University of Mumbai

Music Player based on Age Classification

Submitted in partial fulfillment of requirements

For the degree of

Bachelors in Technology

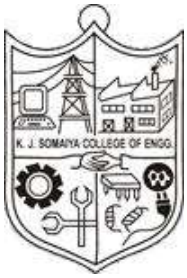
by

Giten Kadam
Roll No: 1414089

Heet Navsariwala
Roll No: 1414099

Keya Mankar
Roll No: 1414103

Guide
Prof. Sujata Pathak



Department of Information Technology
K. J. Somaiya College of Engineering, Mumbai-77
(Autonomous College Affiliated to University of Mumbai)

Batch 2014 -2018

K. J. Somaiya College of Engineering, Mumbai-77

(Autonomous College Affiliated to University of Mumbai)

Certificate

This is to certify that the dissertation report entitled **Music Player based on Age Classification** is bonafide record of the dissertation work done by

1. Giten Kadam
2. Heet Navsariwala
3. Keya Mankar

in the year 2017-18 under the guidance of Prof. Sujata Pathak of Department of Information Technology Engineering in partial fulfillment of requirement for the Bachelors in Technology degree in Information Technology Engineering of University of Mumbai.

_____ _____

Guide Head of the Department

_____

Principal

Date:

Place: Mumbai-77

K. J. Somaiya College of Engineering, Mumbai-77

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Certificate of Approval of Examiners

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1. Giten Kadam
2. Heet Navsariwala
3. Keya Mankar

This project is approved for the award of Bachelors in Technology Degree in Information Technology Engineering of University of Mumbai.

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DECLARATION

We declare that this written thesis submission represents the work done based on our and / or others' ideas with adequately cited and referenced the original source. We also declare that we have adhered to all principles of intellectual property, academic honesty and integrity as we have not misinterpreted or fabricated or falsified any idea/data/fact/source/original work/ matter in our submission.

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Abstract

A human face is an important organ of an individual's body and it is an important factor in classification of an individual's age. This proposed system based on facial feature extraction and age classification will generate a playlist automatically that may adhere to the person's music choice and thereby reducing the effort and time involved in rendering the process manually. The age classification algorithm module of the proposed algorithm is validated by testing the system against user-dependent and user-independent data set. Implementation and testing of the proposed algorithm is carried out using an in-built camera. Hence, the proposed algorithm reduces the overall cost of the system successfully.

Keywords: Facial Feature Extraction, Age Classification, Music Playlist.

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Chapter 1

Introduction

This chapter presents an overview of the project by providing information about the existing procedures, motivations for the implementation of the new system and the scope of the project.

1.1 Problem Definition

Music Player Based on Age Classification can classify the age of the user by taking an image of the user's face and generating a playlist that the user may like. It aims to decrease the manual labor involved in creating playlist of music from different eras. This will help the user to listen to good music without much manual labor.

1.2 Motivation of the thesis

Manually segregating the list of songs and generating an appropriate playlist based on an individual's age is a very tedious, time consuming, labor intensive and upheld task. There is need for an application which suggests songs that the user may like depending upon the age group of the user.

1.3 Scope of the thesis

The application will generate a music playlist which the user may like depending upon the age group of the user. This application will make it convenient for a user to search music and also listen to the music that he or she may like.

1.4 Salient Contribution

The main objective of this application is to decrease the time and effort required in creating a playlist of music from different eras. Generally the user have to browse

through a database of songs and check whether he or she likes a song or not. Using this application, the user will automatically get a system generated playlist which will contain songs depending upon the age group of the user. These songs maybe liked by the user. The user can play any songs he or she wants from the playlist.

1.5 Organization of Thesis

- **Chapter 1**:
  This chapter talks about the overview of the selected project and also defines the motivation behind the project and the scope of the project which is to be implemented.

- **Chapter 2**:
  This chapter provides literature review done to understand the project.

- **Chapter 3**:
  The software project management plan (SPMP) for this project defines the project management goals of the project and includes a plan for the project and how you intend to develop the project and a description of the various deliverables and the time for the various tasks involved in the project.

- **Chapter 4**:
  This chapter contains the functional and non –functional requirement of the project .This document presents an initial description of the various requirements and functionalities of the software.

- **Chapter 5**:
  This chapter provides the software design document (SDD) which is written in order to give a software development team overall guidance to the architecture of a software project.

- **Chapter 6**:
  This chapter provides technologies, Algorithms used and implementation codes for all the modules used in the project.

- **Chapter 7**:
  This chapter provides the software test document (STD) which defines the testing strategy that will be used for the proposed system. Objective of this document is mainly to communicate project–wide quality standards and procedures.

- **Chapter 8**:
  This chapter provides conclusion drawn after working on the project it also provides future scope of the project.

Chapter 2

Literature Survey

This chapter presents all the knowledge about the platform used and also to understand different concepts and algorithms required for the implementation of the project.

We have referred to the following papers:

1. Sarita Jain, Dr. A.J.Patil *Human Age Prediction from Facial Images*. International Journal of Innovative Research in Computer and Communication Engineering, Volume 4, Issue 7, July 2016.

   Age prediction can be regarded as the problem of pattern recognition including two common steps: extraction of features and identification. Identification can easily be done using regression and classification process from an extracted feature. Age classification is basically problematic with the training set through which system is trained and test set on which testing is applied for age classification. The main objective is to develop an algorithm that identifies the person's age from the extracted features. The system can be useful for preventing the young children from, not to have access to the adult contents or materials from the internet and stop or prevent underage drinkers from buying alcohol, cigarette, etc. It provides a wide variety of applications like content analysis of multimedia, designing an interactive and intelligent robot. To attain our goal, good databases are needed like Morph or FG- Net so that these databases can be used to train the classifier by using K-NN and employ the test set on K-NN classifier to resolve our problem. The main objective is age prediction so the work worries about the frontal images of the faces. Now, Gaussian filtering, Viola-Jones algorithm, K-Nearest Neighbors that have been employed in our system implementation.

2. Zainab A. Othman, Dina A. Adnan, "Age Classification from Facial Image System",International Journal of Computer Science and mobile Computing

Volume 3, Issue 10, October 2014, pg.291-303.

In Computer vision system, rapidly expanding various applications. The goal in this paper is to develop a designing age classification system from the characteristics and information that can extract from the human face images for both sexes. The system proposed new algorithm that merging two features techniques (local and global) features. The local features including (primary face features), so the global features including (secondary face features). The new method in this paper present (local binary pattern) as a new technique uses in wrinkle analysis , so as this method uses to classify the input face images into one of four age groups: Baby, young, young adult and senior, and eight age categories: [1-6, 7-11, 12-19, 20-29, 30-39, 40-49, 50-65,66++]. This method based on human face region which contains a lot of information and properties that describe the head growth and face aging pretenses. These information can be used by the human brain to estimate the face age dependent on the external features that shows the craniofacial changes in geometrical characterize results by the growth of the head that changes the primary face features locations, the primary face features are: the center of the two eyes, nose peak, mouth peak, top head, face sides and the chin point, from these primary features we compute the geometrical ratios that distinguish babies faces from the three age groups: young, young adult and senior. The other changes that appear when the face aging is the texture changes which are the secondary features can be used to estimate the age of the face. The secondary face features may be the wrinkle appearance, duple chin, and eye bags. The wrinkle lines are calculated in the curliest five regions these are: for head, under two eyes and cheeks regions. These lines are computed and used to distinguish young, young adult, and senior age groups and age categories.

Chapter 3

Software Project Management Plan

This chapter presents the project management goals for the project and includes a description of the deliverables and deadlines.

3.1 Introduction

3.1.1 Project Overview

Music has become an integral part of a person's day to day life. Music plays an important role for people as they age but what they listen to is chosen to suit particular 'life challenges' they face and meet social and psychological needs. Different generations listen to different music. Senior citizen generally listen to older music from 1960s, whereas, teenagers and kids listen to current music. This proposed system based on facial feature extraction and age classification will generate a playlist automatically that may adhere to the person's music choice and thereby reducing the effort and time involved in rendering the process manually.

3.1.2 Project Deliverable

Sr. no.	Deliverables	Expected Delivery Date
1	Software Requirement Specification	16/08/2017
2	Software Project Management plan	16/08/2017
3	Software Design Document	06/09/2017
4	System Test Document	20/09/2017
5	Detection of face and its features	02/10/2017
6	Age Classification System.	22/01/2018
7	Playlist generation.	23/02/2018
8	Deployment of Final application	12/03/2018

Table 3.1: Project Deliverables

3.2 Project Organization

The subsection will explain how overall work is done by referencing the Spiral software process model by dividing and assigning roles and responsibilities.

3.2.1 Software process models

The process model which we have used for making the project is prototype model. As it will allow us to experiment with the system, and so, refine the requirements. We might get new ideas for requirements, and find areas of strength and weakness in the software.

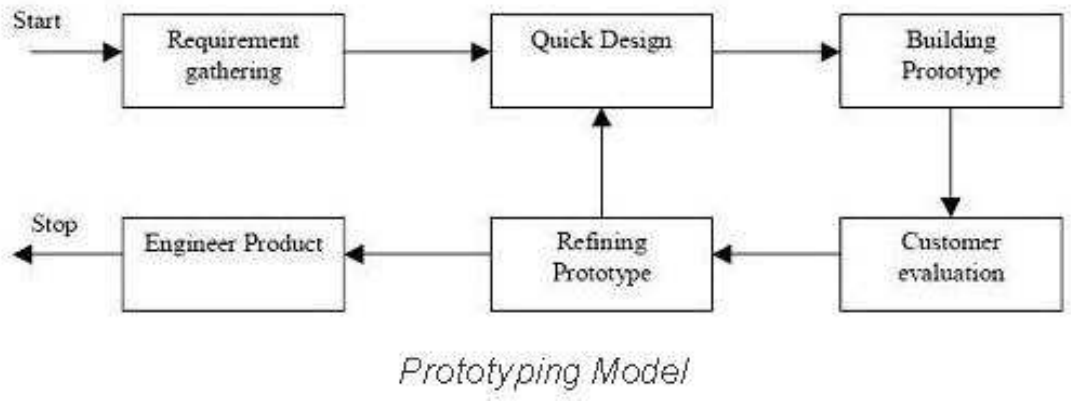

Figure 3.1: Prototype Model

3.2.2 Roles and Responsibilities

Name	Role	Responsibilities
Giten Kadam	Project Team Member	Documentation, Implementation, Requirement Gathering, System Design.
Heet Navsariwala	Project Team Leader	Documentation, Implementation, Requirement Gathering, System Design.
Keya Mankar	Project Team Member	Documentation, Literature Survey, Requirement Gathering, System Design.

Table 3.2: Roles and Responsibilities

3.2.3 Tools and Techniques

Software Requirements

Tools	**Purpose**
Matlab	Development
Microsoft PowerPoint	Presentation
Word online	Documentation
Gantt Project	Project Planning Time-Table Chart
Latex	Documentation

Table 3.3: Tools and Techniques

Hardware Requirements

- Minimum 4 GB RAM
- Windows 7 or above Operating System
- Web-camera

3.3 Project Management Plan

3.3.1 Task-1: Resource Gathering - T1

Description

This task involves gathering all the required information required to understand and implement the project. It includes technical papers for reference, gathering images with a face for the project etc.

Deliverables and Milestone

Technical papers and other information required to understand and implement the project, images with a face.

Resources Needed

Internet.

3.3.2 Task-2: Prepare Project Scope - T2

Description

Project scope defines what will or will not be included in the project, and controls what gets added or removed as the project is executed.

Deliverables and Milestone

Complete project scope document.

Resources Needed

Microsoft Word.

3.3.3 Task-3: SRS(Software Requirement Specification) - T3

Description

The SRS document will identify and describe the requirements needed to develop the system.

Deliverables and Milestone

The deliverable will be in the form of a verified SRS Document.

Resources Needed

The SRS document will be generated by the team members using Latex based on the Literature Review and research done by the team.

Dependencies and Constraints

The project must be approved by the assigned Panel.

Risk and Contingencies

The SRS may go under Change Control Processes in case there is a requirement.

3.3.4 Task-4: (Software Design Document) - T4

Description

This document will be used to specify the design for implementation of the project in the form of various diagrams which will specify the work flow of the project.

Deliverables and Milestone

The team members will generate a Software Design Document which will then be verified and will act as the deliverable.

Resources Needed

Microsoft Office

Dependencies and Constraints

The completion and approval of T3-Software Requirement Specification Documentation.

Risk and Contingencies

During the progress of the project, it may be required to revise the document.

3.3.5 Task-5: Detection of face and its features - T5

Description

This feature of the application will detect the face of the user and features like mouth, eyes and nose.

Deliverables and Milestone

To detect face and features for implementation of algorithms in the future.

Resources Needed

MATLAB software

Dependencies and Constraints

The completion and approval of T4-Software Design Document.

Risk and Contingencies

The face may not be detected if not correctly aligned.

3.3.6 Task-6: Implementation of Age Classification System - T6

Description

This feature of application will predict the age group of the user from the captured image.

Deliverables and Milestone

To implement age classification algorithms for successfully predicting the user's age.

Resources Needed

MATLAB software

Dependencies and Constraints

The completion and approval of T5-Detection of face and its features.

Risk and Contingencies

Correct age group may not be predicted.

3.3.7 Task-7: Playlist generation based on predicted age - T7

Description

This feature of the application will generate playlist based on predicted age group of the user.

Deliverables and Milestone

To generate playlist by mapping the age predicted of the user to the songs stored in the database.

Resources Needed

MATLAB software

Dependencies and Constraints

The completion and approval of T6-Implementation of Age Classification System.

Risk and Contingencies

Playlist may not be generated according to the predicted age.

3.3.8 Task-8: User Interface - T8

Description

This task aims at integrating the prototypes and provide the user an attractive, easy to use User Interface.

Deliverables and Milestone

A near to complete desktop application with an attractive User Interface ready to be tested.

Resources Needed

MATLAB software

Dependencies and Constraints

The completion of T7 Playlist generation based on predicted age.

Risk and Contingencies

The complexity of prototypes may cause problems in integration.

3.3.9 Assignments

Task	Allotment
Approval Presentation	Keya, Heet and Giten
Requirement Gathering	Keya, Heet and Giten
Literature Survey	Keya, Heet and Giten
Design UI	Keya Mankar
Face Detection and Feature extraction	Heet Navsariwala
Age Classification	Giten Kadam
Playlist Generation	Heet and Keya
Testing	Heet and Giten

Table 3.4: Assignments

3.3.10 Time table

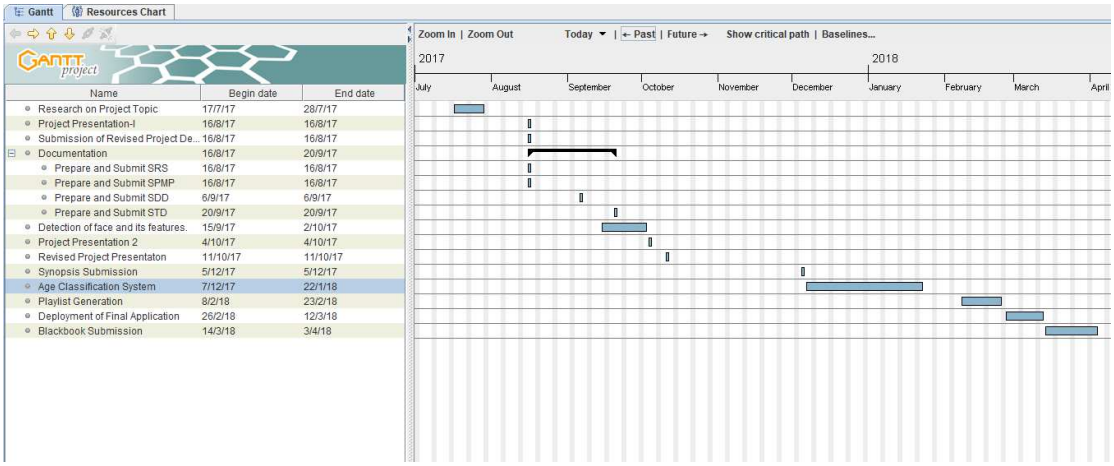

Figure 3.2: Timeline of Project

Chapter 4

Software Requirement Specification

This chapter presents the software system to be developed, laying out functional and non-functional requirements.

4.1 Introduction

4.1.1 Product Overview

Music has become an integral part of a person's day to day life. Music plays an important role for people as they age but what they listen to is chosen to suit particular 'life challenges' they face and meet social and psychological needs. Different generations listen to different music. Senior citizen generally listen to older music from 1960s, whereas, teenagers and kids listen to current music. This proposed system based on facial feature extraction and age classification will generate a playlist automatically that may adhere to the person's music choice and thereby reducing the effort and time involved in rendering the process manually.

4.1.2 Overview of Developer's Responsibilities

The developer is responsible for development and providing the updates with bug fix and new features. Management of database will be handled by the developer.

4.2 Specific Requirements

4.2.1 Product Perspective

The primary objective of the system is to classify age of user based on user's facial image and automatically generate a playlist which the user may like.

4.2.2 Product Features Overview

This application will have the following features:

- Detecting age group of the user.
- Suggesting a playlist based on the age detected by the system.
- Playing a song from the suggested playlist for the user.

4.2.3 User Characteristics

In this proposed application, everyone in any age group can have a very easy and efficient access to all the functionality of the system. From a college student to an entrepreneur can efficiently use this system.

4.3 Functional Requirements

The software has intuitive and very user friendly interface.

1. Image input from user
2. Generated playlist
3. Playing the music

4.3.1 Image input from user

The user will use the webcam as an input device to give the image input.

4.3.2 Generated playlist

A playlist will be generated based on the input from the user.

4.3.3 Playing the music

Any audio track can be played by the user from the generated playlist.

4.4 External Interface Requirements

4.4.1 User Interfaces

- Capture Facial Image:
  When a user opens the application he/she needs to capture his or her image using the web-camera.
- Playlist:
  User can choose a song from the playlist generated by the system.

4.4.2 Hardware Interfaces

- Web-camera.
- Windows computer.

4.4.3 Software Interfaces

- MATLAB.
- Computer Vision Tool Box
- GUIDE Tool

4.5 Non Functional Requirements

4.5.1 Performance Requirements

Performance for generating a playlist will depend on the size of the training model used for classification.

4.5.2 Software Quality Attributes

Because of external disturbance the quality of input might get hampered and thus can lead to inaccurate results. Use of large data set can improve accuracy of the model.

Chapter 5

Software Design Document

This chapter presents a written description of a software product which is written in order to give a software development team overall guidance to the architecture of a software project.

5.1 Introduction

5.1.1 Design Overview

This application generates a playlist that the user may like based on their age. This application provides an unique approach to users to play songs of their liking. The users have to capture their image using web-camera, or upload his/her image. The application will detect the face and extract features. After feature extraction, age of the user is classified and depending upon the age-group a playlist is generated. The user can play any song from the system-generated playlist.
The application uses component-based architecture.The mentioned application broken down into three individual components-Face detection and feature extraction, age classification and Playlist generation.

5.1.2 Requirement Traceability Matrix

	User Interface	Application Logic	Display result
Input image	X		
Classification of age		X	
Playlist generation		X	
Music Player	X		X

Table 5.1: Requirement Traceability Matrix

5.2 System Architectural Design

5.2.1 Chosen System Architecture

The application have individual logical components that represent well-defined communication interfaces containing methods, events, and properties. Hence the System Architecture chosen is Component based architecture. There are three logical components. The first one is the face detection and feature extraction module using Viola-Jones algorithm. The second module is the age classification module. In this module, based on the features extracted in the previous module age is classified using Canny-edge detection and calculating ratios that are used to differentiate between an adult and an child. Lastly, the third module is where a playlist is generated depending on the age classified by the system.

5.2.2 Discussion of Alternative Designs

The alternative options were Layered Architecture, Data-flow architecture and Data-centred architecture. Layered architecture is used at system level. It's for any type of editors like Notepad, etc. Data-flow architecture is for android based projects. It is suitable for applications that involve a well-defined series of independent data transformations or computations on orderly defined input and output such as compilers and business data processing applications. Because of being more vulnerable to failure and data replication or duplication. Data-centered architecture is not preferred.

5.3 Detailed Description of Components

5.3.1 Face Detection and Facial Parts Detection

Responsibilities:	1. Detect Face of the User. 2. Extract facial features from the captured image by calculating ratios and performing wrinkle analysis.
Constraints:	1. Valid image of a human face.
Composition:	1. MATLAB
Interactions:	1. User captures an image with the help of the webcam shown in the UI.
Resources:	Web camera

Table 5.2: Face Detection Feature Extraction

5.3.2 Age Classification

Responsibilities:	1. Classify age of the user using Multi-SVM classifier into an age group. 2. Map the detected age group to the songs from the database.
Constraints:	Valid age group to be generated.
Composition:	1. MATLAB
Interactions:	
Resources:	

Table 5.3: Age Classification

5.3.3 Playlist Generation

Responsibilities:	1. Display the playlist for the user. 2. Display the Music Player for the user to control the audio.
Constraints:	
Composition:	1. MATLAB
Interactions:	1. User can select a song from the playlist. 2. Play, Pause or Stop a song.
Resources:	

Table 5.4: Playlist Generation

5.4 User Interface Design

5.4.1 Description of User Interface

The user interface allows the user to capture their photo using the web-camera. Using the photo captured, the system will generate a playlist depending upon the age classification performed by the SVM Classifier. The user can choose a song from the playlist displayed and play it. The user at any given point can pause or stop playing the current song.

Objects and Actions

- User can capture photo using web-camera.
- User can choose any song to play from the playlist generated by the application.
- User can control the state of the audio playing at a particular time.

Screen Images

1. The user has to capture their image using the web camera. The user is provided with a button 'Take Image' to capture the image.

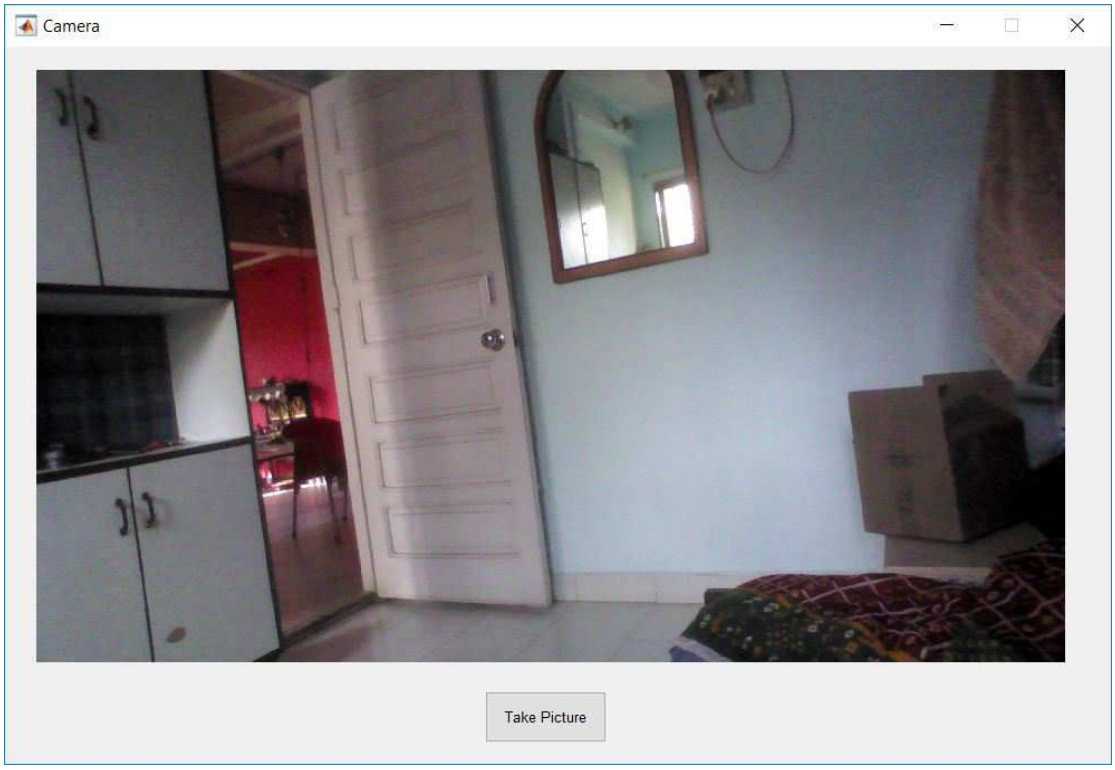

Figure 5.1: Input Screen

2. After the user has captured his or her image, the system will generate a playlist. User can select any song from the given playlist and play it. The Music Player provides buttons to play, pause or stop the audio and the scroller can be used to control the audio.

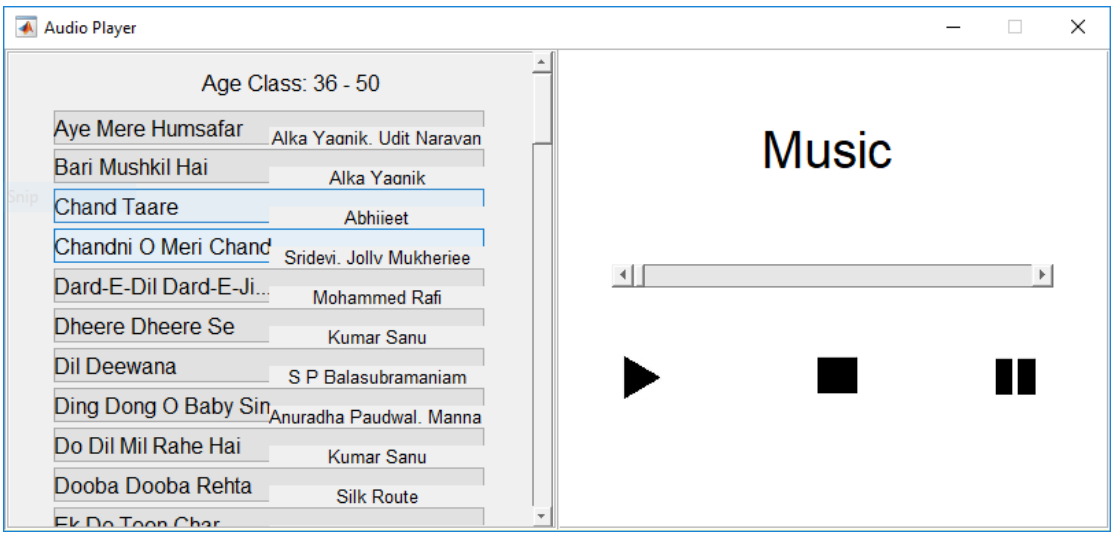

Figure 5.2: Generated Playlist Music Player

5.5 Use Case

A use case diagram is a graphic depiction of the interactions among the elements of the system.

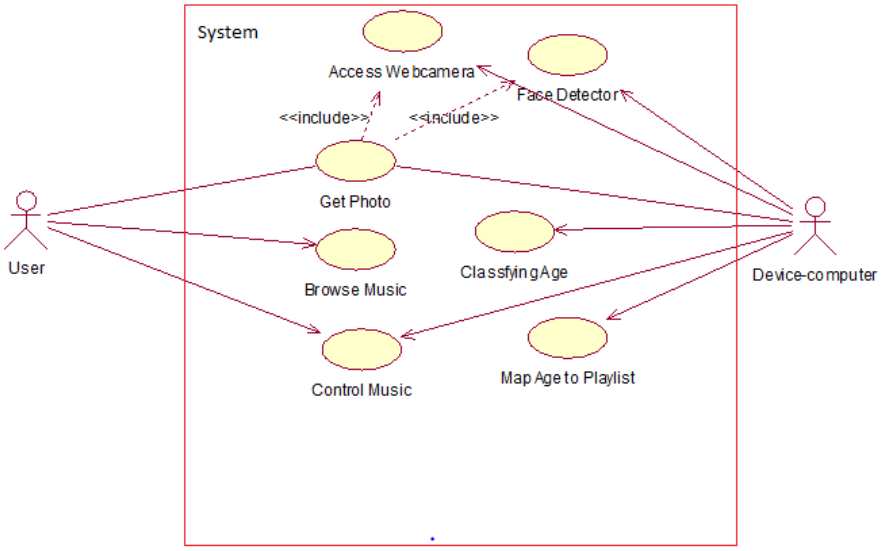

Figure 5.3: Use Case

5.6 Design Document

5.6.1 Level 0 DFD

DFD Level 0 is also called a Context Diagram. It's a basic overview of the whole system or process being analyzed or modeled.

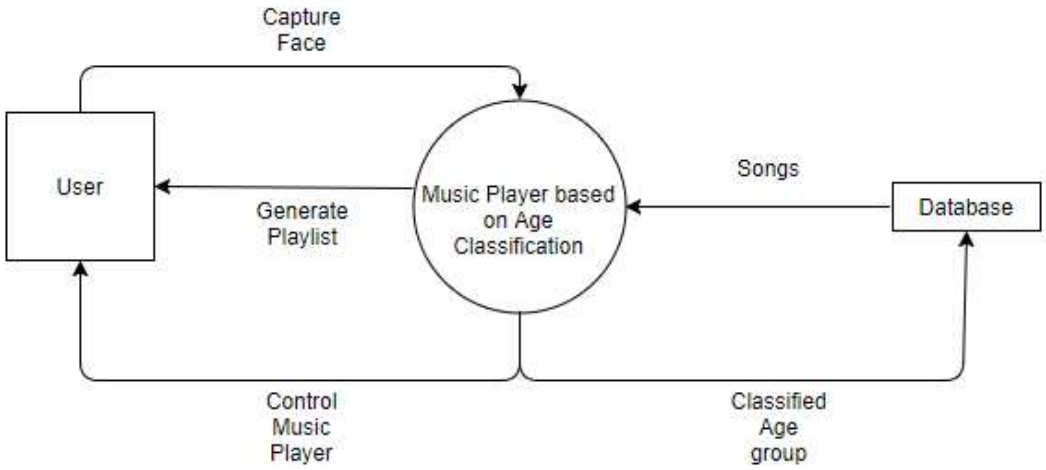

Figure 5.4: DFD Level 0

5.6.2 Level 1 DFD

DFD Level 1 provides a more detailed breakout of pieces of the Context Level Diagram. Here, the main functions carried out by the system, by breaking down the high-level process of the Context Diagram into its sub-processes.

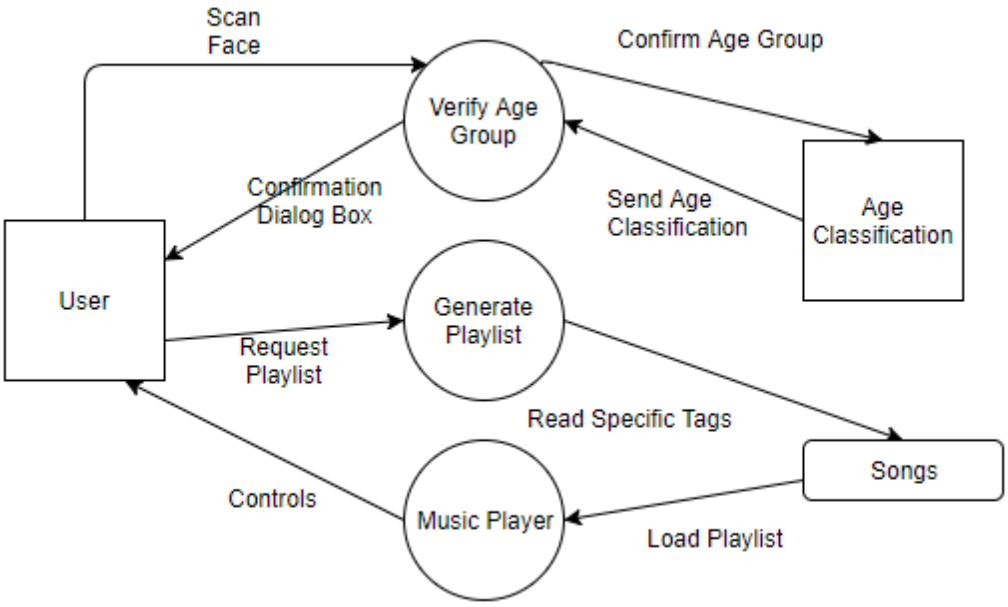

Figure 5.5: DFD Level 1

Chapter 6

Implementation

This chapter presents technologies, Algorithms used and implementation codes for all the modules used in the project.

6.1 Technologies

6.1.1 MATLAB

MATLAB (matrix laboratory) is a multi-paradigm numerical computing environment and fourth-generation programming language. A proprietary programming language developed by MathWorks, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms and creation of user interfaces.
The MATLAB platform is optimized for solving engineering and scientific problems. The matrix-based MATLAB language is the world's most natural way to express computational mathematics. Built-in graphics make it easy to visualize and gain insights from data. A vast library of prebuilt toolboxes lets you get started right away with algorithms essential to your domain. The desktop environment invites experimentation, exploration, and discovery. These MATLAB tools and capabilities are all rigorously tested and designed to work together.

6.1.2 Latex

LaTeX is a document preparation system. When writing, the writer uses plain text as opposed to the formatted text found in WYSIWYG word processors like Microsoft Word or LibreOffice Writer. The writer uses markup tagging conventions to define the general structure of a document (such as article, book, and letter), to stylize text throughout a document (such as bold and italics), and to add citations and cross-references. A TeX distribution such as TeX Live or MikTeX is used to produce an output file (such as PDF or DVI) suitable for printing or digital distribution. LaTeX is widely used in academia for the communication and publication of scientific documents in many fields, including mathematics, statistics, computer science, engineering, chemistry, physics, economics, quantitative

psychology, philosophy, and political science.

6.1.3 Gantt Project

GanttProject is GPL-licensed (free software) Java based, project management software that runs under the Windows, Linux and Mac OS X operating systems. A Gantt chart is a type of bar chart. Gantt charts illustrate the start and finish dates of the terminal elements and summary elements of a project. Terminal elements and summary elements comprise the work breakdown structure of the project.

6.2 Algorithms Used

6.2.1 Viola-Jones Algorithm

The Viola–Jones object detection framework [3] is the first object detection framework to provide competitive object detection rates in real-time proposed in 2001 by Paul Viola and Michael Jones. Although it can be trained to detect a variety of object classes, it was motivated primarily by the problem of face detection. The problem to be solved is detection of faces in an image. A human can do this easily, but a computer needs precise instructions and constraints. To make the task more manageable, Viola–Jones requires full view frontal upright faces. Thus in order to be detected, the entire face must point towards the camera and should not be tilted to either side. While it seems these constraints could diminish the algorithm's utility somewhat, because the detection step is most often followed by a recognition step, in practice these limits on pose are quite acceptable.

6.2.2 Canny Edge Detection

Canny edge detection[1, 2] is a image processing method used to detect edges in an image. It is used to detect edges of different objects in an image. There are different Edge Detection methods such as Sobel, Prewitt, Roberts but Canny method differs in that it uses two thresholds to detect strong and weak edges and considers weak edges in the output only if they are connected to strong edges. Hence Canny method is less likely to be affected by noise and more likely to detect true weak edges. We use the following function in Matlab :

The Edge Detection block finds edges by looking for the local maxima of the gradient of the input image. It calculates the gradient using the derivative of the Gaussian filter. Here threshold is a two-element vector in which the first element is the low threshold, and the second element is the high threshold. The Canny method applies two thresholds to the gradient: a high threshold for low edge sensitivity and a low threshold for high edge sensitivity. The edge function starts with the low sensitivity result and then grows it to include connected edge pixels from the high sensitivity result. This helps fill in gaps in the detected edges.

-1	0	+1
-2	0	+1
-1	0	+1

+1	+2	+1
0	0	0
-1	-2	-1

Figure 6.1: Convolution masks for Canny Operators

6.2.3 SVM Classification

Support Vector Machine(SVM) [3] is a supervised learning classifier with associated learning algorithms that analyze data used for classification and regression analysis.Support Vector Machine (SVM) performs classification by finding the hyperplane that maximizes the margin between the two classes.The vectors that define the hyperplane are the support vectors. SVM needs a set of training examples which are classified to one or the other class to build a model that classifies new data to one of the two classes. We use the following equation to train the SVM classifier :

SVMStruct = svmtrain(Training,Group,Name,Value)

Here Training is the matrix of Training data, Group defines the class labels,svmtrain uses 'kernel_function' to map the training data into kernel space and 'rbf' i.e Gaussian Radial Basis function is the Kernel function used by svmtrain. We have used 1000 images of different ages to train the SVM classifier. The images are classified into 5 Age groups as follows:

Class 1 : 1 - 15

Class 2 : 16 - 35

Class 3 : 36 - 50

Class 4 : 51 - 70

Class 5 : 70+

The following function classifies new data into the respective class:

Group = predict(SVMStruct,Sample)

Here Sample is a matrix Testing data which is classified using the information in the SVM classifier structure SVMStruct which was created before. The Sample matrix must have same numbers of columns as the training data matrix as the number of columns defines the number of features.

6.2.4 Naive Bayesian Classification

Naive Bayes [3] is a simple technique for constructing classifiers: models that assign class labels to problem instances, represented as vectors of feature values, where the class labels are drawn from some finite set. It is not a single algorithm for training such classifiers, but a family of algorithms based on a common principle: all naive Bayes classifiers assume that the value of a particular feature is independent of the value of any other feature, given the class variable. For example, a fruit may be considered to be an apple if it is red, round, and about 10 cm in diameter. A naive Bayes classifier considers each of these features to contribute independently to the probability that this fruit is an apple, regardless of any possible correlations between the color, roundness, and diameter features.

Group = fitcnb(Training,Group,Name,Value)

6.3 Pseudo Codes

6.3.1 Face Detection

```
FaceDetect = vision.CascadeObjectDetector('FrontalFaceCART');

        BB = FaceDetect(capt1);
        I = imcrop(capt1,BB(1,:));

        width = BB(1,3);
        height = BB(1,4);

        NoseDetect = vision.CascadeObjectDetector('Nose');
        BBN = NoseDetect(I);

        MouthDetect = vision.CascadeObjectDetector('Mouth','
           ↪ ,MergeThreshold',50);
        BBM = MouthDetect(I);

        EyeDetect = vision.CascadeObjectDetector('EyePairBig');
        BBE = EyeDetect(I);

end
```

6.3.2 Canny Edge Detection

```
function [w1,w2,w3,w4,w5] = wrinkles(I,BBF,BBUL,BBUR,BBLC,BBRC)
    [~, ~, n] = size(I);
    if n > 1
        I = rgb2gray(I);
```

```
    end

    ForeImage = imcrop(I,BBF(1,:));
    BW1 = edge(ForeImage,'Canny',0.5);

    LeftUnderImage = imcrop(I,BBUL(1,:));
    BW2 = edge(LeftUnderImage,'Canny',0.5);

    RightUnderImage = imcrop(I,BBUR(1,:));
    BW3 = edge(RightUnderImage,'Canny',0.5);

    LeftCheekImage = imcrop(I,BBLC(1,:));
    BW4 = edge(LeftCheekImage,'Canny',0.5);

    RightCheekImage = imcrop(I,BBRC(1,:));
    BW5 = edge(RightCheekImage,'Canny',0.5);
end
```

6.3.3 Classification

```
    model = load('Models.mat',models);
    for j=1:size(TestSet,1)
        for k=1:numClasses
            if(predict(model{k},TestSet(j,:)))
                break;
            end
        end
        result(j) = k;
    end
```

6.4 Results

Class	Range	Count
1	1 - 15	9
2	16 - 35	538
3	36 - 50	254
4	51 - 70	167
5	70+	32

Table 6.1: Training Data used for Classification

Class	Range	Count
1	1 - 15	4
2	16 - 35	135
3	36 - 50	62
4	51 - 70	42
5	70+	6

Table 6.2: Testing Data used for Classification

- The classification model is trained using data of a 1000 images.
- The accuracy of the SVM age classification model comes to 39%.
- The time for the same processing ranges between 15 and 20 seconds.
- The accuracy of the Naive Bayesian age classification model comes to 48%.
- The time for the same processing ranges between 10 seconds.

Chapter 7

System Test Document

This chapter presents the testing strategy that will be used for the proposal system. Objective of this document is mainly to communicate project –wide quality standards and procedures.

7.1 Introduction

7.1.1 System Overview

The system consists of 3 main modules:

- Face Detection and Feature Extraction
- Age Classification
- Playlist Generation and User Interface

7.1.2 Test Approach

Testing would be conducted with the Pro-Active test approach. In Pro-Active method, we would be testing the system as we are developing it so any bugs or inconsistencies would be found out at an earlier stage hence reducing the risk of building a system that does not work at all. It is also easier to find the flaws of the system as the system grows increasingly complex rather that testing a complex system all along.

7.2 Test Plan

7.2.1 Features to be Tested

- Face Detection Module.
- Music Player.

7.2.2 Features not to be Tested

- Classification of age.

7.3 Test Cases

7.3.1 Face Detection

Purpose

To check whether the input image contains a face.

Inputs

- Captured Image

Expected Outputs and Pass/Fail Criteria

Depending on number of faces detected, the system should give output accordingly.

7.3.2 Music Player

Purpose

To check whether the music player works correctly.

Inputs

- Music File
- Button Press

Expected Outputs and Pass/Fail Criteria

The player should follow the functions of the buttons without any interruptions to executions.

7.3.3 Test Cases

Test Case ID	Description	Input	Expected Output	Actual Output	Test Result
FD-1	Detection of face from clear image	Capture clear image of a face	Proceeds to next phase in the process	Proceeds to next phase in the process	Pass
FD-2	Detection of face from an unclear image	Capture unclear image of a face	Gives error message "No face detected"	Gives error message "No face detected"	Pass
FD-3	Detection of face from image with multiple faces	Capture image with multiple faces	Gives error message "Multiple faces detected"	Gives error message "Multiple faces detected"	Pass
FD-4	Detection of face from a low contrast image	Capture a low contrast image of a face	Gives error message "No face detected"	Gives error message "No face detected"	Pass
MP-1	Testing of play button of Music Player	Press play	Song starts playing	Song starts playing	Pass
MP-2	Testing of pause button of Music Player	Press pause	Song pauses playing	Song pauses playing	Pass
MP-3	Testing of stop button of Music Player	Press stop	Song stops playing and goes back to the beginning of the song	Song stops playing and goes back to the beginning of the song	Pass
MP-4	Testing of Music Scroller	Shift scroller to a random position	Song should stop and start playing from the time represented by position of scroller	Song should stop and start playing from the time represented by position of scroller	Pass
MP-5	Playing a song	Select a song to play	Song plays completely	Song plays completely	Pass

Table 7.1: Test Cases

Chapter 8

Conclusion and Future work

This chapter presents the conclusion and gives an overview of the scope for future work for the given project.

8.1 Conclusion

A Music player which generates a playlist based on the user's age is implemented in this project. The system processes include pre-processing of input image, face and facial part detection, edge detection, wrinkle analysis, train the classifier by sending extracted features to the SVM classifier and finally, testing is done for the test data by passing it to classifier in order to obtain the results.

The face is captured using the web camera and using the captured face the age of the user is classified based on the ratios calculated and wrinkle analysis with the help of the MATLAB software.

The playlist generation module has been beneficial in reducing time required to search songs of a particular era and thereby increasing the overall efficiency of the system.The major strengths of the system are complete automation of software as well as user dependence.

8.2 Scope for Future Work

The system created can be integrated with face authorization system to save a user's preferences and can also be coupled with a mood detection system to further refine the objective of playlist generation.

The system can also be developed as a learning system for better accuracy of results.

At present the system is an executable application which can only run on a desktop, but in future it can also be modified to work as a web application or a smartphone application.

Chapter 9

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Music Player Based on Age Classification

Giten Kadam
Information Technology
K. J. Somaiya College of Engineering,
Mumbai, India

Keya Mankar
Information Technology
K. J. Somaiya College of Engineering,
Mumbai, India

Heet Navsariwala
Information Technology
K. J. Somaiya College of Engineering,
Mumbai, India

Prof. Sujata Pathak
Information Technology
K. J. Somaiya College of Engineering,
Mumbai, India

***Abstract*— A human face is an important organ of an individual's body and it is an important factor in the classification of an individual's age. This proposed system based on facial feature extraction and age classification will generate a playlist automatically that may adhere to the person's music choice and thereby reducing the effort and time involved in rendering the process manually. The system classifies the user into three age groups - Young, Adult and Old. The process of the system is divided into three main stages: feature extraction, age-group classification and playlist generation.**

Keywords – Facial Feature Extraction, Age classification, Music Playlist.

I. INTRODUCTION

A person's face is the repository of a lot of information such as age, gender and identity. Faces allow humans to estimate/classify the age of other persons just by looking at their face. Manually segregating the list of songs and generating an appropriate playlist is a very laborious and time consuming task. In this paper, a computer application which classifies the age group of the user and automatically generates a music playlist depending on the classified age group is proposed. This proposed system based on facial feature extraction and age classification will generate a playlist automatically thereby reducing the efforts and time required for manually creating a playlist. The system classifies the user into three age groups - Young, Adult and Old. The process of the system is divided into three main stages: feature extraction, age-group classification and playlist generation.

II. RELATED WORK

In this paper[1], the system developed extracts the primary features from the facial images and calculates six ratios which are able to distinguish between an infant and an adult. Further, to distinguish among adults wrinkle analysis is carried out using canny edge detection to find number of wrinkles. The images are then classified using the ratios and the number of wrinkles identified previously to estimate the age of the user.

III. PROPOSED SYSTEM

The main objective of this application is to decrease the time and effort required in creating a

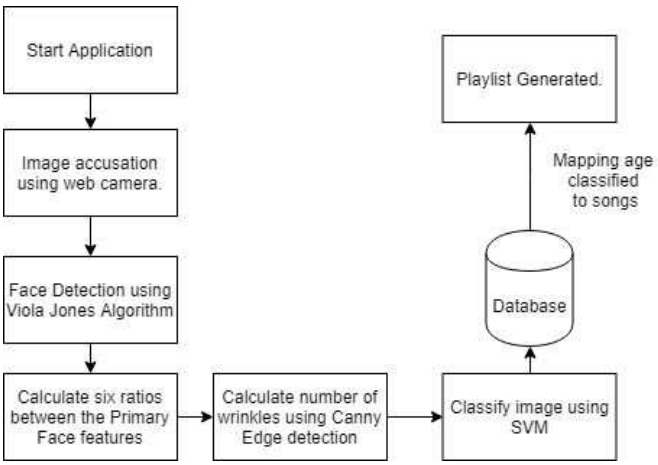
playlist of music from different eras. Generally the user has to browse through a database of songs and check whether he or she likes a song or not. Using this application, the user will automatically get a system generated playlist which will contain songs depending upon the age group of the user. These songs maybe liked by the user. The user can play any songs he or she wants from the playlist.

The main functions would include:

1. Classify age group using facial images.
2. Recommend a playlist based on user's age.
3. Play the song from the recommended playlist.

IV. METHODOLOGY[1]

The application have individual logical components that represent well-defined communication interfaces containing methods, events, and properties. Hence the System architecture chosen is component based architecture. There are three logical components. The first one is the face detection and feature extraction module using Viola-Jones algorithm. The second module is the age classification module. In this module, based on the features extracted in the previous module age is classified using Canny-edge detection and calculating ratios that are used to differentiate between an adult and a child. Lastly, the third module is where a playlist is generated depending on the age classified by the system.



System Workflow

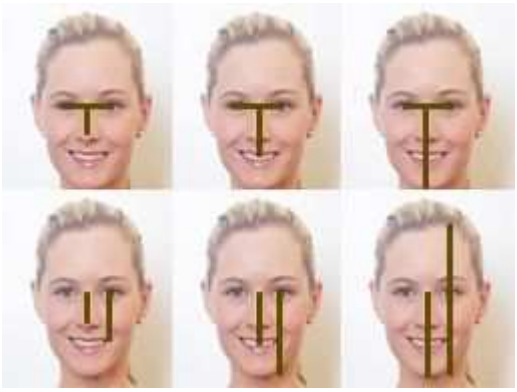
V. IMPLEMENTATION

The home page of the application will have an option to take a picture for generation of the playlist. Selecting that option takes the user to an interface with a camera. The user then clicks a picture of themselves which the system uses to classify the user in a particular age group. The system generates a playlist for that age group.

A. Primary Face Features

There is a difference between the primary face features of an infant and a grown up. The primary features are used to calculate six ratios[1]. The features used are position of eyes, peak of nose, centre of the mouth, end of chin and top of forehead. **Ratio 1** is the ratio between T1, the distance between the centre of the eyes and T2, the height of the eyes from the nose peak. **Ratio 2** is the ratio between T1 and T3, the height of the eyes from mouth. **Ratio 3** is the ratio between T1 and T4, the height of the eyes from the bottom of the chin. **Ratio 4** is the ratio between T2 and T3. **Ratio 5** is the ratio between T3 and T4. **Ratio 6** is the ratio between T4 and T5, the distance between the top of the forehead and bottom of the chin. The primary features are close at infant stage and as the individual grows they keep spreading apart

which helps the system in distinguishing the faces.



Primary feature ratios

B. Secondary Face Features

Wrinkle and skin features are important factors in identifying age. Wrinkles are high frequency regions in an image. Edge detection techniques can be used to detect wrinkles in specific areas of the face. The areas of the face that are used in this process are forehead, skin under the eyes and skin on the cheeks. Canny edge detection[4] is used to identify number of wrinkles that is then used for classification along with the six ratios calculated previously.

C. Classification

The SVM[2] algorithm will be used exhaustively to scan the user's image for facial patterns such as the six ratios mentioned before. The six ratios and the number of wrinkles will be used to classify the face using Support Vector Machine(SVM). SVM classifiers are frequently used in pattern recognition and classification. SVM takes the six ratios and the wrinkle numbers and classifies the user's face into one of the three groups - Young, Adult or Old.

VI. Conclusion

A Music player which generates playlist based on user's age group is presented and discussed in this paper. The music player does away with users requiring to manually create a playlist of songs which they like. The proposed system aims at providing a music playlist to the user which will help reduce the searching time for music.

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