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# Music Recommendation System Based on Emotion Detection

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**ABSTRACT:** Emotion of an individual can be identified by their facial expression. Facial expression can be determined from human face directly using camera. The data can then be used to get a list of songs that is derived from their mood. Music Recommendation System Based on Emotion Detection aims to create a playlist based on the facial expression. The system focuses on generating a playlist based on the facial expression that helps to eliminate the time consumed in finding the song user wants to play.

## I. INTRODUCTION

Music recommendation system based on emotion detection is an application that recommends music by detecting facial expression of user. Facial expressions plays an important role in emotion. Through facial expressions a human conveys different messages. Also, music has become an inseparable part in every human life.

The web application is developed using Django framework of python and facial recognition OpenCV is used. Python is a high level objected oriented programming language. It is very interactive.[13] Python run smoothly on various platforms (Windows, Mac, etc).[14] Python consists various framework from which Django is widely used. Django is an open source high level python framework.[8] It is based on Model View Controller (MVC) architectural pattern.[11] OpenCV is a library that can develop real-time computer vision application. It is mostly used for image processing, video capture and analysis from which we can use feature like face and object detection. [13]

For a person it is very difficult to search music that suits their current mind state or their current mood. They spend hours and hours for searching new music and also end up not liking them. They find it waste of time. And people want everything very handy or they want something that is quick and easy to use.

To many users, the music recommendation based on emotion detection might be very fruitful because users get songs based on their current mood. If they are happy or excited it recommends songs that will enhance their moods. Through this system user gets familiar to new music and also they can find music according to their mood. Users can get deeper into music area through this application.

## II. LITERATURE REVIEW

**Moodplay: Interactive Mood-based Music Discovery and recommendation**
Ivana Andjelkovic, Denis Parra and John O'Donovan proposed a large body of research in recommender system that focused on optimizing, predicting and ranking. They introduced 'Moodplay' that is a hybrid recommender system that integrates content and mood-based filtering in an interactive interface. They defined how MoodPlay allows user to explore collection of music by latent affective dimensions and also explained how to integrate user input at recommendation based on pre-existing user profile. Results of a user study (N = 240) was discussed, with four conditions evaluated with varying degree of visualization, interaction and control.[1]

**Emotion Based Music Player Using Facial Recognition**
The input is directly taken from human face through camera. The input can be used to get information of mood of an individual and then the data can be used to get a list of songs that comply with the mood. It is less time consuming, eliminates the hectic task of grouping the songs into different list and helps to get a playlist based on emotional feature. For automating the playlist generation process different algorithms have been proposed. The paper basically focuses on the methodologies available for detecting human emotions for developing emotion based music player. The application is developed to manage the contents accessed by user, analyze the image properties and determine then mood of the user based on mp3 file properties so that they can be added into suitable playlists according to the mood.[3]

A classification algorithm is an important component of facial recognition. It is used to find valuable data distribution and data models in the potential data. K-mean algorithm gathers the idea of classification analysis that is to gather each element to the closest heart-shaped (mean) class. The steps included in this algorithm are:

Step 1 - The object is roughly divided into K initial classes
Step 2 - The object is assigned individually to closest mean class.
Step – 3 Second step is repeated until no various elements are in and out.

K-medoids method is a method to select 'medoid' instead of central role in K-mean algorithm.
Input: K is the number of clusters and N is the number of data object database contains.
Output: K-clustering classes which meets the standard minimum variance.
The process of finding medoid is:

P1. Choose K objects from N data objects as initial      cluster center
P2. Repeat
P3. Assign each of the remaining objects to the nearest cluster represented by the center;
P4. Select randomly a non-center object -Orandom;
P5. Calculate of the total cost of E, using Orandom instead of Oj
P6. IF E<0, then replace Oj with Orandom, forming a new set of K center points.[5]

### Analysis of reviewed literature
Analyzing the above two systems, facial expression can be used to determine the emotions. Examining those systems reveals various concepts that can be distilled to create analogous systems. For instance, by studying the initial system, we can discern methods for incorporating user input into recommendations, leveraging existing user profiles. And from the second system, we can analyze how the contents accessed by the user can be managed by analyzing the image properties that helps to define mood of the user. We can learn how the data can be managed more precisely. From both the system we can learn how to detect emotion using facial expressions.

## III. DEVELOPMENT

### Selection of methodology
Agile methodology is one of the software development life cycle in which the development is broken down to iterations. In each iterations the development and testing is done.[4] Different framework falls under agile methodology. Some are chosen and described below:

**1)     Scrum:**
Scrum embodies a robust collection of values, principles, and methodologies while maintaining a lightweight approach. Its iterative and incremental nature revolves around a repetitive cycle of iterations, delivering functionality in small, manageable batches.[9] Scrum facilitates swift feedback loops, ongoing enhancements, quick adaptation to changes, and expedited delivery processes. [10] The following are the three pillars of process control:

**1.1     Transparency:**
A clear visibility of the process should be given to make sure everyone understands what they are observing.

**1.2 Inspection:**
Every progress needs to be kept under inspection so that every tasks are on track.

**1.3 Adaption:**
A process is fixed as soon as possible so that any further issues can be minimized.[10]
The utility of the Scrum methodology lies in its high degree of flexibility, allowing for the planning of each sprint. Product quality remains paramount as testing is conducted within every sprint, ensuring continual maintenance and enhancement.

**2) Kanban:**

Kanban is a framework used to implement agile software development. It manages the workflow. The main goal of Kanban is to identify the potential bottlenecks in the process and fix then so that the work flows through it cost-effectively at an optimal speed or throughput. The following are principles if the kanban methodology:

Step 1 - Start with what you are doing now
Step 2 - Agree to pursue incremental evolutionary change
Step 3 - Initially, respect current roles, responsibilities and job titles
Step 4 - Encourage acts of leadership at all levels[2]

To manage the work system, kanban is very useful because it focuses on continuous delivery and reduces the waste of work and time. It helps in increasing productivity and efficiency and is flexible.

**3) FDD (Feature Driven Development):**

FDD is a customer-centric, iterative and incremental framework. It is easier to track progress and result because it encourages status reporting at all level. It allows the team to update project frequently and identify errors very fast. The five basic activities that exists during FDD are:

1) Develop overall model
2) Build feature list
3) Plan by feature
4) Design by feature
5) Build by feature[6]

FDD is simple and allows rapid development. Development standards are pre-defined which helps the team to move forward with continuous success with an ease and quickly. [7]

*Selected methodology*

Analyzing the different methodologies for the project management, Scrum methodology is more suitable than the other two methodologies because the activities can be adjusted as per situations. Scrum is more structured than kanban and also team makes the boards overly complex. Feature Driven Development (FDD) methodology works better with bigger projects and also is not good for individual software developer. Iterations are not as properly defined as scrum has.

Scrum encompasses a potent blend of values, principles, and methodologies while maintaining a streamlined and lightweight structure. The stages included in scrum methodology are:

**1. Begin:**

During this stage, the comprehensive plans, visions, and objectives are established. This phase involves the following actions:

P1. Create a project plan
P2. Identify scrum master and stakeholder
P3. Form scrum team
P4. Develop epics
P5. Create prioritize product backlog
P6. Conduct release plan

**2. Plan and estimate:**

The estimation of timeframe for the project is done in this phase. What tasks are to be performed on which date and what can be done so that the project moves along the time frame is planned here. This phase has following actions:

P1. Create user stories
P2. Approve, estimate and commit user stories
P3. Create tasks
P4. Estimate tasks
P5. Create sprint backlog

**3. Implement:**

The main deliverable of this phase is to execute the plans. All the tasks are executed. The following actions are performed in this phase:

P1. Create deliverables
P2. Conduct daily stand-up
P3. Groom prioritized product backlog

**4. Review and Retrospect:**

The main task in this phase is to find out the things that needs to be improved before handing it to the client. The actions performed are:
P1. Convene Scrums of Scrums
P2. Demonstrate and validate sprint
P3. Retrospect sprint

**5. Release:**

Release is called the deployment phase. The products are released to the clients in this phase. The actions included in this phase are:

P1. Ship deliverables
P2. Retrospect project

*Review of different tools and techniques*

The tools that are to be used are:

1. **IDE: Visual Studio Code**
   Visual Studio Code is preferred due to its user-friendly coding environment and the availability of diverse plugins, making it a popular choice among developers.

2. **Database: MySQL**
   MySQL stands as an open-source relational database management system renowned for its rapid processing capabilities. Its user-friendly interface simplifies the storage of structured data, making it an accessible choice for many.

3. **Programming language: Python (Django Framework)**
   Python is object oriented and easy to use. It is open source and has a community based development model. Python is flexible, portable and can run on any platform easily.

4. **Library: Open CV**
   OpenCV is an open source computer vision and machine learning software library. It is great when it comes to image processing.

5. **Project management tools: Jira**
   With Jira it is easier to plan, track and manage the software development process using sprints.

The techniques that are to be used are:

i. **Exploration:**
   The internet serves as an unparalleled resource for conducting research. Countless research papers, documents, and various websites offer abundant information tailored to our needs.

ii. **Web-based Survey:**
   Utilizing online surveys enables us to pinpoint the precise demands of users within such systems, empowering us to tailor our efforts accordingly to meet those needs.

iii. **UI modelling:**
UI modelling will help to visualize the outcome of the project which will help in the development phase. UI/ UX testing can be done before the product is developed which will be time saving.
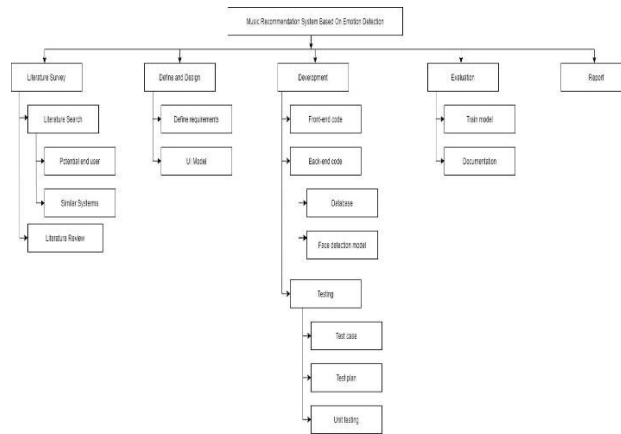
## IV. PROJECT PLAN

*Work Breakdown Structure*



Figure 1: High-level Work Breakdown Structure

## V. PROBABLE ISSUES DURING THE PROJECT

*Possible risk factors*
During a project there could be many risk factors that could affect in completion of the project. Following are the possible risk factors identified in the project:

R1. The hard disk might crash.
R2. Supervisor may leave anytime.
R3. Due to procrastination the time available may be underestimated which will lead in delay of project completion.
R4. The software which we are using may crash.

*Fallback plan for the risk factors*
A fallback plan should always be kept in mind in case of any problem may arise. The following are some fallback plans for the risk identified above:

S1. To survive from the risk of hard disk crashing the backup of the project can be kept using google drive and GitHub.
S2. By maintaining a proper documentation it will be easy for us and the supervisor to get along the project.
S3. Use of project management tool will help to keep track of the project.
S4. The technical issues like software crashing or anything can be tacked using other laptop or desktop.

*Social, legal and ethical issues that might arise during or after the project*
After this project it might affect people of certain age group. As the songs are recommended with facial expression, some songs might contain word that are unacceptable for children. This might have negative impact on them. In the same way the privacy of data can also be a legal issue. And talking about the ethical issues, data of user is used to improve AI of the application.

*Solution for social, legal and ethical issue*
For the above issue the songs can be recommended according to age that user has used during registering. The data can be more secured if the system is more secured. And it will be better when the system uses data with permission of user.

## VI. CONCLUSION AND FUTURE WORK

*Key finding of the proposal*
While doing research on similar systems many new features and techniques were found which could be the part of this project too. This also helped to picturize the overall system. Different tools and technique were researched to build this system. Building this system it require some methodology out of which scrum was the suitable one. Since every project requires a proper planning, WBS (0) was used to prepare the plan for this project.

*Future Work*

The development of the project can be started after the proposal is completed and also the first thing that should be noted is the key knowledge of using different tools. As the chosen methodology is scrum, the task is allocated in terms of sprint and by following the project plan the project can be started.

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