MoodSphere

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Abstract— **MoodSphere is a Web Application designed to resonate the users listening experience according to their mood using image recognition algorithm. The WebApp caters the user to upload or click a real-time image to personalize and suggest them best recommendation. MoodSphere learns about the latest trends of music by comprehensive genres, artists, and languages, aiming for a more engaging interface to enhance the user's experience. This paper presents the key features, underlying technology, and potential impact of MoodSphere on the language learning landscape.**

Keywords—— **Machine Learning, Firebase, ResNet50, Music Recommendation, Image Detection, ReactJS, Flask, FER-2013.**

I. INTRODUCTION

Human Emotions, which is clustered array of six moods-happiness, sadness, surprise, anger, disgust, and fear [1] which plays a vital role in moulding our responses into numerous stimuli, including *Music.* These primary emotions serve as the inception of subtle feelings such as cheerfulness or sadness which later leads in influencing our preference and reaction to music. Recognizing the serious impact of music on emotional well-being, there is a substantial interest growth in developing extensive Music Recommendation Systems (MRS) that not only predicts the music preference of user with past interests but also consider user's current emotional state to suggest more personalized and therapeutic listening experience [2].

A large number of people worldwide, approximately deals with mental health challenges, and these issues are relatively serious for younger adults [3]. This scenario depicts the strong need for further ways to help everyone who is suffering. Music has a special influential manner that affect our feeling and provides a fresh path to heal mental health, more importantly where people have their monotonous lifestyle, and they are having a hard time looking for regular mental health services. By drilling into how music and our moods are resonated [2], these new types of systems that can suggest music could really help user to improve the mental health.

The emergence of music streaming has fundamentally changed the way people consume music; while bringing attention to the significant gap in the market and the need for product that user can use which is an ever-changing interaction between music and emotional state of the listener. Existing products, which can prioritize using user's previous history, do not satisfy user's current emotional state. That's where *MoodSphere* puts an upper edge by providing user satisfactory music which not only make them enjoy but also resonates with their emotional state.

II. LITERATURE REVIEW

In this emerging era of digitalization, music streaming services such as Spotify, Amazon Music, Apple Music, and YouTube Music have comprehended the music discovery and usage by resonating the user's music listening experience at the extent by tailoring the music recommendation. These services collaborate with ample of Machine Learning Algorithms to efficiently predict and cater as per user's past choices or predict future choices while enhancing users' current emotional states utilizing recommendation algorithms. Mathew, Chooramun, and Sharif [4] have developed a chatbot-based music recommender system using Natural Language Processing (NLP) to suggest songs to user to personalize their experience more on a real time emotion and enhance it emotionally relatable which not only satisfy their current feeling but also to modulate the negative mood for their well-being.

Out of numerous innovations in AI-driven models using image recognition have made the industry more comprehended with various methodologies in hand. A case study on captivating users' real-time images to suggest music which resonates with the emotional state of users was done utilizing Convolutional Neural Networks (CNN) and Blockchain technology for safe and accurate emotion-based music recommendation. This AI model processes the lyrics of songs and user inputs relating to their emotional state by using advanced approaches such as emotional tagging, collaborative filtering, and content-based filtering, which helps enhance the user's emotional listening experience [5].

The most advanced approach to music recommendation is the Moodify system, which makes use of reinforcement learning to provide the expected emotional states of listeners. From all the traditional music recommendation systems using users' mood status to enlarge the listening experience, Moodify creates a more dynamic engagement between the user and the music selection process [6]. The UI of the web app shows the real-time evaluation of their webapp prototype with the visuals of the level of user happiness, systems responsiveness, and accurate recommendations. This study emphasizes on untapped potential of reinforcement learning that enhances mood and emotional well-being.

III. PROJECT REQUIREMENTS

1. *Software Requirement- Development:*

- IDE: Visual Studio, PyCharm
- Design: Figma, Miro Board, Idea Board
- Database: Firebase
- Development Technology: React, Tailwind CSS, Python, Flask
- Version Control: GitHub
- Project Management: JIRA
- Documentation: Microsoft Word, Excel, Google Docs

2. Hardware Requirement:
- Minimum of 6GB RAM
- Basic graphics GPU

3. Functional Requirement:
- The end user will be able to upload images and get music recommendation.
- End user could keep their vocabulary in check.
- Users will get notifications and information about their mood according to image uploaded.
- End user data would be secure, and the webapp would preserve privacy as much as possible.
- WebApp will include registration and login features.
- WebApp will provide clickable YouTube and Spotify links for listening experience.

IV. SYSTEM DIAGRAMS
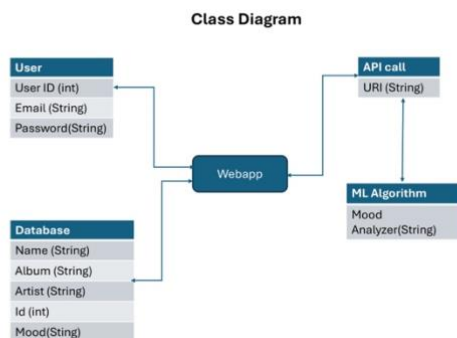
1. Class Diagram:

Fig:1 Class Diagram

Fig:1 is a class diagram which is an outlined structure of our WebApp- MoodSphere. It features a "User" class, along with the details of the user; "Database" class defines the information about the songs- song name, album, artist, and mood predicted by the model. "Webapp" plays a role as a centric node which interacts with "User" & "Database" while making "API calls" to an "ML Algorithm" item; with that said, it processes the user preferences to predict their mood. Further steps are to fetch and recommend the music from database that resonates with the user's emotions.

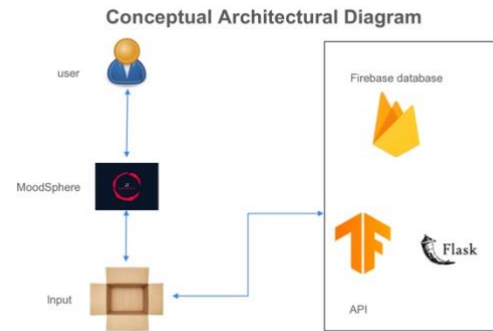**2. Conceptual Architectural Diagram:**

Fig:2 Conceptual Architectural Diagram

Fig:2 is a Conceptual Architecture Diagram which is an outlined structure of our WebApp- MoodSphere, that allows a user to input data to be further analysed by the program. It goes further to communicate with an API constructed using Flask, which is a Python-based lightweight framework. This API supports us in communicating with our Firebase database, which is a cloud-hosted NoSQL database which can captivate for storing or retrieving the data. The results are controlled ultimately using the Flask API meanwhile the maintenance and data storage are managed by Firebase.
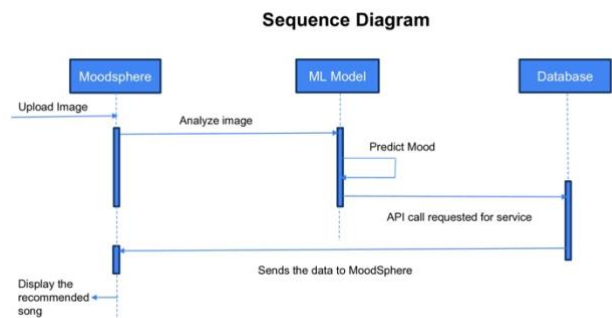
3. Sequence Diagram:

Fig:3 Sequence Diagram

Fig:3 is a Sequence Diagram which is an outlined sequence of our WebApp- MoodSphere. The Machine Learning model analyses the image uploaded by a user to predict the user's current emotional state to recommend the music which resonates with the mood. On the contrary, once the ML model predicts the mood, an API trigger is sent to the database to retrieve the songs which match the mood. This sequence is the basic flow from uploading the image of the user to getting music recommendations according to the mood of the user.
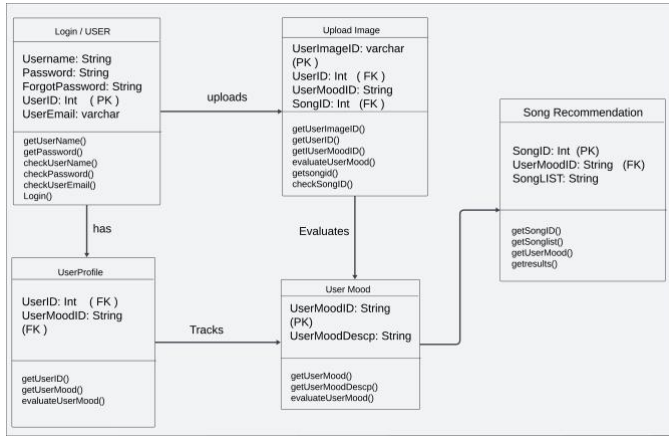
4. State Diagram:

Fig:4 State Diagram

Fig:4 is a State Diagram which is an outlined sequence of our WebApp- MoodSphere, which quantifies the connection between attributes such as User Login, Upload Image, User Profile, User Mood, and Song Recommendation. Both actions are associated with their individual user ID. The user can authenticate themselves by logging in using credentials to be able to upload images. The user's mood is determined and characterized, perhaps impacted by uploaded images, and used to assess their present condition. The mood plays a crucial role in creating customized music suggestions, where each song is assigned a distinct identification and a set of qualities or metadata. The diagram encompasses many techniques for data manipulation, including accessors and mutators for user particulars, picture and mood data, as well as functions to verify and assess these elements for the recommendation algorithm. ER Diagram
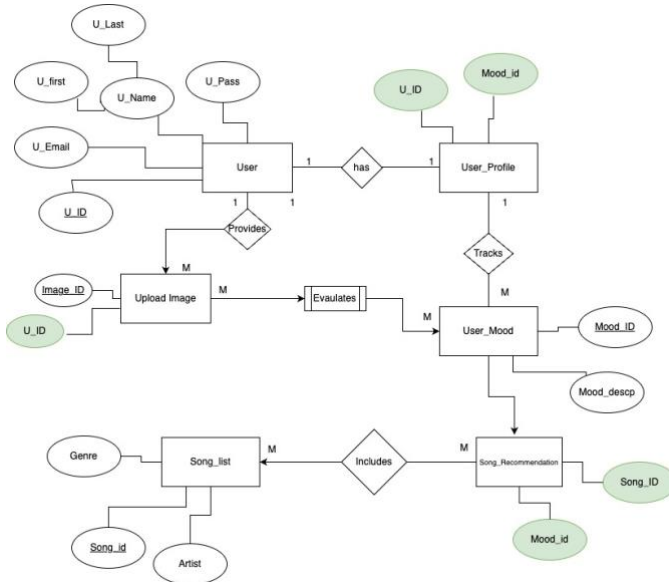
5. *ER Diagram:*

Fig:5 ER Diagram

Fig:5 is an ER Diagram which is an outlined sequence of our WebApp- MoodSphere, revolving around user interaction and personalization. In the system, each user with distinct attributes such as username, password, and email have one user profile where he/she can upload multiple images. The user profile contains the user's mood, which is identified using the images uploaded. From the term recommend, it may mean that mood is being evaluated in one way or the other to recommend songs that will be suitable for the user depending on the state he/she is in. The song list is where songs are categorized in genre and artist, where each song has a unique ID. The song recommendation entity presents a combination of mood pronoun and song ID, this term is vague, but it may mean that this system recommends songs in relation to the mood of the user; therefore, this is a personalized music system.

V. METHODOLOGY

MoodSphere is developed using a web application framework utilizing React for frontend tasks, Flask, which handles all backend tasks, and Firebase deals with real-time database storage and authentication. The user interface construction will be briefly covered in this section. It will also explain how we trained and used machine learning tools to develop our CNN model. For sprint planning and project management, we used Jira, while Visual Studio Code was our IDE for code editing and debugging. For this product- MoodSphere, functional directory was stored, managed, and tracked on GitHub.

A. User Frontend:

In a concise manner- Figma, the cloud-based design and mock-up software, was used to create an interface design that the team could work on in real time, from user flows to feature functionality. Moreover, MoodSphere's front end was developed using addressable JSX with React, a flexible, dynamic user interface through a component-based framework. All devices benefit from this architecture's responsiveness, from photo uploads to tailored audio choices. Also, we used Material-UI, a popular React UI framework with ready-made tool components that are easy to alter and operate on all displays. The integration keeps the design clean and current while making it easy to use on many devices.

B. Backend & API:

In MoodSphere, the API gateway facilitates communication between the user-faced web interface and the complex backend mood analysis model. Precisely, a user uploads an image through a web interface that is a part of the mood detection and music recommender service. Upon accomplishing this, a replica of the image is formed and adequately reserved. Also created is the image URL reference and the JSON payload of the image URL. Then the image URL comprising the JSON payload is submitted to the flask API. The choice of Flask for the API part is informed by the factors of its lazy learning curve and time-to-market especially when interposing a robust web service is a fantasy. The flask API accomplishes this request and accesses the image read from the served URL, triggers the mood analysis model, and initiates flooding the image down a steady prediction pipeline. Clearly, the API becomes a mid-

interface player between the user input, the UI, and the AI algorithm, as illustrated.

Generally, the API seeks to contribute to bridging the gap between the UI and the AI and make the prediction process simple or easily understood by the target end user. songs-by-artist: REFERENCES.entrySet()getParameter()At the root of MoodSphere is a powerful tool used to identify moods and tie them to an exhaustive library of modern music.

C. Machine Learning Model:
The MoodSphere application indeed has a unique heart, which is its sophisticated model for emotion recognition in images based on the ResNet50V2 architecture. ResNet50V2 is a specialized CNN architecture developed within image recognition algorithms, specifically for its depth and residual connections that can counteract the vanishing gradient problem. Thanks to these architectural specifics, the model performs image classification best, which is essentially the basis for its successful use in recognizing a broad spectrum of human emotions. The model is trained using the transfer learning principles – first, on a general image dataset, such as ImageNet, to capture generic image patterns and, secondly, on a designed specific dataset that has about 20,000 images of human expressions. Thus, the CNN model can learn image structures from a more substantial dataset and then focus solely on its task, which is recognizing human expressions – this allows learning from less data.

Furthermore, the model architecture is complemented by sophisticated computer vision techniques for preparing the input: the OpenCV library is used to detect faces with Haar Cascades, then the faces are converted to neutral gray, resized, and normalized to fit the ResNet50V2 input layer parameters. When the emotions are recognized, there is a final classification of the tensor output into the following categories: Angry, Disgust, Fear, Happy, Neutral, Sad, and Surprise – classification is implemented based on a SoftMax activation function for a probabilistic distribution of results. After receiving these results, they are converted into concrete moods thanks to the music recommendation system, which is also a vital part of the model. While the focus on the embedded sound player has not been part of development, it can be noted that the program successfully integrates with the recognized emotions by mapping them to the actual moods found in a parallel dataset of track-by-mood. The implemented music content-based recommendation stimulates pandas DataFrame operations, which manage the popularity of tracks and the general mood database agreed as a parallel activity.

$$s\left(x_i\right) = \frac{e^{x_i}}{\sum_{j=1}^{n} e^{x_j}}$$

Fig:6 SoftMax Function Formula [7]

VI. PRODUCT RESULTS

We achieved an accuracy of 75% and precision, one can rely on the quality of our model, primed after extensive training on a diverse group of over 20000 images. MoodSphere focuses on personalizing music for its users by detecting and feeling the mood of the current user based on the matched image materials using a highly sophisticated image detection algorithm.

Our easy-to-use web interface is optimized for easy navigation, and our platform ensures that the user logs into a platform specifically adapted to their special needs. After the log-in, the system allows the user to upload an image or record a live image which our system instantly screens to generate a source of music recommendation tailored entirely for the user. The music provided is lifted from the latest music trends across several genres and artists. Nonetheless, the influence is greatly inclined towards the current user based on their mood.

Furthermore, the MoodSphere platform is accoutred with a dashboard that avails users of an easy-to-use profile that enables the viewing of mood analysis ubiquity, music recommendable, and precise feedback information concerning music selection. Moreover, MoodSphere features a customer-driven approach together with essential elements such as the searchability of music databases and user preference for secure storage. This element ensures the unison experience of the music exposure is tailored for emotional fulfillment at each user's progress, further cementing the tool's breakthrough enhancement of mental well-being using personal music. Fig 7 to 12 demonstrates our UI.
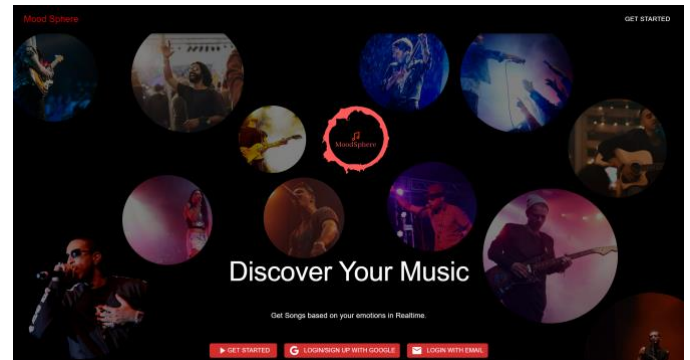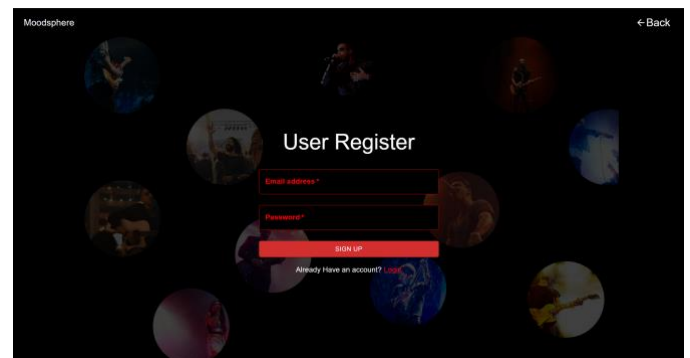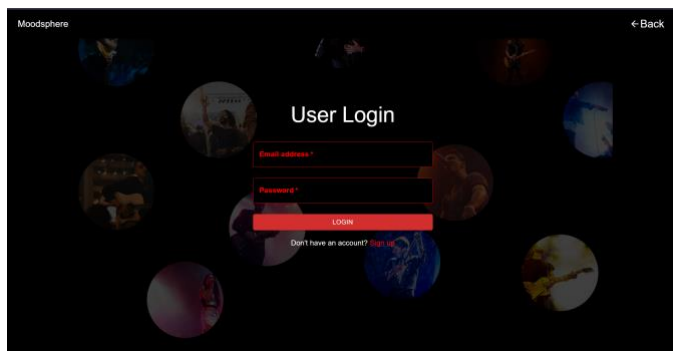

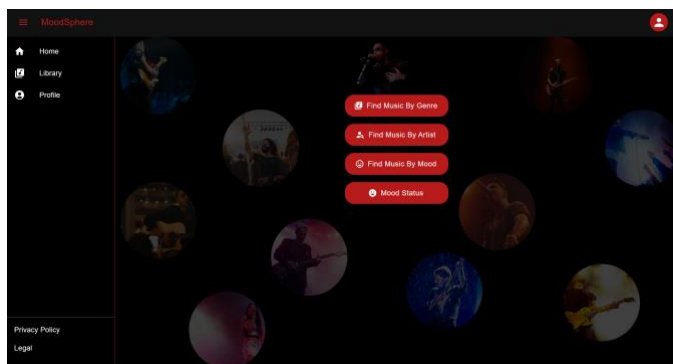Fig:7 Landing Page
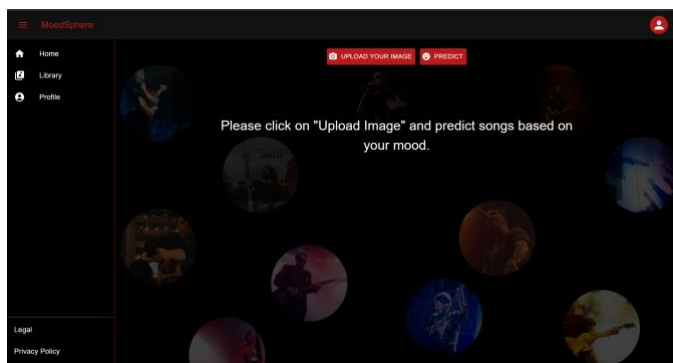

Fig:8 Sign Up Page

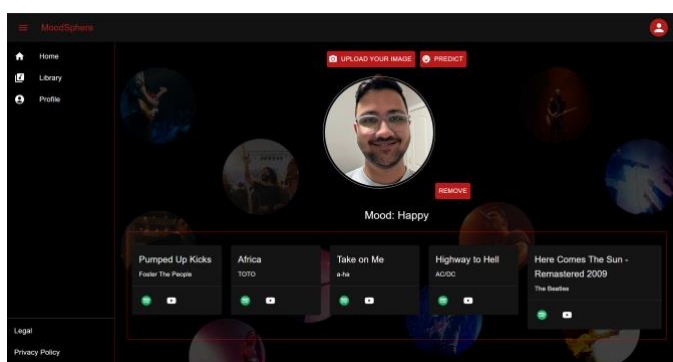Fig:9 Login Page

Fig:10 Home Page

Fig:11 Find Music by Mood Page

Fig:12 Predicted Mood with Recommended Music

VII. CONCLUSION

In the end, MoodSphere is a living example paving the way for the integration of technology and music, offering a remedy to heal the universally acknowledged common issue of emotional wellbeing. By utilizing a sophisticated image detection algorithm and individualized music suggestions, this web tool shatters the walls, paving the way to a therapeutic universe of possibilities where users can escape and revive. MoodSphere's demonstrated precision and customizability suggest vast potential for transformation of the field of musical discovery.

MoodSphere can urge music to be much more than simply another art form; it can be a source of psychological solace and a source of lifelong development. As a vision of the future, MoodSphere marks the start of a one-of-a-kind song recommendation heritage plan. However, our serious music library extension ambitions and efforts to collaborate with music libraries and integrate genuine time temper detection won't fade away. MoodSphere should be an indicator of the future, technology that not only knows what individuals want to feel but also gives them exactly that. An audio experience that is a rewarding as it is individual.

VIII. REFERENCES

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