VISVESVARAYA TECHNOLOGICAL UNIVERSITY
"JNANA SANGAMA", BELAGAVI - 590 018

A PROJECT REPORT

on

"MUSIC PLAYER BASED ON FACIAL EMOTION"

Submitted by

AKARSH C SHETTY	4SF19CS015
MONISH SHETTY	4SF19CS096
SANJAY SHETTY	4SF19CS141
VAMSIKRISHNA THOTA	4SF19CS179

In partial fulfillment of the requirements for the award of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE & ENGINEERING

Under the Guidance of

Ms. Vanishree B S

Assistant Professor, Department of CSE

at

SAHYADRI

College of Engineering & Management

(An Autonomous Institution)

Adyar, Mangaluru - 575 007

2022 - 23

SAHYADRI

College of Engineering & Management

(An Autonomous Institution)
Adyar, Mangaluru - 575 007

Department of Computer Science & Engineering

CERTIFICATE

This is to certify that the project entitled **"MUSIC PLAYER BASED ON FACIAL EMOTION"** has been carried out by **AKARSH C SHETTY (4SF19CS015), MONISH SHETTY (4SF19CS096), SANJAY SHETTY (4SF19CS141) and VAMSIKRISHNA THOTA (4SF19CS179)**, the bonafide students of Sahyadri College of Engineering & Management in partial fulfillment for the award of Bachelor of Engineering in Computer Science & Engineering of Visvesvaraya Technological University, Belagavi during the year 2022 - 23. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of the project work prescribed for the said degree.

Signature of the Guide	**Signature of the HOD**	**Signature of the Principal**
Ms. Vanishree B S	Dr. Nagesh H R	Dr. Rajesha S

External Viva:

Examiner's Name	Signature with Date
1.	....
2.	....

SAHYADRI

College of Engineering & Management

(An Autonomous Institution)
Adyar, Mangaluru - 575 007

Department of Computer Science & Engineering

DECLARATION

We hereby declare that the entire work embodied in this Project Report titled **"MUSIC PLAYER BASED ON FACIAL EMOTION"** has been carried out by us at Sahyadri College of Engineering and Management, Mangaluru under the supervision of **Ms. Vanishree B S,** for the award of **Bachelor of Engineering** in **Computer Science & Engineering**. This report has not been submitted to this or any other University for the award of any other degree.

AKARSH C SHETTY (4SF19CS015)

MONISH SHETTY (4SF19CS096)

SANJAY SHETTY (4SF19CS141)

VAMSIKRISHNA THOTA (4SF19CS179)

Dept. of CSE, SCEM, Mangaluru

Abstract

Every individual human might have completely different faces; however, their expressions tell us the same story and it notably plays a significant role in extraction of an individual's emotions and behavior. Music is the purest form of art and a medium of expression, which is known to have a greater connection with a person's emotions. It has a novel ability to lift one's mood. This project system focuses on building an efficient music player which works on emotion of user using facial recognition techniques. The facial features extracted will generate a system thereby reducing the effort and time involved in doing it manually. Facial data is captured by employing a camera. The emotion module makes use of deep learning techniques to spot the exact mood relative to that expression. The accuracy of mood detection module in the system for real time footage is above 80 percentage, While for static pictures it is 95 to one hundred percent. Therefore, it brings out higher accuracy relating to time and performance.

Acknowledgement

It is with great satisfaction and euphoria that we are submitting the Project Report on **"MUSIC PLAYER BASED ON FACIAL EMOTION"**. We have completed it as a part of the curriculum of Visvesvaraya Technological University, Belagavi for the award of Bachelor of Engineering in Computer Science & Engineering.

We are profoundly indebted to our guide, **Ms. Vanishree B S**, Assistant Professor, Department of Computer Science & Engineering for innumerable acts of timely advice, and encouragement and We sincerely express our gratitude.

We also thank , **Mr. Suhas A Bhyratae** , **Ms. Parashakthi** and **Mrs. Pooja N S** Project Coordinators, Department of Computer Science & Engineering for their constant encouragement and support extended throughout.

We express our sincere gratitude to **Dr. Nagesh H R**, Head & Professor, Department of Computer Science & Engineering for his invaluable support and guidance.

We sincerely thank **Dr. Rajesha S**, Principal, Sahyadri College of Engineering & Management, who has always been a great source of inspiration.

Finally, yet importantly, We express our heartfelt thanks to our family & friends for their wishes and encouragement throughout the work.

AKARSH C SHETTY (4SF19CS015)
MONISH SHETTY (4SF19CS096)
SANJAY SHETTY (4SF19CS141)
VAMSIKRISHNA THOTA (4SF19CS179)

Table of Contents

List of Figures

List of Tables

Chapter 1

Introduction

Depression is a prevalent mental health condition that affects millions of individuals worldwide. While there are various therapeutic approaches to managing depression, music has long been recognized as a powerful tool for emotional regulation and mood enhancement. In recent years, music recommendation systems based on facial expressions have emerged as a potential solution to help individuals overcome depression and improve their well-being. Music recommendation systems based on facial expressions utilize computer vision algorithms and emotion recognition techniques to analyze users' facial expressions and identify their emotional states. By capturing and interpreting facial cues, such as expressions of happiness, sadness, or other emotions, these systems gain insights into the user's emotional state. Leveraging this information, the system can recommend music that aligns with positive emotions and has the potential to uplift the user's mood. The personalized music recommendations provided by these systems can act as a form of musical therapy, offering a tailored listening experience that resonates with the user's emotions. By suggesting music known for boosting mood, fostering relaxation, or evoking feelings of happiness, the system aims to positively impact the user's emotional well-being. This approach taps into the power of music to evoke emotions and trigger positive feelings, providing individuals experiencing depression with a potential tool for self-care and emotional support.

1.1 Purpose

Music recommendation systems based on facial expressions offer a promising approach to help individuals overcome depression. By analyzing users' facial expressions and identifying their emotional states, these systems provide personalized music suggestions that align with positive emotions. Leveraging the power of music to regulate emotions and uplift mood, the recommendations aim to create a tailored listening experience that resonates with users' emotions. This form of musical therapy offers a potential tool for self-care, emotional support, and comfort for individuals experiencing depression. However, it's important to note that these systems should complement professional mental health treatment, and individuals are encouraged to seek guidance from mental health professionals for comprehensive care and support. With their ability to bridge the gap between music and emotions, music recommendation systems based on facial expressions hold the promise of enhancing emotional well-being and providing individuals with a unique pathway towards managing depression and improving their overall quality of life.

1.2 Scope

Music recommendation systems based on facial expressions have a broad scope, catering to individuals seeking emotional support and personalized music experiences. They can be implemented in smartphone apps and online platforms, leveraging computer vision algorithms, emotion recognition techniques, and music databases. The scope emphasizes the need for integration with professional mental health treatment and highlights the accessibility of these systems for individuals with internet access. Ultimately, the scope aims to provide a tailored approach for individuals with depression, utilizing music's therapeutic power to regulate emotions and enhance well-being.

1.3 Overview

Music recommendation systems based on facial expressions target individuals seeking emotional support and personalized music experiences, leveraging computer vision algorithms and emotion recognition techniques. They can be implemented on various platforms, utilizing music databases to suggest songs based on identified emotions. The systems complement professional mental health treatment and aim to regulate emotions, provide support, and enhance well-being for individuals with depression, offering an accessible and tailored approach to music listening.

Chapter 2

Literature Survey

Suci Dwijayanti, Rahmad Rhedo Abdillah, and Hera Hikmarika.,[1] provides a comprehensive overview of the application of Convolutional Neural Networks (CNN) in the domains of facial expression recognition and face recognition. It explores about how CNNs can effectively analyze and classify facial expressions, enabling machines to understand and interpret human emotions. It uses the architecture and design of the CNN models used for facial expression recognition, highlighting the importance of feature extraction, convolutional layers, and pooling layers in capturing and discerning subtle facial cues that convey different emotional states. In addition to facial expression recognition, face recognition is also used for focusing on the use of CNNs to identify and verify individuals based on their facial features, So that the effectiveness of CNNs in extracting discriminative facial features, training the models with large-scale datasets, and evaluating their performance in terms of accuracy and efficiency will be high.

S. Kherchaoui and A. Houacine.,[2] presents a novel system for facial expression identification using the Euclidean distance of facial edges. Limitations of traditional approaches by leveraging the geometric properties of facial edges can be reduced. The system involves preprocessing the facial images, extracting facial edges using the Canny edge detector, and representing each expression as a set of distances between corresponding points on the edges. Machine learning algorithms, specifically Support Vector Machines, are employed for classification. Here we use the system using publicly available datasets, achieving competitive performance in facial expression identification. It contains applications in real-time emotion recognition, facial expression analysis in robotics, and emotion-aware human-computer interaction. It offers a streamlined system that overcomes computational complexity and improves accuracy in facial expression identification tasks.

Young Eun An and Yi Wan.,[3] offers a comprehensive overview of the use of facial landmarks in facial expression recognition. Here it delves into the significance of facial landmarks as crucial indicators of facial muscle movements and their connection to different emotional expressions. They emphasize the importance of accurate landmark detection and extraction techniques, discussing both traditional methods and recent advancements in deep learning-based approaches. Various classification algorithms, including Support Vector Machines (SVM), Decision Trees, and Artificial Neural Networks (ANN), are used for highlighting their effectiveness in accurately categorizing facial expressions. Furthermore, they shed light on the importance of feature selection and dimensionality reduction techniques to enhance classification performance and mitigate the curse of dimensionality. It provides valuable insights into the various techniques, algorithms, and challenges associated with facial expression recognition based on landmarks. The findings presented here serve as a foundation for further research and advancements in the field, with potential applications in areas such as affective computing, human-computer interaction, and psychological studies involving facial expression analysis.

Kaviya P and Arumugaprakash T.,[4] provides an overview of emotion recognition using deep convolutional neural networks (CNN). Here the CNNs are used in analyzing facial expressions to accurately identify and classify different emotions. It states the important significance of deep learning techniques in capturing complex patterns and features from facial images, enabling robust emotion recognition systems. It highlights the various stages of the proposed framework, including data preprocessing, CNN architecture design, training and validation, and evaluation. The findings demonstrate the efficacy of deep CNNs in emotion recognition from facial expressions, opening avenues for improved affective computing applications and human-computer interaction systems. In addition to the overview of emotion recognition using deep convolutional neural networks, Data preprocessing techniques are employed to enhance the quality of facial images and ensure accurate representation of emotions. Here the importance of dataset selection and augmentation methods are highlighted to address data imbalance and improve the model's ability to generalize.

Dr. M. Srinivas, Harshini, Mayuka, and Himani.,[5] presents a novel approach to music player systems that utilize facial expressions for enhanced user experience. Here, computer vision techniques and emotion recognition algorithms are used to detect and interpret facial expressions, and subsequently recommend music that aligns with the user's emotional state. It contains the system architecture, which involves facial expression detection and analysis modules, as well as the incorporation of a music recommendation engine. Here, The importance of accurate facial expression recognition for personalized music recommendations are considered and it discusses the potential benefits of such a system in improving mood regulation and emotional well-being. The findings of the paper contribute to the development of innovative music player applications that leverage facial expressions as a means of creating tailored and emotionally engaging music experiences.

Yu-Huei Cheng, Pang-Ching Chang, and Che-Nan Kuo.,[6] presents an approach to music genre classification using Convolutional Neural Networks (CNN). The deep learning techniques are used to automatically classify music into different genres based on audio features. They discuss the importance of music genre classification in various domains such as recommendation systems, music streaming platforms, and personalized music experiences. It gives us the overview of proposed CNN architecture, which incorporates convolutional layers for feature extraction and classification. The process of preparing the dataset, including data collection, preprocessing, and feature extraction is done. Performance of the CNN model is checked using various evaluation metrics, demonstrating its effectiveness in accurately classifying music genres. The findings of this paper contribute to the advancement of music genre classification techniques, showcasing the potential of CNNs in improving the accuracy and automation of genre classification systems.

Daniel Maturana, Domingo Mery, and Alvaro Soto.,[7] It uses face recognition that combines decision tree-based classification with Local Binary Patterns (LBP). Challenges associated with face recognition tasks, including variations in pose, illumination, and facial expressions were found during the process. The proposed methodology involves the extraction of LBP features from facial images, which captures local texture patterns in a robust and efficient manner. LBP encodes the relationship between a central pixel and its neighboring pixels, providing a compact representation of facial texture information. LBP features are utilized as discriminative descriptors to capture distinctive characteristics of faces and enhance recognition accuracy. Experimental results demonstrate the effectiveness of the proposed approach, as it achieves high recognition accuracy rates and outperforms other state-of-the-art methods. The findings contribute to the advancement of face recognition techniques by showcasing the potential of combining decision tree-based classification with LBP features. This approach offers a reliable and interpretable solution for face recognition tasks, with applications in various domains such as surveillance systems, access control, and biometric identification. The methodology presented in this paper provides insights and inspiration for further research and advancements in face recognition technology.

Chapter 3

Problem Definition

According to research, very few people are willing to discuss their mental problems with a psychologist. Social fear is one of the reasons that people dealing with the lower stages of mental illness don't open up.

Our project detects these problems through the facial expressions of the music listeners and based on their emotions list of songs is recommended to them and listening to them will make them calm and relieve stress.

Chapter 4

Software Requirements Specification

4.1 Introduction

Software prerequisites Without describing how the software will carry out the behavior, the specification completely states how the software should behave. The primary goal of the requirement stage is to produce the software requirement specification that specifies the projected software's peripheral performance. A well-defined software requirement is a condition of the capacity needed by a user to solve a problem or achieve a goal.

4.2 Purpose

It serve as a guide to developers and testers who are responsible for the future development of the system.

4.3 User Characteristics

User may be anyone who might be suffering from low stages of mental problems and do not really want to reach out to consult anyone.

4.3.1 Psychologists

Can utilize a smart music player based on facial emotion to enhance their therapeutic interventions and understand their clients' emotional states.

4.3.2 Patient

can also benefit from using a smart music player based on facial emotion to support their emotional well-being and self-care.

4.3.3 Hardware Interfaces

- Processor : i5 or above
- RAM : 8GB or above
- Hard Disk : 1GB
- Input Device : Standard keyboard and Mouse
- Output Device : High Resolution Monitor.

4.3.4 Software Interfaces

- Operating System: Windows 10 or above.
- Programming Language : Python
- Environment: Visual Studio Code/Google colab.
- Libraries: cv2, NumPy, os, glob.

4.4 Functional Requirements

- Input: User Face Image
- Users: People suffering from low level of mental problems
- Technology: FisherFace Algorithm
- Output: Song is played based on mood

4.5 Non-Functional Requirements

- Security: To ensure that only the required personnel have access to the system and can perform actions on it.

- Availability: To ensure that the system is available for use at all times, with a minimum delay if any.
- Access: Make the interface as simple as possible to make it accessible by all potential users.
- Integrity: It is crucial that manufacturers and developers prioritize the protection and secure handling of this data to prevent unauthorized access or misuse.

Chapter 5

System Design

5.1 Architecture Design

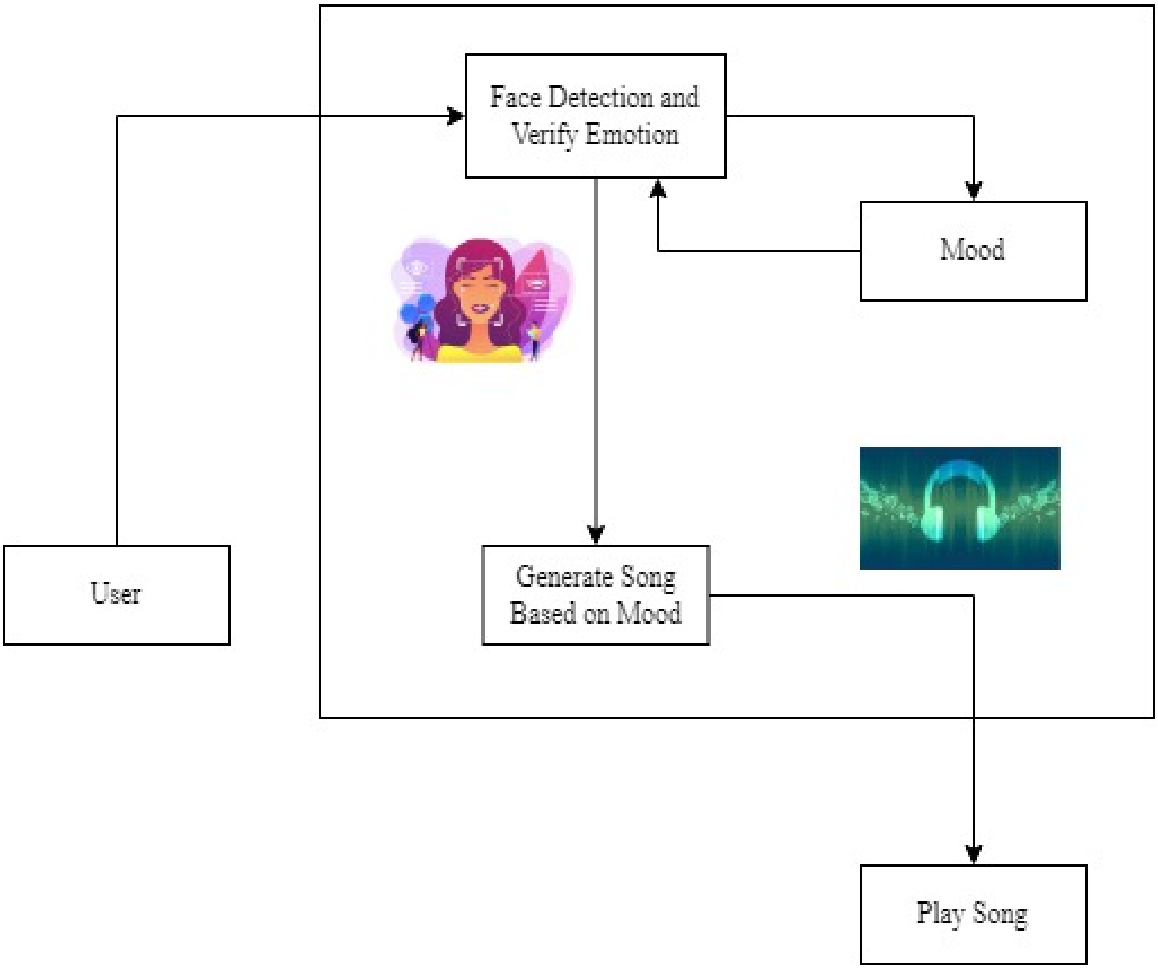

Figure 5.1: System Architecture Diagram

- The user opens the smart music player and the camera is turned on
- The camera captures the facial expression of the user and verifies the emotion

- The mood of the user is determined based on the predefined dataset
- Song is generated based on the mood of the user
- Finally the song is played

5.2 Decomposition Description

The flowchart commences with the initialization of the camera, enabling the music recommender device to seamlessly capture the user's facial input. Starting from the device's startup screen, it diligently proceeds to capture the user's image. Upon a successful capture, the device initiates the analysis of the image, meticulously examining its contents. In the event of a failed analysis, the device perseveres by attempting to capture the image again, ensuring the highest possible quality. Once the image analysis triumphs, the device proceeds to extract the distinctive features present within the image. With successful feature extraction, the device employs this invaluable information to determine the user's mood, as indicated by their facial expression. Leveraging the power of the music recommender, a comprehensive list of music selections tailored to the user's current emotional state is then presented. The user can freely choose their desired song from this carefully curated playlist, igniting a melodic journey. Upon song selection, the device gracefully plays the chosen composition, immersing the user in a captivating audio experience. Following this delightful interaction, the device once again stands ready to capture a new image, perpetuating the seamless and engaging user experience.

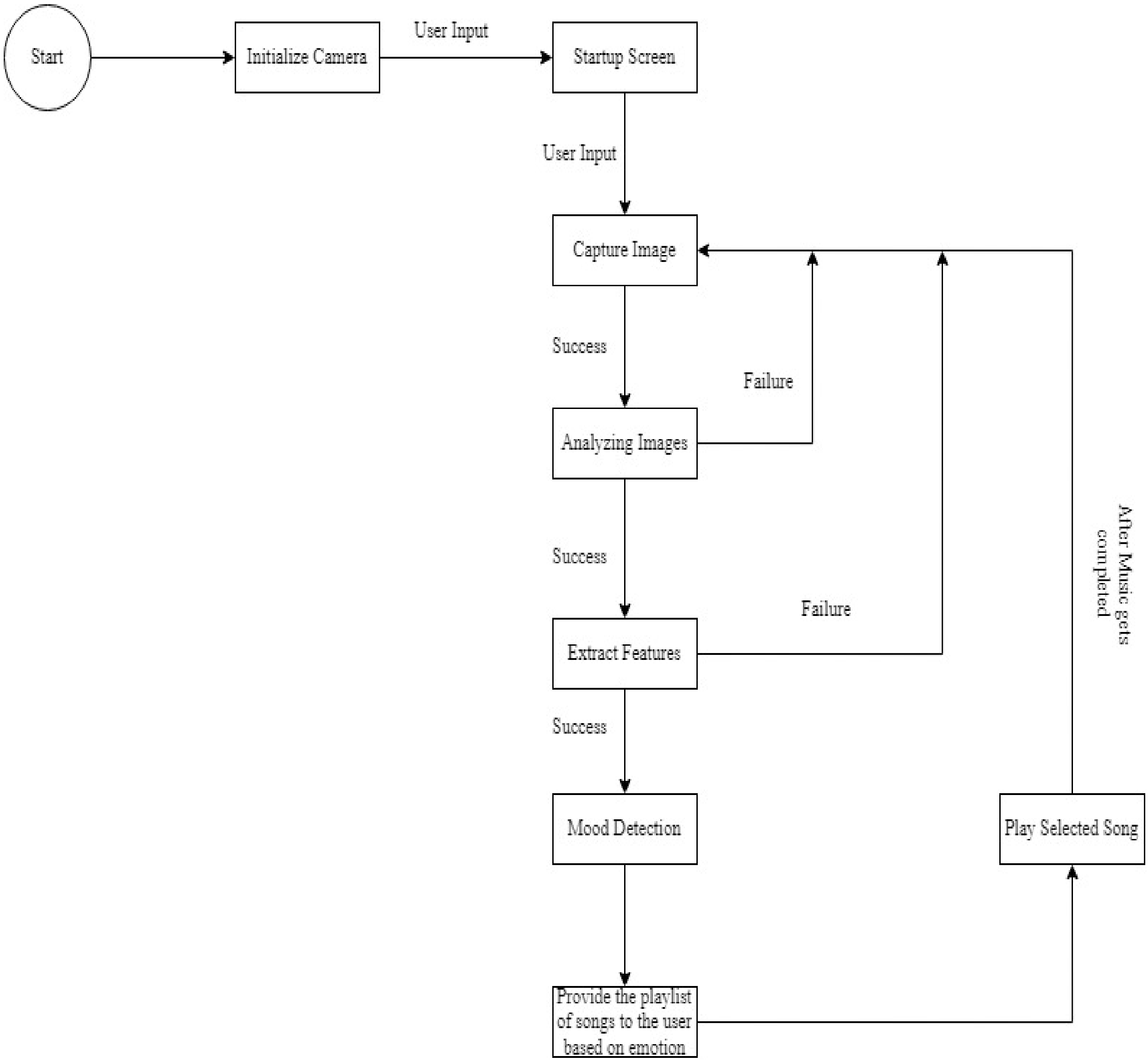

Figure 5.2: Decomposition Diagram

5.3 Data Flow Design

The Fischer Face algorithm is an ingenious method for face recognition and classification. It was developed by the renowned mathematician and computer scientist, Peter Fischer, and has become a prominent technique in the field of computer vision.

Imagine you are in a room filled with people, and your task is to recognize and differentiate between each individual. Now, each person has distinct facial features that make them unique. These features could be the shape of their eyes, the curvature of their lips, or the structure of their nose. The Fischer Face algorithm aims to extract and analyze these crucial facial characteristics to classify and identify individuals effectively.

To achieve this, the Fischer Face algorithm employs a clever mathematical approach known as principal component analysis (PCA). PCA is a powerful technique that uncovers the underlying patterns and variations within a dataset. In the context of the Fischer Face algorithm, it helps in capturing the essential facial traits that differentiate one person from another.

The algorithm first needs a training dataset, consisting of a collection of images of different individuals' faces. It then preprocesses these images, removing noise and standardizing them to ensure consistency. Next, it extracts the facial features using techniques like edge detection and facial landmark detection.

Once the facial features are obtained, the Fischer Face algorithm applies PCA to reduce the dimensionality of the feature space. This dimensionality reduction process identifies the most significant facial variations among the individuals in the training dataset. These variations, referred to as eigenfaces, represent fundamental facial patterns that account for the majority of the differences between people.

The algorithm then constructs a set of "Fischerfaces" by weighting and combining the eigenfaces. Fischerfaces are essentially linear combinations of the eigenfaces that emphasize the features that best discriminate between individuals. This step effectively compresses the facial information into a smaller, more manageable representation.

To recognize a new face, the Fischer Face algorithm projects the face onto the subspace spanned by the Fischerfaces. By calculating the similarity or distance between the projected face and the known faces in the training set, the algorithm can determine the identity of the individual. The recognition accuracy is significantly enhanced because the Fischerfaces represent the most discriminative facial features.

In summary, the Fischer Face algorithm is an elegant blend of mathematics and computer vision techniques. It extracts essential facial characteristics, reduces the dimensionality of the feature space, and constructs Fischerfaces that capture the distinctive traits of individuals. Through this process, the algorithm enables accurate face recognition and classification, opening the doors to applications such as surveillance systems, access control, and human-computer interaction.

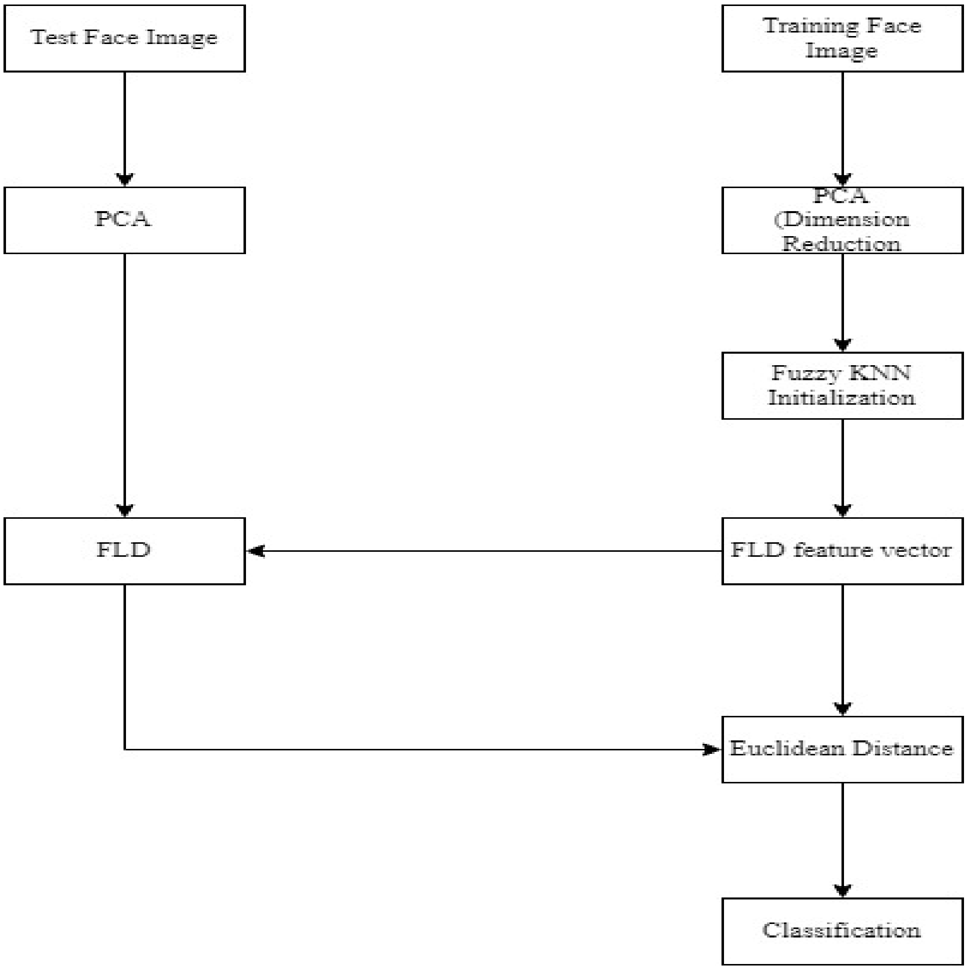

Figure 5.3: Data Flow Design

5.4 Sequence Diagram

Within this sequence diagram, three essential actors play their roles: the user, the device, and the database. The user engages with the device, utilizing its capabilities, including accessing the device's webcam. The device captures the user's photo and proceeds to detect their facial expression. Subsequently, the device retrieves the user's mood, storing this valuable information within the database. As a result, the user's mood is elegantly presented back to them, allowing them to perceive and acknowledge their current emotional state. Drawing upon the user's mood, the device gracefully selects and plays music, sourced from the extensive collection available within the database, tailored precisely to suit the user's emotional disposition. The device then projects this harmonious soundscape, delighting the user's senses as they immerse themselves in the melodious scene being played. Ultimately, the user can thoroughly relish and enjoy this captivating musical experience provided by the device, lending an enchanting ambiance to their surroundings.

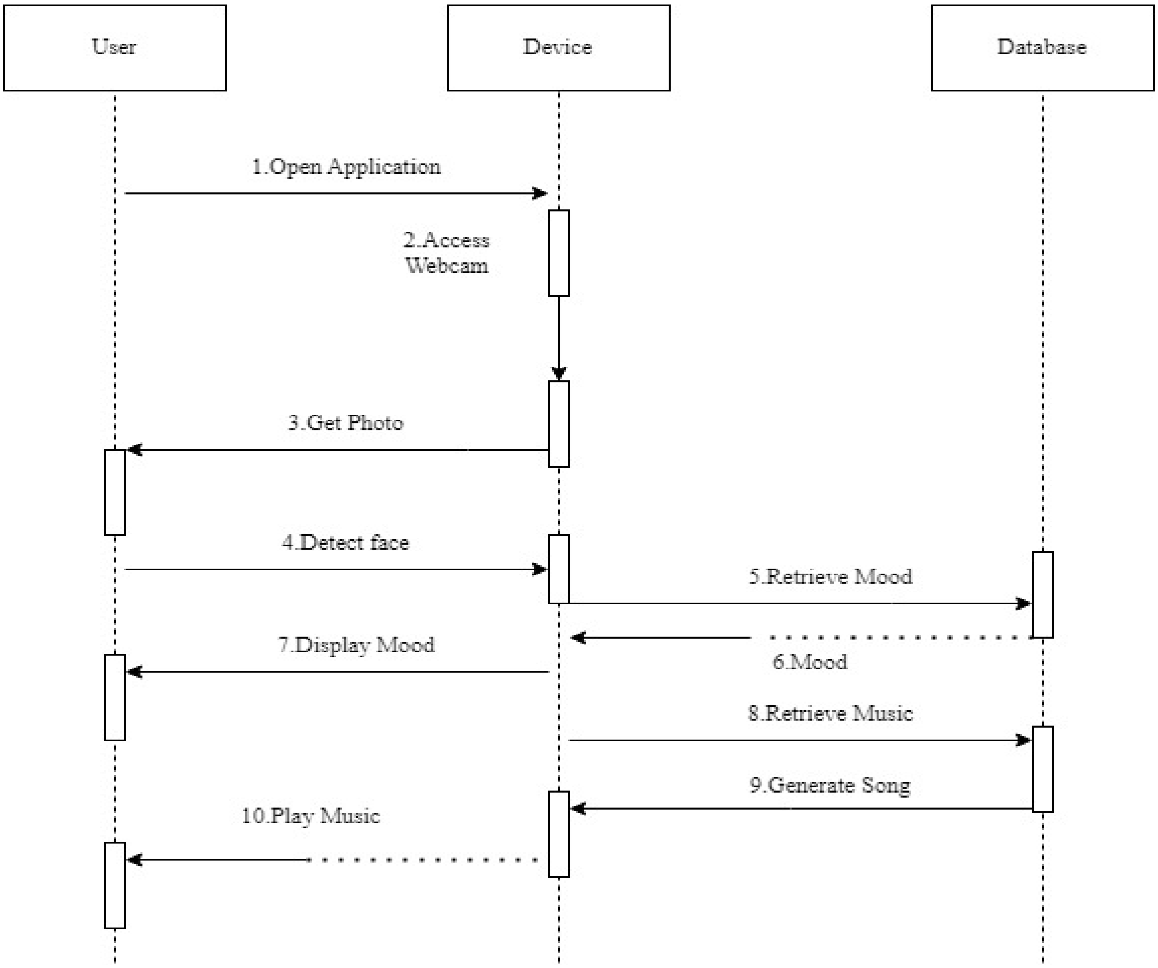

Figure 5.4: Sequence diagram for the proposed system

5.5 Use case Diagram

The use case diagram illustrates the interactions between the actors and the system in a music player based on facial expressions. The primary actors involved are the "User" and the "System." The User is responsible for initiating actions, while the System performs various tasks to provide the desired functionality.

One of the main use cases in the system is "Capture Facial Image." This use case enables the User to capture their facial image using a camera or device. By capturing the facial image, the System obtains the necessary input to analyze the facial expressions and detect the user's mood.

Another crucial use case is "Detect Face and Mood." This use case represents the core functionality of the system. The System processes the captured facial image and utilizes facial recognition techniques to identify and locate the user's face. It then analyzes the facial expression to determine the user's mood, recognizing emotions such as happiness, sadness, or excitement.

The use case "Create Result" follows the mood detection process. Once the user's mood is identified, the System generates a result or recommendation based on that mood. The System employs predefined rules or algorithms to map the user's mood to suitable music genres, playlists, or specific songs. This step ensures that the recommended music aligns with the user's emotional state.

Finally, the "Play Music" use case allows the System to play the recommended music based on the user's mood. The System accesses the music library or an online streaming service to retrieve the appropriate music content and delivers it to the User for listening. This use case completes the music recommendation process, providing the User with a personalized music listening experience based on their facial expression.

These use cases outline the essential functionalities of the music player system based on facial expressions. They demonstrate the interaction between the User and the System, starting with capturing the facial image, followed by face and mood detection, creating a music recommendation result, and ultimately playing the recommended music for the User's enjoyment.

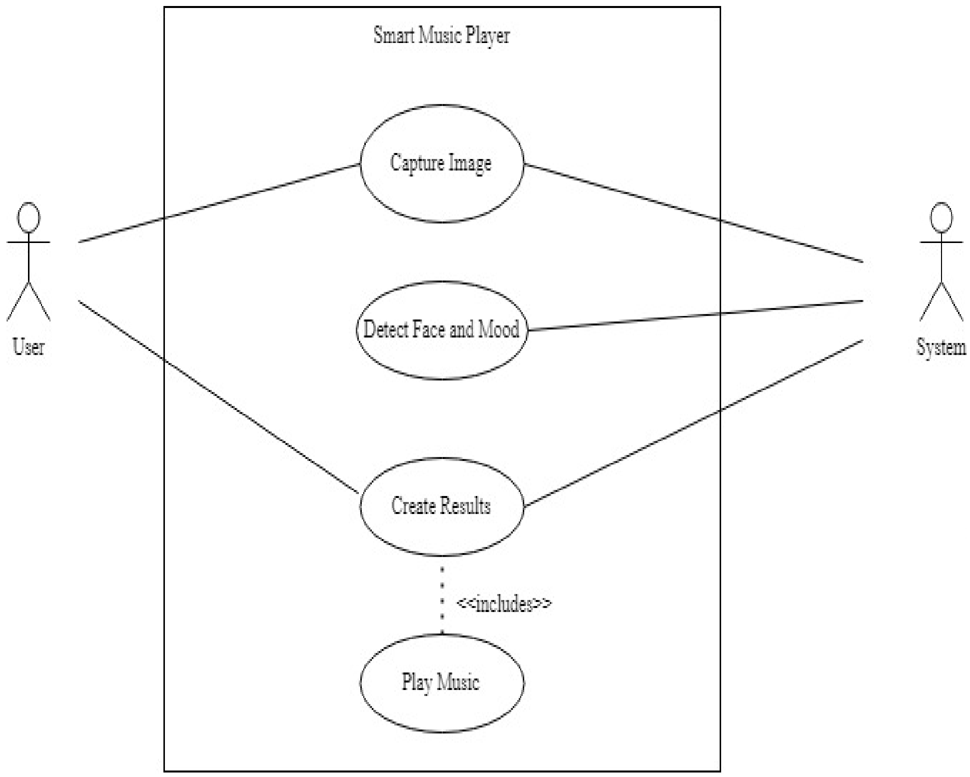

Figure 5.5: Use case diagram for customer

5.6 Class Diagram

Music Recommender class represents the main Music Recommender system. It contains references to the facialExpressionDetector and musicDatabase classes. The class provides a method recommendMusic that takes a facial expression as input and returns a list of recommended music titles.

facialExpressionDetector class is responsible for detecting facial expressions. It likely uses facial recognition technology or algorithms to interpret the user's facial expressions and determine their emotional state.

musicDatabase class represents the database that stores information about music. It may contain various attributes such as title, artist, genre, and facial expression associated with each music entry.

Music class represents an individual music item. It has attributes such as title, artist, genre, and facialExpression. These attributes describe the specific characteristics of a music piece.

The Music Recommender system utilizes the facialExpressionDetector to analyze the user's facial expression. It then queries the musicDatabase to retrieve music items that match the detected facial expression. The Music class represents individual music items with their respective attributes. The Music Recommender class acts as the main controller, facilitating the recommendation process by connecting the facial expression analysis with the music database.

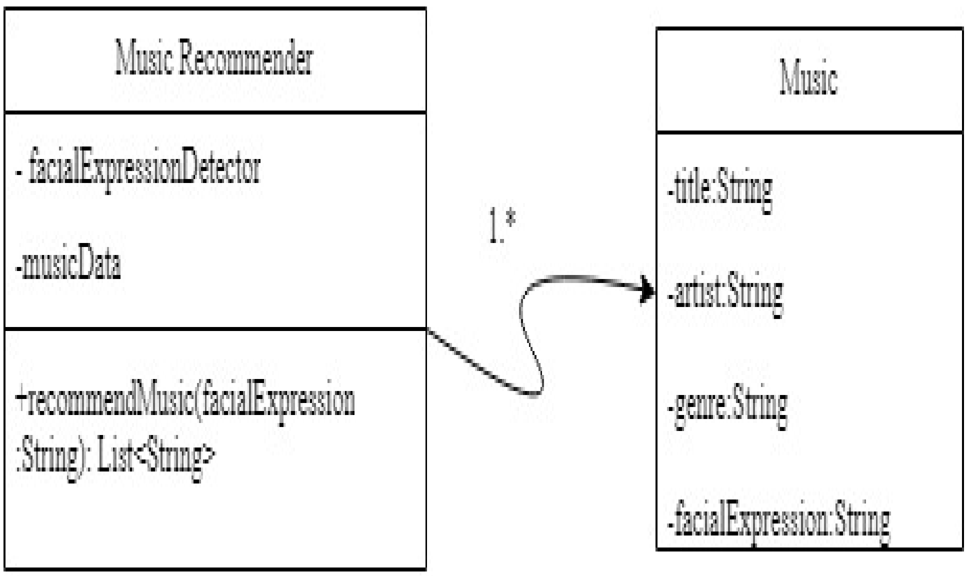

Figure 5.6: Class diagram for the system

5.7 Activity Diagram

The activity diagram illustrates the flow of actions and decision points in the music player application. The diagram begins with the "Start" activity and shows the different paths the User can take while interacting with the music player.

After the application starts, the User proceeds to the "Open Music Player" activity. From there, the User is presented with a choice to select a mode. There are two modes available: "Queue/Random Mode" and "Emotion Mode." If the User selects the "Queue/Random Mode," the music player proceeds to the "Play Song" activity. In this mode, the system plays songs from a predefined playlist or a randomized selection. The User can enjoy the music without any direct connection to their facial expressions.

On the other hand, if the User chooses the "Emotion Mode," the music player moves to the "Read Face" activity. In this mode, the system utilizes facial recognition techniques to capture and analyze the User's facial expression. The system then determines the User's emotion based on the facial expression detected. After analyzing the User's emotion, the music player proceeds to the "Play Song Based on Expression" activity. In this step, the system selects a song that matches the detected emotion. The music player plays the recommended song, providing the User with a personalized music experience based on their facial expression.

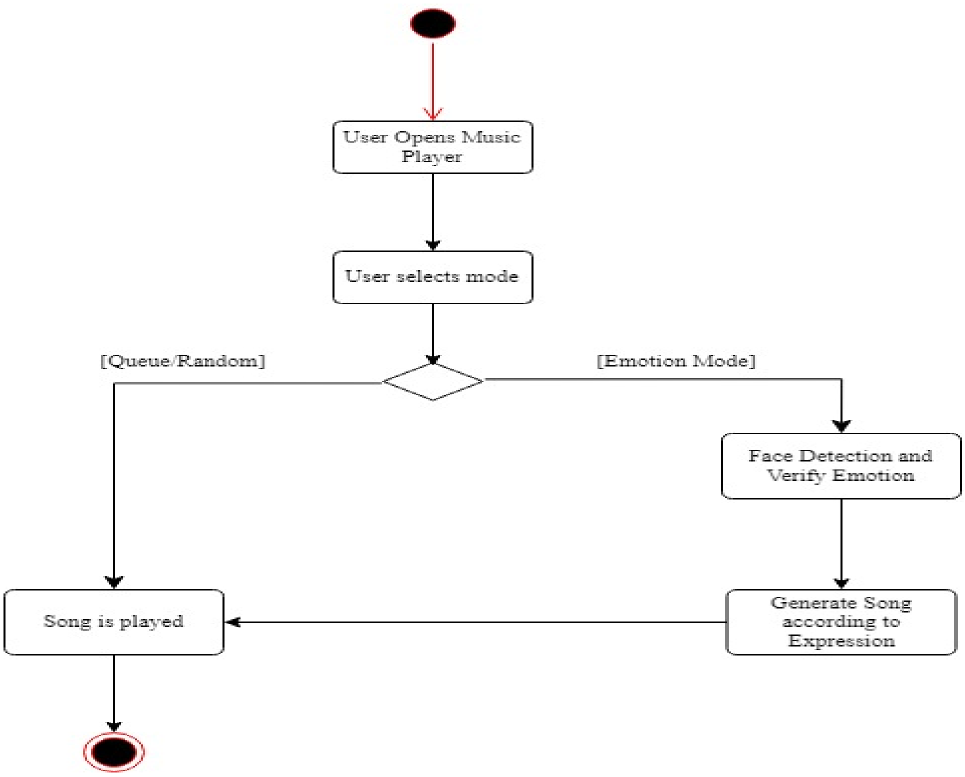

Figure 5.7: Activity diagram for proposed system

Chapter 6

Implementation

This section helps in understanding the implementation of the “Smart Music Player Based on Facial Expression”. This gives us an overall idea of the different modules present in the system.

6.1 Getting the Datasets

For detecting facial emotions, a Kaggle dataset was used. Kaggle, being a platform for data science and machine learning, hosted a variety of datasets for different tasks, including facial emotion recognition. These datasets typically consisted of labeled facial images representing different emotions such as anger, happiness, sadness, neutrality, and fear. The images in the dataset were used to train machine learning models or deep learning algorithms to recognize and classify emotions accurately based on facial expressions.

Figure 6.1: Datasets

6.2 Preprocessing

For pre-processing face detection techniques are applied to locate and identify faces within the input images or video frames. Following that, face alignment techniques are employed to normalize the face orientation, ensuring consistent positioning for accurate analysis. Once the faces are aligned, they are cropped to remove unnecessary background, focusing solely on the facial region containing the relevant emotional cues.

```python
eel.init('src')
emotions=["angry", "happy", "sad", "neutral","fear"]
fishface = cv2.face.FisherFaceRecognizer_create()
font = cv2.FONT_HERSHEY_SIMPLEX
try:
    fishface.load("model.xml")
except:
    print("No trained model found... --update will create one.")
parser=argparse.ArgumentParser(description="Options for emotions based music player(Updating the model)")
parser.add_argument("--update", help="Call for taking new images and retraining the model.", action="store_true")
args=parser.parse_args()
facedict={}
video_capture=cv2.VideoCapture(0)
facecascade=cv2.CascadeClassifier("haarcascade_frontalface_default.xml")
def crop(clahe_image, face):
    for (x, y, w, h) in face:
        faceslice=clahe_image[y:y+h, x:x+w]
        faceslice=cv2.resize(faceslice, (350, 350))
        facedict["face%s" %(len(facedict)+1)]=faceslice
    return faceslice

def grab_face():
    ret, frame=video_capture.read()
    cv2.imwrite('test.jpg', frame)
    cv2.imwrite("images/main%s.jpg" %count, frame)
    gray=cv2.imread('test.jpg',0)
    clahe=cv2.createCLAHE(clipLimit=2.0, tileGridSize=(8,8))
    clahe_image=clahe.apply(gray)
    return clahe_image
```

Figure 6.2: Code Snippet Used In Preprocessing

Figure 6.2 outlines pre-processing steps that collectively enhance the quality, consistency, and relevance of the facial images, facilitating the application of more accurate emotion recognition algorithms in the music player system..

6.3 Feature Extraction

Feature extraction plays a vital role in a smart music player that utilizes facial emotion recognition with the Fisherface algorithm. After pre-processing the facial images, Fisherface algorithm extracts discriminative features that capture the unique characteristics of different emotions. This algorithm employs linear discriminant analysis to project the pre-processed facial images into a lower-dimensional subspace. In this subspace, the Fisherfaces, which are the optimal linear combination of features, are derived to maximize the inter-class variation and minimize the intra-class variation. These Fisherfaces serve as representative features that effectively encode emotional information from the facial expressions.

```
fishface=cv2.face.FisherFaceRecognizer_create()
data={}

def update(emotions):
    run_recognizer(emotions)
    print("Saving model...")
    fishface.save("model.xml")
    print("Model saved!!")

def make_sets(emotions):
    training_data=[]
    training_label=[]

    for emotion in emotions:
        training=training+sorted(glob.glob("dataset/%s/*" %emotion))
        for item in training:
            image=cv2.imread(item)
            gray=cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
            training_data.append(gray)
            training_label.append(emotions.index(emotion))
    return training_data, training_label

def run_recognizer(emotions):
    training_data, training_label=make_sets(emotions)
    print("Training model...")
    print("The size of the dataset is "+str(len(training_data))+" images")
    fishface.train(training_data, np.asarray(training_label))
```

Figure 6.3: Code Snippet Of Training The Model

Figure 6.3 depicts the process of feature extraction using the Fisherface algorithm. Training the model involves learning the discriminative features from a dataset of pre-processed facial images.

6.4 Emotion Detection

In this step, the extracted features from the pre-processed facial images are used to classify and recognize the emotional states of the user. The Fisherface features are typically fed into a machine learning algorithm, such as a nearest neighbor classifier or support vector machine, which has been trained on a labeled dataset of emotions. The trained model then compares the extracted features with the known emotional patterns to predict the most likely emotion associated with the user's facial expression. This enables the music player system to identify and categorize the user's emotional state, allowing for personalized and contextually relevant music selection based on the detected emotion.

```
def identify_emotions():
    prediction=[]
    confidence=[]
    for i in facedict.keys():
        pred, conf=fishface.predict(facedict[i])
        cv2.imwrite("images/%s.jpg" %i, facedict[i])
        prediction.append(pred)
        confidence.append(conf)
    output=emotions[max(set(prediction), key=prediction.count)]
    print("You seem to be %s" %output)
    facedict.clear()
    return output;
```

Figure 6.4: Code Snippet Of Emotion Prediction

Figure 6.4 illustrates the process of detecting emotion from feature extraction using the Fisherface algorithm.

Chapter 7

System Testing

Testing is the process of running the program with the clear aim of identifying any errors that would cause it to fail. This phase is crucial to the development of the product.

It plays an extremely important function in quality assurance and assuring pro-Without fail, gramming quality. It is a method for detecting errors and missing procedures, as well as a thorough confirmation to ensure that the goals and client criteria have been satisfied. The purpose of testing is to reveal project prerequisites, outlines, or coding problems. As a result, several levels of testing are utilised in programming frameworks. The results of the tests are used during maintenance. This section is in charge of overseeing the areas of interest in the numerous test classes that should be used to validate abilities, imperatives, and so on.

The purpose of testing is to reveal project prerequisites, outlines, or coding problems. As a result, several levels of testing are utilised in programming frameworks. The results of the tests are used during maintenance. This section is in charge of overseeing the areas of interest in the numerous test classes that should be used to validate abilities, imperatives, and so on.

This section oversees the areas of interest in the various test classes that should be used to validate abilities, imperatives, and execution. This can be done primarily by employing testing techniques, which play a significant role in the development of a product.

Useful testing does not take the program's structure into account. Test cases are only picked based on the requirements or specifics of a program or module of the program nevertheless, the internals of the module or program are not taken into account while choosing experiments.

Table 7.1: Work Flow

Sl No	Work	Duration(in Weeks)
1	Basic research and feasibility check	1
2	Dataset collection, public	2
3	Building of the models	6
4	Testing of models	2
5	Building the front-end	2
6	Test working	2

Table 7.2: Test cases

Test Case	Description	Expected Result	Actual Result	Status
TC-1	Showed Multiple Face	Multiple face detected	Detected multiple face and passed frame	Pass
TC-2	Display a happy facial expression	Plays cheerful songs.	player selects upbeat songs.	Pass
TC-3	Display a sad facial expression	player selects melancholic songs.	Player plays slower songs.	Pass
TC-4	Display a neutral facial expression	player selects a balanced mix of songs	Plays a balanced song.	Pass
TC-5	Start the smart music player in Random Mode	Player selects and plays songs randomly	Plays random song from library,	Pass
TC-6	Start the smart music player in Queue Mode	Music plays in order they were added	Player plays the songs in queue.	Pass

Chapter 8

Results and Discussion

This chapter has snapshots of the results of the project.

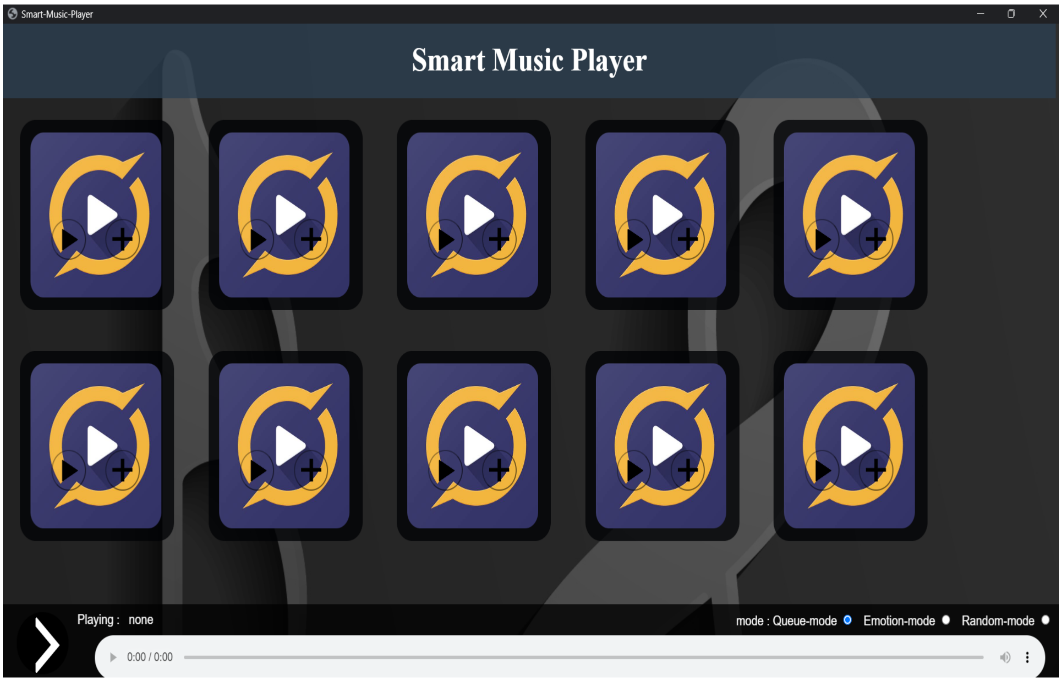

Figure 8.1: Landing Page

Figure 8.1 is the home page of the web application where all features are displayed. Three modes are given for users to select and other settings.

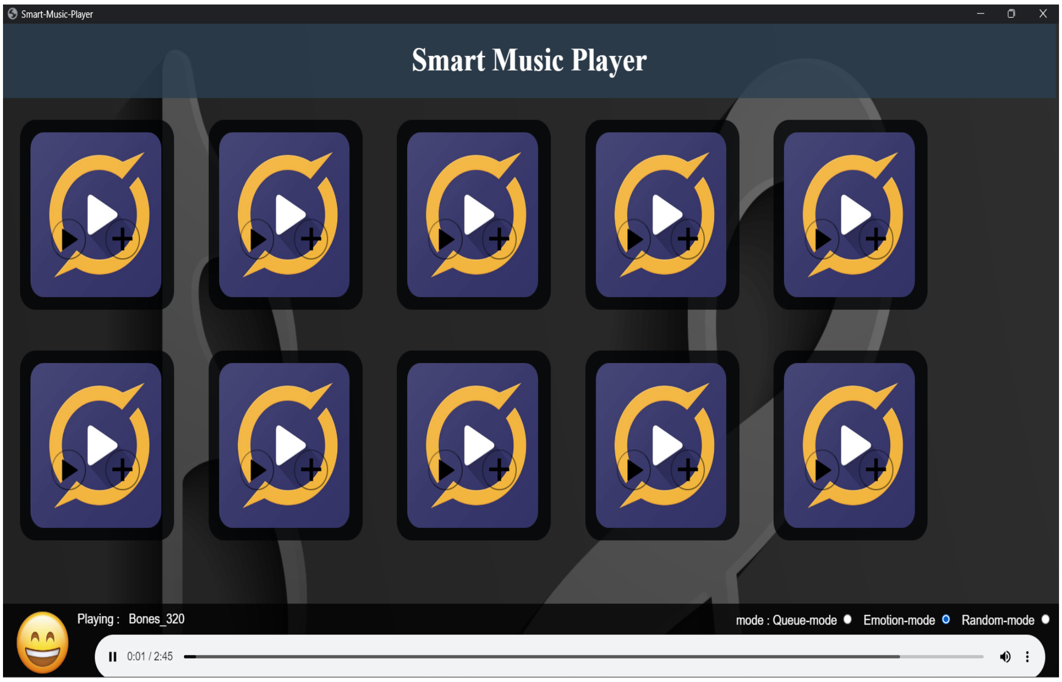

Figure 8.2: Selected Emotion Mode

Fig 8.2 depicts the happy emotion with a happy emoji detected by the system and a song based on this emotion is played.

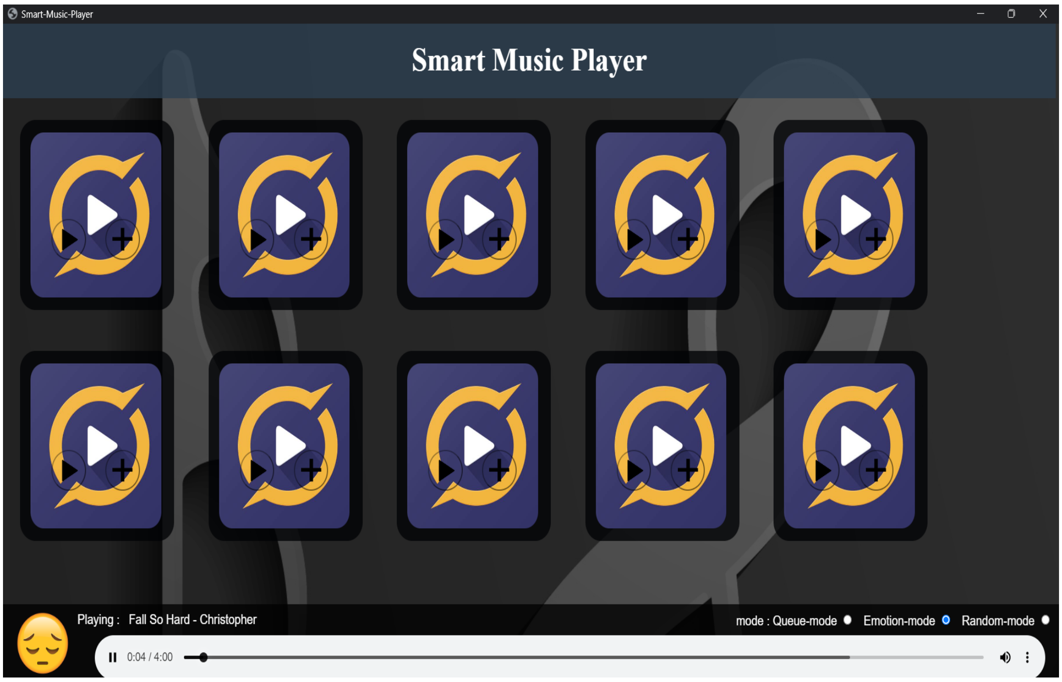

Figure 8.3: Sad Emotion detected

Fig 8.3 shows the interface with sad emoji which shows sad emotion detected and a song is played in order to overcome this particular emotion.

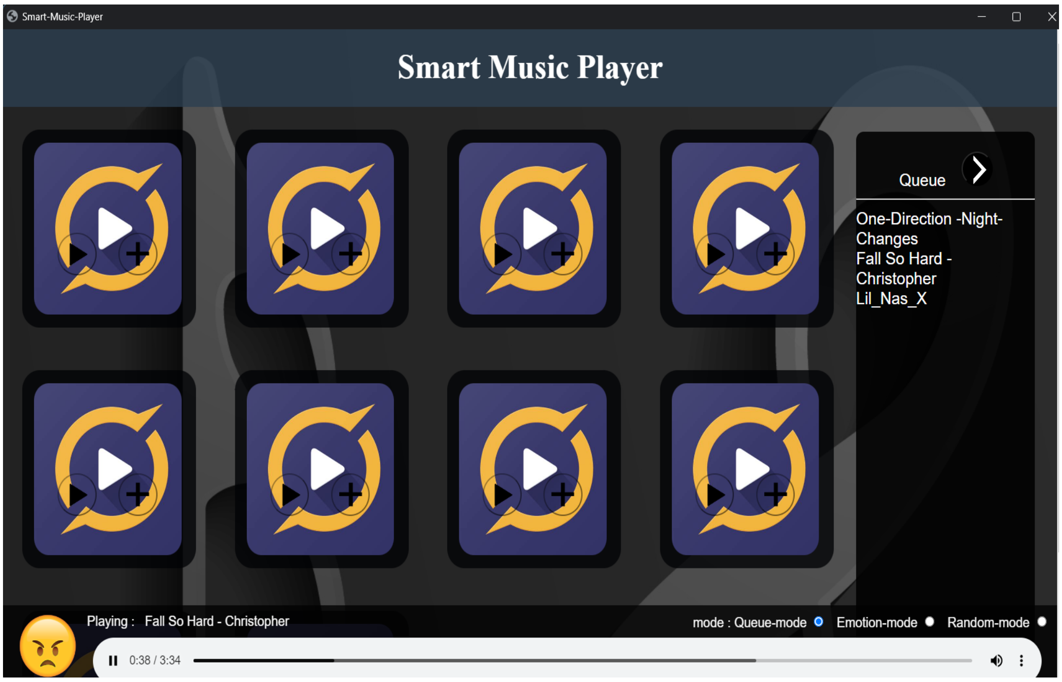

Figure 8.4: Selected Queue Mode

Figure 8.4 depicts the music player running in queue mode, where the user can add their songs to the queue, and they will play in that sequence.

Chapter 9

Conclusion and Future work

In summary, the development of the smart music player based on facial emotion represents a significant advancement in leveraging technology for emotional well-being. By providing a personalized music experience, this player offers individuals a means to address low-stage mental illnesses, stress, and anxiety. As further advancements are made in emotion recognition technology and user feedback mechanisms, this smart music player has the potential to become a valuable asset in the emotional well-being toolkit, supporting individuals on their journey towards improved mental health and overall well-being. The integration of emotion mode, queue mode, and random mode in the music player allows individuals to tailor their music experience based on their emotional needs. Emotion mode, in particular, stands out as a powerful tool for addressing mental health concerns. By analyzing the user's facial expressions in real time, the player can adapt the music selection to promote positive emotions, relaxation, and stress reduction.

The "Smart Music Player base on Facial Emotion" method will need to be improved in a number of crucial areas in the next few years. First, Continuously refining the emotion recognition algorithms and models can improve the accuracy and reliability of emotion detection. Exploring deep learning techniques and incorporating more extensive facial expression datasets can lead to more precise emotion classification. The integration of additional features driven by emotions can enhance the user experience. For example, dynamically adjusting the tempo, volume, or genre of the music based on the detected emotion can create a more immersive and engaging listening experience. Collecting user feedback and preferences to customize the music recommendations further can be valuable. Implementing a feedback loop that learns from user interactions and adapts the music selection accordingly can ensure a more personalized and tailored music experience.

References

[1] Suci Dwijayanti, Rahmad Rhedo Abdillah, Hera Hikmarika. Facial Expression Recognition and Face Recognition Using a Convolutional Neural Network. IEEE conference paper,2020.

[2] S. Kherchaoui and A. Houacine. Facial expression identification system with euclidean disatnce of facial edges. IEEE conference paper,2020.

[3] Young Eun An and Yi Wan. Facial Expression Recognition based on Landmarks. IEEE conference paper,2021.

[4] Kaviya P and Arumugaprakash T. Emotion recognition from facial expression using deep convolutional neural network. IEEE conference paper,2020.

[5] Dr. M. Srinivas, Harshini, Mayuka, Himani. Music Player using Facial Expression. IEEE conference paper,2021.

[6] Yu-Huei Cheng, Pang-Ching Chang, Che-Nan Kuo. Convolutional Neural Networks Approach for Music Genre Classification. IEEE conference paper,2021.

[7] Daniel Maturana, Domingo Mery, and Alvaro Soto. Face Recognition with Decision Tree-Based Local Binary Patterns. IEEE conference paper,2021.