tone analysis algorithms, the chatbot interacts with users, detecting their sentiments based on text inputs. By integrating readily available APIs for playlist generation and recommendations, the system tailors music suggestions to match the user's mood. Through text-based interactions, users can receive soothing music recommendations aligned with their emotions, offering a source of comfort and relaxation in stressful times. This proposed system not only identifies the user's current mood but also provides a platform for seamless human-computer interaction, emphasizing the importance of emotion recognition in enhancing user engagement and satisfaction.

Keywords - Chatbot, Song recommendation, last.fm API, IBM tone Analyzer, Playlist generation, Music classification, Text analysis, Machine Learning, Support vector Machine (SVM), Sentiment analysis, CakeChat.

I. INTRODUCTION

In our daily lives, communication is ubiquitous, but the ability to perceive and understand emotions through music adds a unique dimension. Music holds significant importance for individuals seeking greater enjoyment and fulfillment in life. Yet, conventional music streaming services often fall short in delivering personalized recommendations that resonate with the user's emotional state. Imagine receiving song recommendations tailored not just to your preferences but also to your current mood, based on your conversation with a chatbot. Research shows that approximately 93% of communication is influenced by the emotions expressed, highlighting the critical role of emotions in successful interactions.

Chatbots have emerged as valuable tools for businesses to scale their user interactions across various platforms such as Facebook, Messenger, Slack, and Telegram. However, the focus here is not solely on business-driven communication but on creating a casual and engaging interaction experience. Furthermore, our chatbot will go beyond mere conversation by suggesting songs based on the user's tone of voice. Leveraging APIs like Last.fm and IBM Tone Analyzer, our chatbot will analyze the emotional tone of the conversation, enabling it to recommend music that resonates with the user's mood. The integration of APIs is paramount in today's chatbot landscape, where functionality extends beyond information dissemination to include user-friendly features. Python, with its extensive array of open-source libraries such as scikit-learn and TensorFlow, provides a robust framework for building chatbots and conducting complex analyses, particularly for smaller datasets. Recognizing the stress-relieving power of music, our research proposes the development of an Emotion-based Music Player—a player capable of dynamically adjusting the music playlist according to the user's emotional state. While the recognition of human emotions is a global consensus, the methods for categorizing emotions vary, ranging from data-driven to statistical and hybrid approaches. However, challenges persist in accurately capturing and interpreting the nuances of human emotions.

II. LITERATURE SURVEY

The exploration of various research papers underscores several key methodologies and innovations in the realm of emotion detection and recommendation systems:

Nikhil et al. [1] employ a sophisticated blend of algorithms, including Haar cascade, Canny area, and Blob detection, to pioneer emotion detection methodologies. Their system captures images of individuals and discerns mood based on facial expressions. Leveraging inputs such as facial features and emotional cues extracted from images, the system facilitates dynamic interactions through a chatbot interface. This novel approach to building a conversational application allows for tailored responses, with the system detecting smiles and stress levels. Upon detecting a smile, humorous content like jokes is presented, while stress triggers the delivery of inspirational quotes and uplifting music selections.

Ai Thanh Ho et al. [2] introduce an Emotion-based Film Recommender System (E-MRS) aimed at addressing the limitations of conventional recommendation systems. Recognizing the significance of user emotions in decision-making, E-MRS leverages a combination of collaborative filtering and content-based techniques to customize recommendations. Emotions and user preferences are integral factors in the recommendation process, augmented by insights from similar user experiences. To establish emotional connections with films, users engage in a questionnaire to express their movie preferences corresponding to different emotions. Additionally, users personalize their emotional profiles by selecting colours to represent their avatars, enriching the recommendation process with individualized emotional contexts.

Jae Sik Lee et al. [3] propose a novel approach incorporating context reasoning into a music recommendation system, enhancing user experience and system performance. Their system comprises distinct modules such as the goal Module, mood Module, and recommendation Module, each contributing unique functionalities. Context reasoning, facilitated by the goal Module utilizing environmental context data, determines user interest in music. Subsequently, the mood Module identifies the most suitable tracks based on the user's context, culminating in recommendations provided by the advice Module.

Renuka R. Londhe et al. [4] delve into facial expression recognition by analyzing various facial properties. Changes in facial features, including curvatures, nose, lips, eyebrows, and mouth region, reflect alterations in pixel intensities. These features are categorized into six expressions—anger, disgust, fear, happiness, sadness, and surprise—using an artificial neural network. Leveraging the Scaled Conjugate Gradient back-propagation algorithm, they achieve an impressive 92.2% recognition rate. Their study utilizes the JAFFE database, comprising seven expressions, for computational assessment.
Dolly Reney et al. [5] highlight the critical role of face and emotion identification in security applications, addressing various challenges encountered in the field. Central to their approach is the utilization of databases to compare facial attributes and sound Mel frequency components for effective face and emotion identification. Leveraging diverse algorithms, they analyze facial expressions and emotions, leading to the creation of a comprehensive database. Their methodology employs the robust Viola-Jones framework for face identification and evaluates face and emotion recognition using the KNN classifier.

Shan C et al. [6] conduct an empirical evaluation of facial presentation, employing statistical local features, specifically Local Binary Patterns (LBP), to discern facial expressions irrespective of individual characteristics. Through the application of various machine learning algorithms on diverse databases, they meticulously analyze LBP features for efficient facial feature recognition. Additionally, they introduce Boosted-LBP to extract discriminant features, achieving superior recognition performance. Notably, their evaluation demonstrates the resilience of LBP features across low-resolution face images and compact video sequences, underscoring their effectiveness in real-world scenarios.

In contemporary digital entertainment platforms like Spotify, Netflix, Gaana, and YouTube, user interaction is primarily driven by search queries and stated preferences, often overlooking the nuanced emotional aspect of user engagement. However, a recent breakthrough in recommender systems proposes a novel CNN-based model capable of detecting emotions and curating playlists tailored to the user's emotional state. This innovative model integrates specialized modules designed for detecting emotions conveyed through facial expressions and sentiments expressed during interactions with a chatbot. By synergizing these modules, the model significantly augments the overall performance and robustness of music recommendation systems, effectively catering to users' emotional needs.

[7] Music Recommendation Based on Colour – October 2020.An intriguing alternative approach to song selection is introduced in a recent study, centered around the association of colours with emotions, manifested through a Colour-to-Music application. This multifaceted project unfolds across three key stages: firstly, the creation of a music library intricately linked to colours and emotions; secondly, the development of diverse graphical user interfaces (GUIs) facilitating colour selection; and thirdly, the collation of feedback from 120 trial participants. Despite its promising premise, the Colour-to-Music Library registers an overall accuracy rate of merely 51.11 percent, indicating scope for refinement, particularly in enhancing the alignment between the HSV model and the fundamental aspects of music.

[8] A Novel Music Emotion Recognition Model for Scratch-generated Music – August 2020Proposing a human emotion recognition system, a recent study leverages 2D-Linear Discriminant Analysis (LDA) fused with 2D-Principal Component Analysis (PCA). Simulated outcomes underscore the superiority of this method over its counterparts, namely 2D-LDA and 2D-PCA, in feature extraction. Notably, the KNN classifier outperforms SVM when integrated with the proposed feature extraction method, showcasing promising avenues for emotion recognition.

Additionally, a pioneering music emotion recognition model tailored specifically for Scratch-generated music is unveiled. Capitalizing on Scratch's music module, which empowers children to craft personalized background music, the model employs a core melody extraction algorithm to compile a dataset of Scratch-generated music. Each musical piece's underlying features are meticulously extracted and input into a CNN module. Subsequently, the final classification results are derived by feeding the learned features from the CNN into an RNN. However, the model's accuracy remains modest, underscoring the intricate relationship between music emotion and its underlying elements, as well as the limitations inherent in Scratch-generated music datasets.

[9] Competence-Based Song Recommendation: Matching Songs to One’s Singing Skill – March 2015Furthermore, an innovative competence-based song recommendation framework is delineated in a recent paper. This framework entails the creation of a singer profile, encompassing voice pitch, intensity, and quality, to encapsulate a singer's vocal prowess. Through a supervised learning approach, a speech quality evaluation function is developed, augmenting competency modelling efforts. A condensed vocalist profile is proposed to streamline the recording task, offering potential enhancements in competency modelling endeavours.

Lastly, the potential of chatbots, AI-powered conversational agents, in augmenting user experience across various domains is explored. Leveraging Artificial Intelligence and Natural Language Processing techniques, chatbot systems like the one detailed in this study utilize WordNet to align user queries with appropriate responses, thereby facilitating seamless interaction within online platforms, such as college websites.

III. METHODOLOGY

DEFINITIONS: THE WEB APP IN OUR PROJECT IS CALLED "MOOD WAVES". THE APPLICATION PRIMARILY IS A CHATBOT APPLICATION WHICH INCORPORATES THE EMOTION DETECTION MODULE.

A chatbot, an innovative conversational software application, is designed to mimic human communication skills, engaging users in automated discussions. It utilizes a chat interface and artificial intelligence, offering modern customer service solutions. AI-powered chatbots possess the capability to comprehend natural language, interpret emotions, and generate intelligent responses. This eliminates the need for customers to endure lengthy phone queues or send numerous emails for inquiries, providing a convenient experience. Moreover, chatbots contribute to reducing call volumes, average handling times, and customer service expenses. However, achieving these capabilities necessitates intricate system interactions. Throughout this study, the term 'AI chatbot' is interchangeably used with conversational agent or advanced dialogue system.

3.1 Taxonomy of Chatbot: The burgeoning interest in chatbots can be attributed to two pivotal developments. Firstly, the proliferation of messaging services, equipped with features such as payments, purchases, and bookings, obviates the need for multiple applications. Users can seamlessly perform tasks like making purchases, restaurant reservations, and inquiries within their preferred chat applications. Prominent examples include Line, WeChat, WhatsApp, and Facebook Messenger. Secondly, advancements in inexpensive computing power, facilitated by deep learning, machine learning, and advanced AI techniques, have revolutionized the ability to comprehend and make decisions. This enhanced computational power efficiently processes vast amounts of data, yielding results surpassing human capabilities.

Objective: The objective of our application is to discern the user's expressed mood and curate a playlist of songs tailored to match that mood. Unlike existing solutions, our program prioritizes the fundamental needs of music enthusiasts without disrupting their experience. Our goals include enhancing consumer satisfaction and engagement, fostering uniqueness within our platform, delivering an immersive streaming experience, and cultivating user trust and listening preferences.

3.2 Architectural Design:

The figure totally confirmed us how this project might be seems like essentially, frontend is going show us how the UI seem like however every time person talk with chatbot it will ultimately displays on the frontend. And the server aspect there are specially API's would be operating to discover the emotion of the textual content of person through the usage of IBM Emotional API and after the detection of the emotion it'll suggest the music via last.FM API.

User starts the conversation Emotional Analysis of the conversation is done using the IBM Emotional API .Get the reply to the conversation from the Cakechat Chatbot • Based on the Emotion which the app perceives, top songs are retrieved using Last.fm songs API • If a user listens to a particular song for some time, a similar song would be recommended to the user using Last.fm API.

3.3 Chatbot Development:

Since Chatbot is the main part of the project, we would be setting up the Chatbot first. A chatbot is a software application used to conduct an online chat conversation via text or text-to-speech, in lieu of providing direct contact with a live human agent. Our chatbot name is Alex.

CakeChat is a backend for chatbots that are able to express emotions via conversations. CakeChat is built on Keras and TensorFlow. The Cakechat Chatbot will respond in your conversation by utilising the last.fm songs API, the app retrieves the top songs primarily based on the Emotion it perceives.

3.4 Integration of IBM Tone Analyzer:

The integration of the IBM Tone Analyzer enhances the chatbot's ability to detect and respond to user emotions. The chatbot passes user input to the Tone Analyzer, which analysis the emotional tone of the text. Emotions such as happiness, sadness, anger, and more are identified.

When a user interacts with the chatbot, their emotional cues are detected in their messages. For example, if a user expresses excitement about a party, the chatbot recognizes the positive emotional tone and can recommend upbeat and energetic songs. This integration adds a layer of emotional intelligence to the chatbot's recommendations. Example of User Interaction:

User: Opens the Anvil web app and initiates a conversation with the chatbot.

Chatbot: Greets the user and asks how they're feeling today.

User: Responds, "I had a long day at work, feeling a bit stressed."

Chatbot: Analysis the user's response using the IBM Tone Analyzer and detects stress. It recommends calming instrumental tracks to help the user relax. User: Expresses appreciation for the recommendation and asks for similar tracks.

3.5 Utilizing Last.fm Songs API:

The Last.fm Songs API is a valuable resource for chatbot-based music recommendations. It provides access to a vast database of songs, artists, and user- generated data. The chatbot leverages this API to retrieve song recommendations based on user preferences and emotions.

For example, if a user indicates that they are feeling relaxed, the chatbot queries the Last.fm API for calming and soothing songs. This integration allows the chatbot to provide users with a diverse selection of music that resonates with their emotional state.

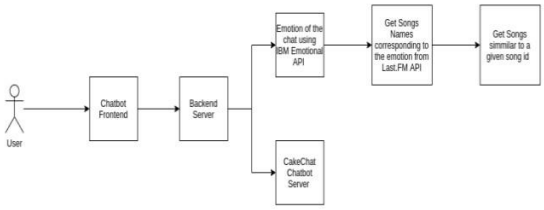

Fig 1: Architectural design of chatbot song recommendation system

3.6 Dataset:

For songs rooted in conversations and emotions, requisite datasets are imperative. In this context, the chatbot's ability to generate responses stems from its training on a diverse dialogue dataset, exposing it to an array of conversational samples. The emotion dataset encompasses positive, negative, and neutral polarities, comprising exchanges and facial expressions that convey emotions in all facets: Positive (e.g., happiness, excitement), Negative (e.g., sadness, anger), and Neutral (e.g., indifference, objectivity).

Integration of these emotion datasets into the model's training equips the chatbot to recognize and respond to various emotional cues during conversations. Depending on the intended emotional resonance of the lyrics—be it positivity, negativity, or neutrality—the chatbot can craft music lyrics reflective of the appropriate emotional tone. These datasets serve to enhance the chatbot's proficiency in generating songs that adeptly encapsulate the requisite conversational and emotional nuances. Through training on these datasets, the model can grasp and produce lyrics aligned with specific conversational tenses and emotional tones.

Conversation Dataset		Emotion Dataset		
		Dataset		
ID	Message	Bot replay	Emotion	Polarity
001	Hi	Hello	Positive	Positive
002	How are You?	I'm Fine, Thanks.	Negative	Neutral
003	I feel Sad.	Oh no, What's wrong?	Neutral	Negative

Fig 2: Example conversation with chatbot

3.7 Last.fm Integration:

Incorporating the Last.fm Songs API facilitates the delivery of personalized song recommendations tailored to users' tone or emotion. This API enables us to offer song suggestions without the necessity of accumulating extensive data, requiring substantial computational resources, or investing excessive time in web scraping for songs aligned with specific tone information previously extracted. Leveraging the "songs input" tag within the Last.fm API facilitates the retrieval of songs seamlessly.

3.8 Chatbot Server:

Employing adaptable code capable of conditioning the model's responses on any categorical variable, the chatbot is constructed utilizing Keras and TensorFlow. Cake Chat serves as the foundational platform for chatbots proficient in conveying emotions, providing a framework conducive to integrating emotional cues into the chatbot's responses, thereby enhancing its ability to express emotions effectively. The code, characterized by its flexibility, empowers developers to create chatbots endowed with dynamic emotional capabilities, leveraging the capabilities of Keras and TensorFlow.

3.9 Flowchart:

3.9.1 Linguistic Analysis for Emotion Detection:

The chat functionality incorporates linguistic analysis to discern emotional and language tones embedded within written text. The Chatbot Server functions as the backend infrastructure for chatbots capable of expressing emotions through conversational interactions. Leveraging the detected emotions, the system recommends songs from Last.fm to enhance user experience.

3.9.2 Chatbot System Modules:

The Chatbot system comprises two primary modules: Admin and User. Both modules facilitate access to the system's features, catering to the respective roles and responsibilities of administrators and regular users.

3.9.3 User Authentication:

Users are granted access to the chatbot system through a login mechanism. Authentication is facilitated by users providing their designated username and password, ensuring secure access to the system.

3.9.4 Admin Module:

Administrators can access the system by logging in using their unique credentials. Within the Admin module, administrators possess the authority to effectuate updates as deemed necessary. Additionally, administrators have visibility into the login details of users, enabling efficient system management and oversight.

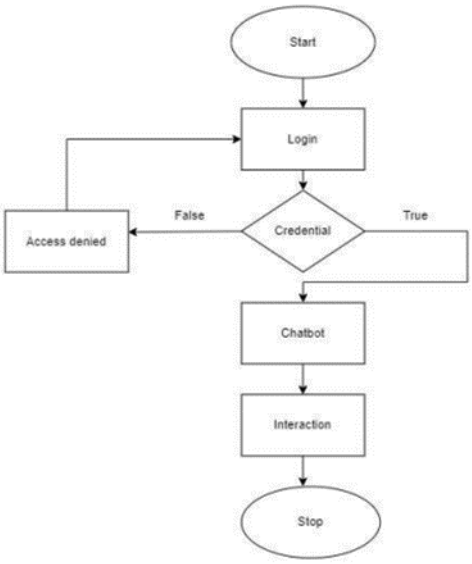

Fig 3: Flowchart of chatbot song recommendation system

3.9.5 User Interaction with Chatbot:

Upon successful login, users are directed to the chatbot page where they can initiate conversations with the chatbot. As users send messages to the chatbot, it analyzes the text to detect the underlying emotion. Based on the detected emotion, the chatbot recommends songs relevant to the user's emotional state.

3.9.6 Dialogue Context Assessment:

The system evaluates the dialogue context feature vector by employing cosine similarity with articles stored in the database. If the similarity surpasses a predefined cutoff threshold, the conversation concludes, and the dialogue context is outputted. Otherwise, the conversation continues seamlessly with the chatbot.

3.9.10 Song Recommendations:

Songs recommended by the chatbot are sourced from playlists on Last.fm, aligning with the user's emotional disposition and conversational context. Users have the option to exit the chatbot system at any time by clicking on the logout button, ensuring a user-friendly and intuitive experience.

IV. RESULT

The chatbot song recommendation system is designed to deliver personalized music suggestions to users, leveraging their preferences and listening history. Integration with the Last.fm API grants access to an extensive music database and user listening data, enriching the recommendation process. Resulting from the chatbot system's operation are tailored song recommendations, influenced by a multitude of factors such as user preferences, favourite artists, genres, and current mood. The system employs collaborative filtering techniques, content-based filtering, or a blend of both methodologies to generate recommendations aligned with user tastes.

The system's predictive capabilities extend to discerning user mood through textual analysis and recent playlist data. By engaging in conversations with users, the chatbot effectively gauges their emotional state, facilitating the recommendation of songs conducive to their mood. During interactions, the chatbot presents users with a curated playlist, reflecting both their expressed mood and recent listening habits. This bilateral display fosters user engagement and facilitates seamless exploration of recommended tracks.

In essence, the chatbot song recommendation system harnesses advanced algorithms and user interaction dynamics to deliver an enriched music discovery experience, tailored to individual preferences and emotional states.

ID	Favorite Artists	Genres	Listening History
1	Arijit Singh	Classic, Romantic Songs, Ghazal	Kesariya, Chaleya, Heeriye
2	Shreya Ghoshal	Bhajan, Indian pop, Alternative/Indie	Chikni Chameli, Teri Meri, Hasi
3	A. R. Rahman	Carnatic music, Qawwali style, Hindustani classical	Maa Tujhe Salaam, Jai Ho, Raanjhanaa

Fig 4: User Preference and Listening History

The integration of chatbots into music recommendation systems has yielded several key outcomes:

4.1 Recommendation Accuracy:

Central to the discourse would be the system's efficacy and accuracy in delivering recommendations. Evaluation metrics such as recall, precision, and user engagement offer insights into the system's performance, complemented by user feedback and satisfaction assessments.

4.2 Personalization:

The degree of personalization in recommendations warrants consideration, with emphasis on adapting recommendations to individual preferences. Exploring techniques like collaborative filtering, user profiling, and machine learning algorithms can enhance the system's ability to provide relevant suggestions tailored to each user.

4.3 User Experience:

Discussions would delve into the chatbot's conversational capabilities and user interactivity, assessing its proficiency in comprehending inquiries, providing appropriate responses, and engaging in natural and meaningful dialogue. User experience evaluations offer valuable insights into system usability and effectiveness.

4.4 Integration with Last.fm API:

The integration of the Last.fm API into the chatbot server's implementation entails detailed discussion, including aspects such as maintaining effective communication, handling API queries, retrieving and processing data, and ensuring robust authentication mechanisms. Addressing these technical considerations ensures seamless operation and data integrity.

4.5 Ethical Considerations:

Ethical implications surrounding user privacy, data security, and the potential for biased or filter bubble-like recommendations necessitate thoughtful deliberation. It is imperative to address these concerns and implement appropriate safeguards to uphold user trust and ethical standards.

4.6 Enhanced User Engagement:

The conversational nature of chatbots enhances user engagement in the music discovery process. Users can interact with the chatbot in a more personalized and intuitive manner, leading to a more satisfying experience.

4.7 Improved Personalization:

By incorporating emotion analysis and Last.fm song API, chatbots offer highly personalized recommendations. Users receive music suggestions that match their emotional states and preferences, increasing the likelihood of user satisfaction.

4.8 Emotional Intelligence:

The use of the IBM Tone Analyzer provides chatbots with a level of emotional intelligence. They can accurately detect and respond to user emotions, ensuring that recommendations are emotionally aligned with the user's mood.

4.9 Diverse Music Selection:

The utilization of the Last.fm Songs API allows chatbots to access a wide variety of songs and genres. Users can explore a diverse range of music styles, ensuring that their preferences are met.

In summary, discussions surrounding the effectiveness, personalization capabilities, user experience, technical implementation, and ethical considerations of a chatbot song recommendation system utilizing the Last.fm API and a chatbot server serve as pivotal points of analysis and discourse.

IV. CONCLUSION

The integration of chatbots into music recommendation systems represents a significant advancement in the music streaming industry. Chatbots offer a new dimension of user engagement, personalization, and emotional intelligence. Music streaming platforms that leverage chatbots can enhance user satisfaction and retention, creating a more interactive and enjoyable music discovery experience. As technology continues to evolve, the potential for chatbot-driven music recommendations is vast by addressing challenges and focusing on continuous improvement, this technology can pave the way for even more personalized and emotionally connected music experiences in the future.

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