MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Project Report

on

MoodBot Music Recommender

Submitted By:

DEVANSHU JAIN

0901CS191031

DIVYAM

0901CS191034

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE

GWALIOR - 474005 (MP) est. 1957

MAY-JUNE 2022

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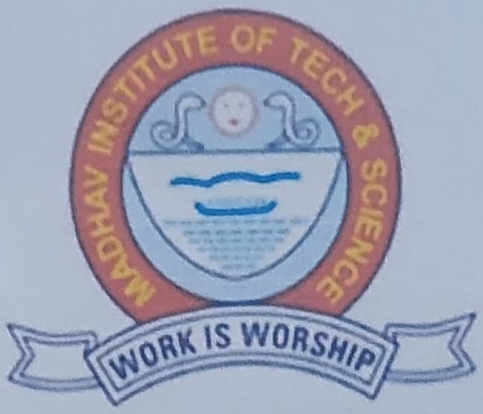

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CERTIFICATE

This is certified that **DEVANSHU JAIN (0901CS191031)** has submitted the project report titled **MoodBot Music Recommender** under the mentorship of **MIR SHAHNAWAZ AHMAD, ASSISTANT PROFESSOR, CSE DEPARTMENT** in partial fulfilment of the requirement for the award of degree of Bachelor of Technology in Computer Science and Engineering from Madhav Institute of Technology and Science, Gwalior.

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MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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DECLARATION

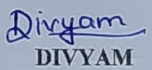
I hereby declare that the work being presented in this project report, for the partial fulfilment of requirement for the award of the degree of Bachelor of Technology in Computer Science and Engineering at Madhav Institute of Technology & Science, Gwalior is an authenticated and original record of my work under the mentorship of **MIR SHAHNAWAZ AHMAD, ASSISTANT PROFESSOR, CSE DEPARTMENT**. I declare that I have not submitted the matter embodied in this report for the award of any degree or diploma anywhere else.

DEVANSHU JAIN

0901CS191031

(2019-2023)

Computer Science and Engineering



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MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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The full semester project has proved to be pivotal to my career. I am thankful to my institute, **Madhav Institute of Technology and Science** to allow me to continue my disciplinary/interdisciplinary project as a curriculum requirement, under the provisions of the Flexible Curriculum Scheme (based on the AICTE Model Curriculum 2018), approved by the Academic Council of the institute. I extend my gratitude to the Director of the institute, **Dr. R. K. Pandit** and Dean Academics, **Dr. Manjaree Pandit** for this.

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ABSTRACT

Nowadays, from a vast range of songs, it's hard to find an accurate music which can match to our mood. Also it becomes tough for us to determine our mood. There has been a lot of different suggestion frameworks available for themes like music, dining, and shopping depending upon the emotion or mood of the user. The main objective of our project is to create a music recommendation system to provide better suggestions to the users to enlighten up their mood or to feel the way they want. The analysis of the facial expression/user emotion may lead to understanding the current emotional or mental state of the user. Music is one area where there is a wide range of suggestions for the clients in light of their inclinations and also recorded information. Recent research and reports affirm that people react constantly to music and that music profoundly affects an individual's cerebrum action. This undertaking revolves around making an application to recommend music for users dependent on their mood by catching their facial expressions. Our objective primarily revolves around the identification of human emotions or their mood in a music player. In this system, computer vision algorithms (Open-CV) are utilized to decide the user's mood through their facial expressions. By developing a recommendation system, it could assist a user to make a decision regarding which music one should listen to helping the user to reduce his/her stress levels. The user would not have to waste any time in searching or to look up for songs and the best track matching the user's mood is detected, and songs would be shown to the user according to his/her mood. The main aim is to make the user's search faster, efficient, optimized and more accurate. A picture of the client or user is clicked using the webcam of the system followed by his/her favourite singer's name and their preferred language and then as per the mood/emotion of the user an appropriate song from the playlist of the user is shown matching the user's requirement.

KEYWORDS

Recognition, Artificial intelligence, OpenCV Application

सार

आजकल, गानों की एक विस्तृत श्रृंखला से, एक सटीक संगीत खोजना मुश्किल है जो हमारे मूड से मेल खा सके। साथ ही हमारे लिए अपने मूड को निर्धारित करना कठिन हो जाता है। उपयोगकर्ता की भावना या मनोदशा के आधार पर संगीत, भोजन और खरीदारी जैसे विषयों के लिए कई अलग-अलग सुझाव ढांचे उपलब्ध हैं। हमारी परियोजना का मुख्य उद्देश्य एक संगीत सिफारिश प्रणाली बनाना है जो उपयोगकर्ताओं को उनके मूड को बेहतर बनाने के लिए या उनके मनचाहे तरीके से महसूस करने के लिए बेहतर सुझाव प्रदान करे। चेहरे की अभिव्यक्ति/उपयोगकर्ता की भावनाओं के विश्लेषण से उपयोगकर्ता की वर्तमान भावनात्मक या मानसिक स्थिति को समझने में मदद मिल सकती है। संगीत एक ऐसा क्षेत्र है जहां ग्राहकों के लिए उनके झुकाव और रिकॉर्ड की गई जानकारी के आलोक में सुझावों की एक विस्तृत श्रृंखला है। हाल के शोध और रिपोर्ट इस बात की पुष्टि करते हैं कि लोग संगीत पर लगातार प्रतिक्रिया करते हैं और संगीत किसी व्यक्ति के मस्तिष्क क्रिया को गहराई से प्रभावित करता है। यह उपक्रम उपयोगकर्ताओं के चेहरे के भावों को पकड़कर उनके मूड पर निर्भर उपयोगकर्ताओं के लिए संगीत की सिफारिश करने के लिए एक एप्लिकेशन बनाने के इर्द-गिर्द घूमता है। हमारा उद्देश्य मुख्य रूप से एक म्यूजिक प्लेयर में मानवीय भावनाओं या उनके मूड की पहचान के इर्द-गिर्द घूमता है। इस प्रणाली में, कंप्यूटर विज़न एल्गोरिदम (ओपन-सीवी) का उपयोग उपयोगकर्ता के चेहरे के भावों के माध्यम से उसके मूड को तय करने के लिए किया जाता है। एक सिफारिश प्रणाली विकसित करके, यह उपयोगकर्ता को यह निर्णय लेने में सहायता कर सकता है कि उपयोगकर्ता को अपने तनाव के स्तर को कम करने में मदद करने के लिए कौन सा संगीत सुनना चाहिए। उपयोगकर्ता को गाने खोजने या खोजने में कोई समय बर्बाद नहीं करना पड़ेगा और उपयोगकर्ता के मूड से मेल खाने वाले सबसे अच्छे ट्रैक का पता लगाया जाएगा, और उपयोगकर्ता को उसके मूड के अनुसार गाने दिखाए जाएंगे। मुख्य उद्देश्य उपयोगकर्ता की खोज को तेज, कुशल, अनुकूलित और अधिक सटीक बनाना है। क्लाइंट या उपयोगकर्ता की एक तस्वीर सिस्टम के वेबकैम का उपयोग करके क्लिक की जाती है, उसके बाद उसके पसंदीदा गायक का नाम और उनकी पसंदीदा भाषा होती है और फिर उपयोगकर्ता की मनोदशा/भावना के अनुसार उपयोगकर्ता की प्लेलिस्ट से एक उपयुक्त गीत मेल खाता हुआ दिखाया जाता है। उपयोगकर्ता की आवश्यकता।

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Chapter 1: Project Overview

1.1 Introduction

People tend to express their emotions, mainly by their facial expressions. Music has always been known to alter the mood of an individual. Capturing and recognizing the emotion being voiced by a person and displaying appropriate songs matching the one's mood and can increasingly calm the mind of a user and overall end up giving a pleasing effect. The project aims to capture the emotion expressed by a person through facial expressions. A music player is designed to capture human emotion through the web camera interface available on computing systems. The software captures the image of the user and then with the help of image segmentation and image processing techniques extracts features from the face of a target human being and tries to detect the emotion that the person is trying to express.

The project aims to lighten the mood of the user, by playing songs that match the requirements of the user by capturing the image of the user. Since ancient times the best form of expression analysis known to humankind is facial expression recognition. The best possible way in which people tend to analyse or conclude the emotion or the feeling or the thoughts that another person is trying to express is by facial expression. In some cases, mood alteration may also help in overcoming situations like depression and sadness. With the aid of expression analysis, many health risks can be avoided, and also there can be steps taken that help brings the mood of a user to a better stage.

1.2 Objective and Scope

The objective of MoodBot is to identify the mood of the user based on the facial data and further suggest him/her a song based on his emotions. This can be used to further ease the burden on the user for finding a relevant song according to his/her mood. It incorporates some niche technologies to achieve this goal. Emotion detection may help in many more such real time applications.

1.3 Project Features

In this project we have an interactive website which takes the language and singer's name from user and analyses his facial expression using deep learning algorithms. Based on the emotion detected further it passes all three input as a query to Youtube search and a song matching to the users mood is displayed.

1.4 Feasibility

Feasibility study is quite important part of any software development. In this we beforehand analyses our project based on some criteria such as benefits, costs, time, technology, skills required to complete the project. A simple system is proposed here for the music recommendation using face emotion recognition. It suggests music by extracting different facial emotion of a person: Happy, anger, surprise, neutral. The webapp is feasible to work for simple facial expressions but is not able to detect for complex expressions i.e. varying facial expressions. The project works fine even on low end systems as well needing that the images taken must me at least 320p for better landmark points creation.

1.5 System Requirements

- Working Webcam
- Minimum 1 GB ram
- Windows XP or above

1.6 Technologies Used

- Google Collab: Collab allows anybody to write and execute arbitrary python code through the browser, and is especially well suited to machine learning, data analysis and education.
- Streamlit: It is an open-source app framework for Machine Learning and Data Science teams. Create beautiful web apps.
- OpenCV: It provides a real-time optimized Computer Vision library, tools, and hardware. It also supports model execution for Machine Learning (ML)
- Model Used: Fisherface is one of the popular algorithms used in face recognition, and is widely believed to be superior to other techniques, such as eigenface because of the effort to maximize the separation between classes in the training process.

Chapter 2: Literature Review

Renuka R Londhe et al. [1] proposed a paper which focused on the study of changes in the curvatures of the face and the intensities of the corresponding pixels. The author used Artificial Neural Networks(ANN), which was used to classify the emotions. The author also proposed various approaches for a playlist. Zheng et al. [2]proposed two significant categories for facial feature extraction, which included Appearance-based feature extraction and geometric based feature extraction, which included extraction of some essential points of the face such as mouth, eyes, and eyebrows.Nikhil et al. [3].determines the mindset of the user by using facial expression Humans often express their feeling by their expressions, hand gestures, and by raising the voice of tone but mostly humans express their feelings by their face. Emotion-based music player reduces the time complexity of the user. Generally, people have a large number of songs on their playlist. Playing songs randomly does not satisfy the mood of the user. This system helps user to play songs automatically according to their mood. The image of the user is captured by the web camera, and the images are saved. The images are first converted from RGB to binary format. This process of representing the data is called a feature-point detection method. This process can also be done by using Haar Cascade technology provided by Open CV. He focused on various approaches that can handle audio and/or visual recordings of displays of affective states. The paper provides a detailed review of audio/visual computing methods. The effect is described as a prototype of emotion categories which include happiness, sadness, fear, anger, disgust, and surprise. This paper focused on discussing the challenges in computing methods for the development of automatic, spontaneous affect recognizer, which helped in emotion detection. It also identified some problems that have been missed or avoided in uni-modal posed emotion recognition. Parul Tambe et al. [7] proposed an idea which automated the interactions between the users and music player, which learned all the preferences, emotions and activities of a user and gave song selection as a result. The various facial expressions of users were recorded by the device to determine the emotion of the user to predict the genre of the music. Jayshree Jha et al. [11].proposed an emotion-based music player using image processing This showed how various algorithms and techniques that were suggested by different authors in their research could be used for connecting the music player along with human emotions. It has thus helped in reducing the efforts of user in creating and managing playlist and providing an excellent experience to the music listeners by bringing them the most suitable song according to the user's his/her current expression. Anukritine etal. [18] came up with an algorithm that gives a list of songs from the user's playlist in accordance with the user's emotion. The algorithm which was designed was focused on having less computational time and also thus reduces the cost included in using various hardware. The main idea was to segregate the emotions into five categories i.e., Joy, sad, anger, surprise and fear also provided a highly accurate audio information retrieval approach that extracted relevant information from an audio signal in less time. Aditya et al. [19] developed an android application which acts as a customized music player for a user using image processing to analyze and

present songs to user according to the user's mood. The application was developed using ellipse characteristics, and in the third part, the eye and lip optimal parameters were used to classify the emotions. The obtained results showed that the speed of facial recognition was far better than other usual approaches. Prof. Nutan Deshmukh et al. [21] focused on creating a system that fetches the emotion of the user using a camera and then automates the result using the emotion detection algorithm. This algorithm captures the mood of the user after every decided interval of time as the mood of the user may not be the same after some time; it may or may not change. The proposed algorithm on an average calculated estimation takes around 0.95-1.05 sec to generate an emotionbased music system, which was better than previous existing algorithms and reduces the cost of designing. Chang Liuet al[24] described a system that makes use of Brain-Computer Interfaces, also called as BCI. BCI makes use of devices to send signals to the processing systems. EEG hardware is used in to monitor the person's cognitive state of mind. The drawback of the scheme is that they require the input from the user's brain continuously to perform the classification. An algorithm based on MID is used to continuously monitor and process the signals received from the brain of the user and use these signals to actively monitor and generate emotions that the user is currently experiencing. Swati Vaid etal[23] reviewed EEG - Electroencephalography (EEG) is a form of medical science that records the electrical activity from the neurons of brain cells. The electrical activity of the neurons from within the cells of the brain is registered. Based on the recorded activity of the neurons an approximation is made, and the emotion of the person is estimated from that analysis. This method mentioned above, although serves the purpose of getting the activity of brain cells but fails to serve the purpose of portability and economics.

Chapter 3: Detailed Design

3.1 Algorithm

Focusing on data dimension a few algorithms extract facial measurements and the next react certain relevant facial region. Advantages of the proposed algorithm Using the static image gives a great advantage on the defect of pose variations. The three most faced problems are the presence of unidentified elements like glasses or beard, quality of static images and unidentifiable facial gesture. Face Feature Extraction Pictures are spoken to as weight edeigen vectors that are consolidated and known as "Eigenfaces". One of the focal points taken by Eigen faces is the comparability between the pixels among pictures by methods for their covariance network. Following are the means required to perceive the outward appearances utilizing this Eigenfaces approach:

Let $X=\{x_1,x_2,\ldots,x_n\} x_i \in R^d$

Here X be a random vector with observations.

1. Calculate the mean μ:

$$\mu=\frac{n}{1}\sum_{i=1}^{n}x_i$$

2. Calculate the covariance matrix S:

$$S=\frac{n}{1}\sum_{i=1}^{n}(x_i-\mu)(x_i-\mu)^T$$

3. Compute the eigenvectors v_i and eigenvalues λ_i of S:

$$Sv_i=\lambda_i v_i,\ i=1,\ 2,\ldots,\ n$$

4. The eigenvectors are arranged by their egeinvalue in descending order:

$$y=W^T(x-\mu)$$

5. Calculate eigenfaces.

3.2 Proposed Architecture

The proposed system can detect the facial expressions of the user and based on his/her facial expressions extract the facial landmarks, which would then be classified to get a particular emotion of the user. Once the emotion has been classified the songs matching the user's emotions would be shown to the user.

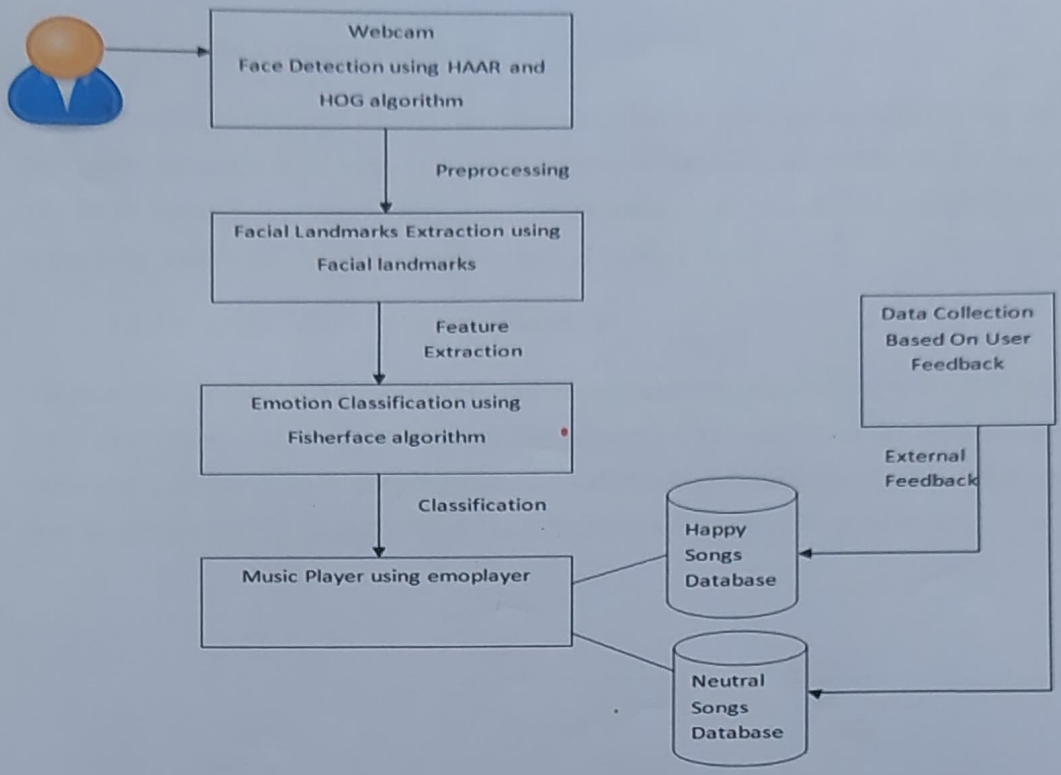

Fig 3.2.1 Architectural Design

3.3 Methodologies

3.3.1 Emotion Extraction Module:

The image of the user is captured with the help of a camera/webcam. Once the picture captured, the frame of the captured image from webcam feed is converted to a grayscale image to improve the performance of the classifier, which is used to identify the face present in the picture. Once the conversion is complete, the image is sent to the classifier algorithm which, with the help of feature extraction techniques can extract the face from the frame of the web camera feed. From the extracted face, individual features are obtained and are sent to the trained network to detect the emotion expressed by the user. These images will be used to train the classifier so that when a completely new and unknown set of images is presented to the classifier, it is able to extract the position of facial landmarks rom those images based on the knowledge that it had already acquired from the training set and return the coordinates of the new facial landmarks that it detected. The network is trained with the help of CK extensive data set. This is used to identify the emotion being voiced by the user.

3.3.2 Audio Extraction Module:

After the emotion of the user is extracted the music/audio based on the emotion voiced by the user is displayed to the user, a list of songs based on the emotion is displayed, and the user can listen to any song he/she would like to. Based on the regularity that the user would listen to the songs are displayed in that order. This module is deployed using the help of Youtube search.

3.3.3 Emotion - Audio Integration Module:

The emotion extracted from the user combined with the language and singer's name entered by the user is passed as an query to the Youtube Search. For example, if the emotion or the facial feature is categorized under happy, the language is selected as Hindi, the singer's name as Arijit Singh then songs from the ("Arijit Singh"+ "happy"+ "Hindi") are displayed to the user on Youtube website.

Chapter 4: Final Analysis and Design

This study proposes a music recommendation system which extracts the image of the user, which is captured with the help of a camera attached to the computing platform. Once the picture has been captured, the captured frame of the image from webcam feed is then being converted to a grayscale image to improve the performance of the classifier that is used to identify the face present in the picture. Once the conversion is complete, the image is sent to the classifier algorithm which, with the help of feature extraction techniques is able to extract the face from the frame of the web camera feed. Once the face is extracted individual features from the face is extracted and is sent to the trained network to detect the emotion expressed by the user. A classifier that is used to detect or obtain the facial landmarks from the face of the user is trained on HELEN dataset. HELEN dataset contains more than 2000 images. These images will be used to train the classifier so that when a completely new and unknown set of images is presented to the classifier, it is able to extract the position of facial landmarks from those images based on the knowledge that it had already acquired from the training set and return the coordinates of the new facial landmarks that it detected. The network is trained with the help of CK extensive data set. This is used to identify the emotion being voiced by the user. Once this has been detected, an appropriate song is selected by the Youtube search query that would best match the mood of the user. The overall idea behind making the system is to enhance the experience of the user and ultimately relieve some stress or lighten the mood of the user. The user does not have to waste any time in searching or to look up for songs and the best track matching the user's mood is detected and played automatically by the Youtube. The image of the user is captured with the help of a webcam. The user's picture is taken and then as per the mood/emotion of the user an appropriate song from the playlist of the user is played matching the user's requirement. The system has successfully been able to capture the emotion of a user. It has been tested in a realtime environment for this predicate. It has to be, however, tested in different lighting conditions to determine the robustness of the developed system. The system has also been able to grab the new images of the user and appropriately update its classifier and training dataset. The system was designed using the facial landmarks scheme and is tested under various scenarios for the result that would be obtained. It is seen that the classifier has an accuracy of more than 80 percent for most of the test cases, which is pretty good accuracy in terms of emotion classification. It can also be seen that the classifier can accurately predict the expression of the user in a real-time scenario when tested live for a user.

4.1 Project Output

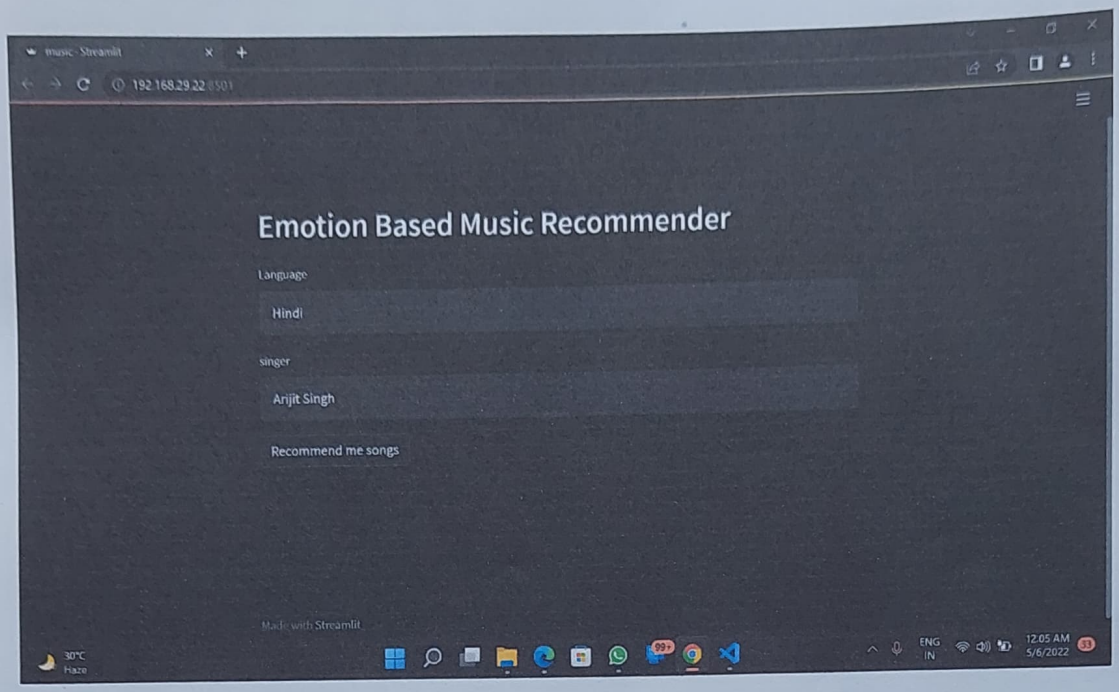

Fig 4.1 Webapp View

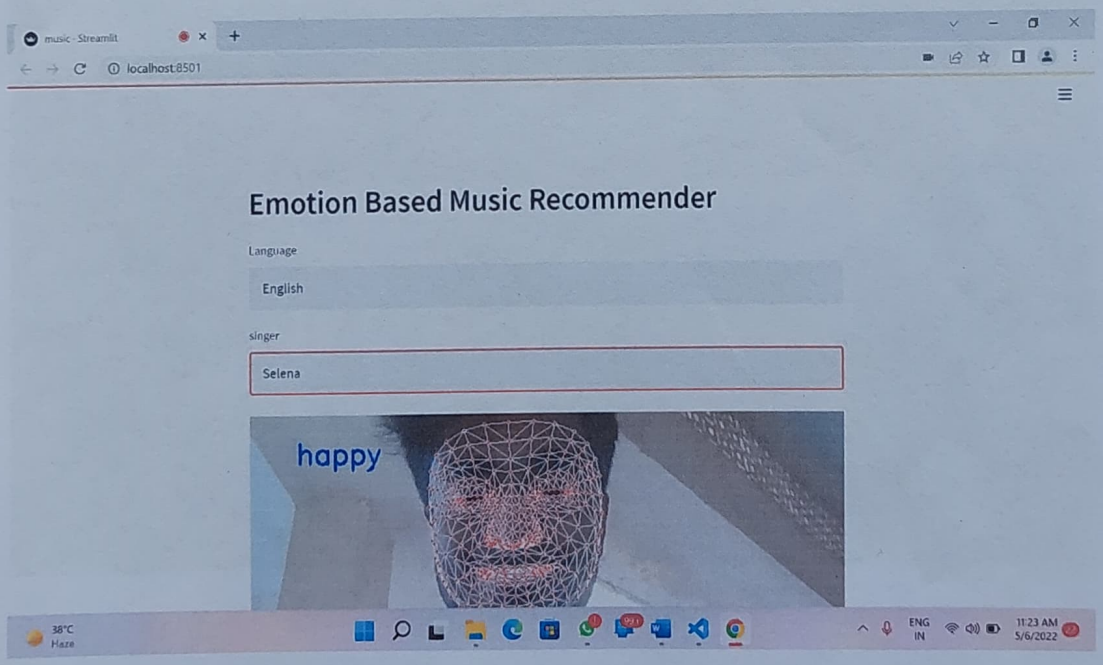

Fig 4.2 “Happy” mood detection

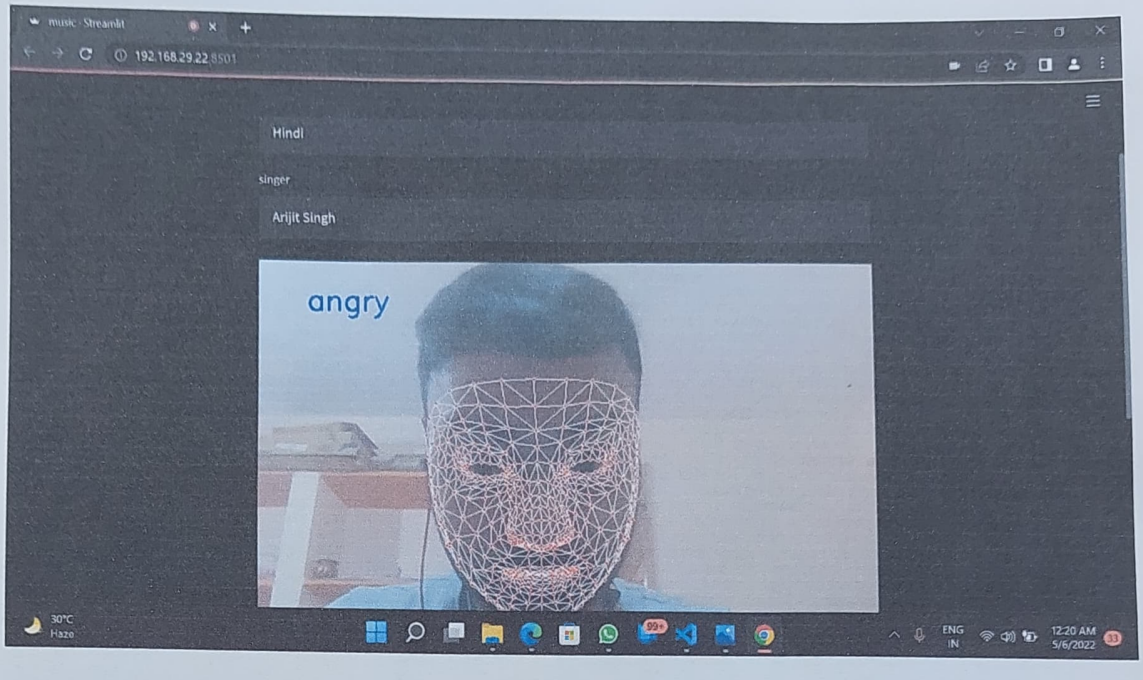

Fig 4.3 “Angry” mood detection

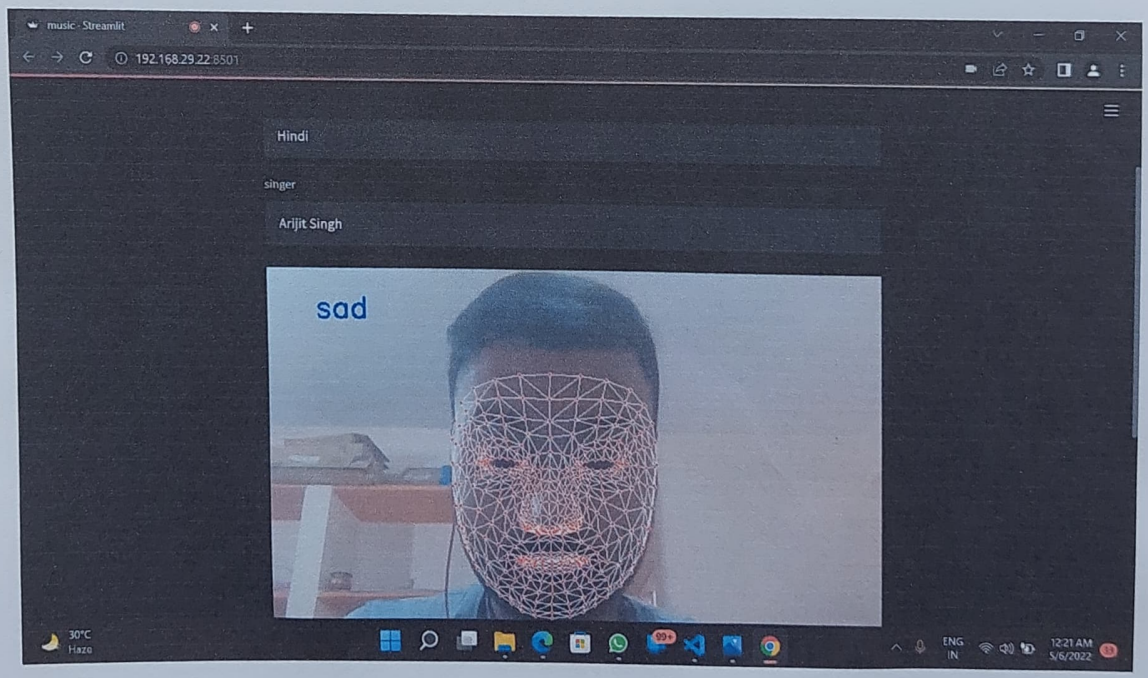

Fig 4.4 “Sad” mood detection

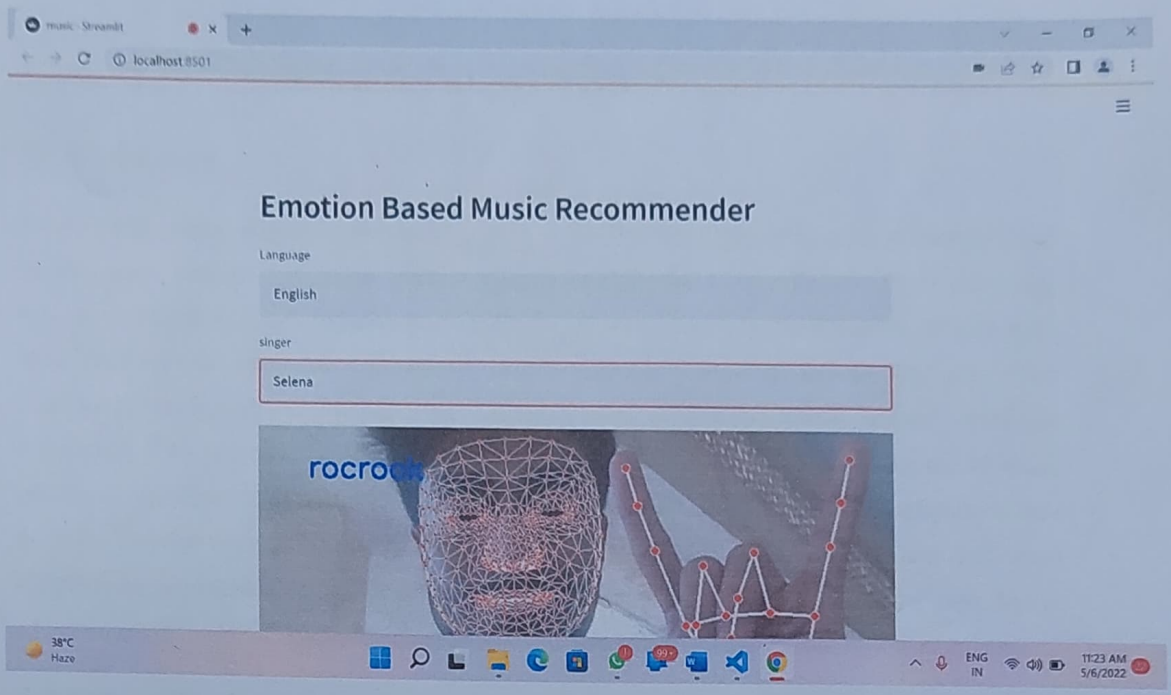

Fig 4.5 “RocRock” mood detection

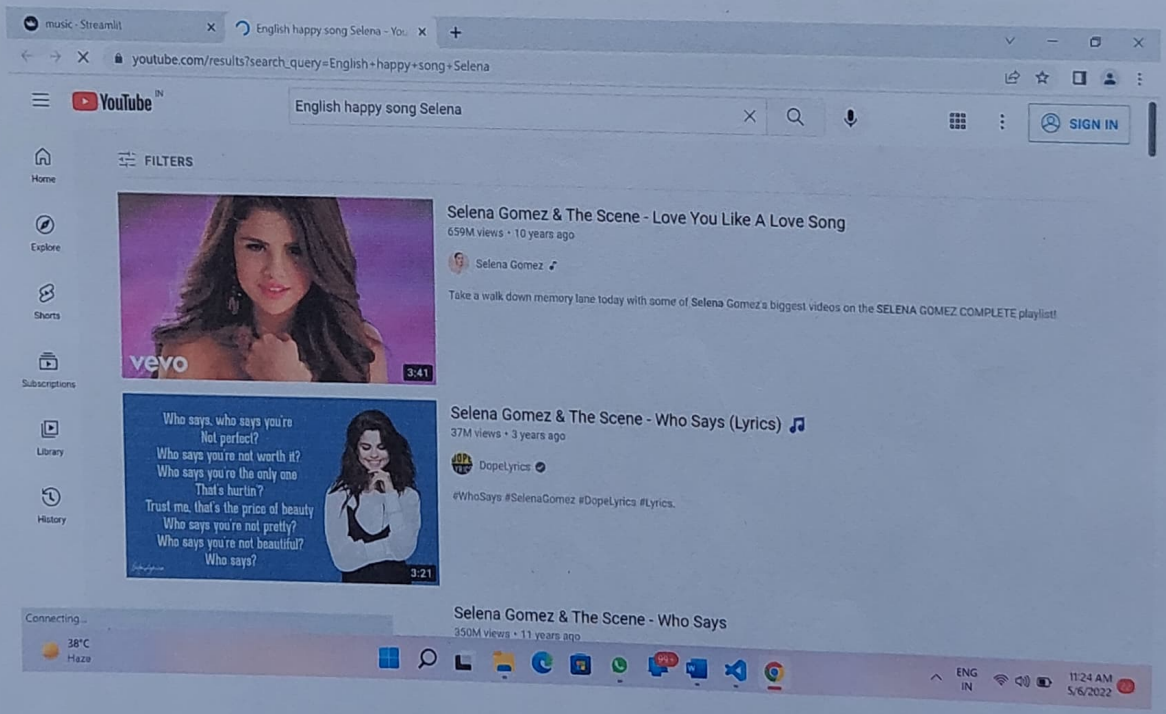

Fig 4.6 Song Output Displayed on YouTube

Chapter 5: Conclusion & Future Work

5.1 Conclusion

Emotion recognition using facial expressions is one of the important topics of research and has gathered much attention in the past. It can be seen that the problem of emotion recognition with the help of image processing algorithms has been increasing day by day. Researchers are continuously working on ways to resolve this by the use of different kinds of features and image processing methods. The applications of image processing algorithms in the field of both medical science and human science are of vast importance. There are continuously new ways and methods being developed that make use of image processing algorithms to extract the emotion of the user and make use of the extracted emotion to treat the user. Emotion recognition has gained a lot of importance in all aspects of life and if a robust algorithm implemented which can accurately classify the emotions of the person, then a great deal of advancement in the industry can be achieved with the help of this.

5.2 Future Work

We are planning to build upon this current platform. We will make the website interactable to the user. So that the user may interact with the website and based on both facial expressions and the conversation a song is suggested to him. It will further increase the chances of correct song suggestions.

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