Tribhuvan University

Institute of Science and Technology

A Final Year Project Report

on

"Music Classification System"

Submitted to:

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ABSTRACT

"**Music Classification System**" is a web-based music system that associates with the classification of music according to the genre. It is a full-stack interactive online music platform that allows users to upload and download music files. The system is built using Java technology with Servlet for the backend and the frontend part is handled using JavaScript, HTML, CSS in JSP. Python is used to implement the music classification module using k-nearest neighbors and recommend through cosine similarity. Users can access all the functionalities of the system by signing in to the system providing user credentials. The classification of the songs will be performed when a user uploads a song to the system and the implemented algorithm will output the resulted genre accordingly.

Keywords: *Java, Servlet Jsp, Python, k-nearest neighbor, classification, etc.*

CHAPTER 1

INTRODUCTION

1.1 Introduction

Music is simply having rhythm, melody, or harmony. It can be treated as learning, therapy, and teaching tool. Music consumption has changed a lot in past years. Back then, people used to purchase CDs, albums and patiently listen to their favorite music on traditional radio stations. It used to connect the people to good quality music traditionally. Over time, the music industry morphed to take advantage of the new digital landscape to find a new way to listen and sell the music effectively in a cost-efficient manner. Digital downloads and online streaming services have eventually become the digital way to distribute music. Today, due to the influence of the internet and its regular involvement among youths and adults, there is a huge opportunity among music consumers.

The Music Classification system is a web application where one could listen to good music classified according to the genre. It will provide a platform to the music industry so, that they can stream their songs all over the nation. The cost of streaming on other websites such as Amazon Music, Spotify is quite expensive. To solve such problems, the system will be of great help. The system will allow users to register an account to listen to good music by streaming online. It will be a great platform for beginners who want to develop their carrier in music. They can upload their original music to the masses directly without the involvement of a third party. As a fan, one can listen to the melodious music enlisted by the different artists anytime anywhere. Users just have to sign in to the website to upload and download the music files to/from the website. The system implements different algorithm to classify and recommend different songs according to the current song or music that the user is listening to. The recommendation algorithm is implemented in python using a cosine similarity algorithm and a further classification algorithm too implemented in python is performed using the K-nearest neighbor algorithm of machine learning.

The main goal of the Music Classification System is to classify the uploaded in their respective genre. Whenever the admin uploads a song the classification algorithm runs and classifies the respective song according to the pre-defined genre. And recommendation algorithm thus recommended songs which users can play online.

1.2 Problem Statement

The internet has forever changed the landscape of the music industry. Nowadays, when people want to listen to music, they search or surf the web. The traditional approach to store the songs on the memory device, CDs, and cassettes is none in use due to the streaming services provided by different companies. To cope up with the modern trends and technology music industry should uphold the streaming application. The streaming platform mainly for Nepali music is not available currently which has created an impact on the influence of Nepali cultural music. One must pay highly to streaming platforms such as Spotify and Amazon Music to channelize their own.

The never-ending list of offerings can be overwhelming but it is essential to have a clear cut of the problem of these online platforms. A few major problems out there are that new Nepali artists might have to wait years to see a profit on their investment. And lots of youths are attracted to foreign music. And lastly, to cope up with the larger number of uploads daily, a good classifier is needed most to specify the genre automatically.

1.3 Objectives

The main objective of the project is to build a system for streaming music with a proper classifier and recommendation algorithm.

Major objectives are:

- To build a system that can classify and recommend music.
- To build a system that allows downloading mp3 files.

1.4 Scope and Limitations

1.4.1 Scope

Music Classification System aim is broad in terms of other music systems as it solves the problems of classifying the music, as k-nearest neighbor algorithm has better result. This system can be used as an online platform for the music-related projects. Easy Registration, uploading, and downloading of music files can be performed. Users can access from anywhere anytime as it is a web-based platform.

1.4.2 Limitation

The limitations of Music Classifier System are as follows:

- The system can't generate revenue for now.
- The system is made for audio files so it cannot allow the user to upload the audiovisual files.
- An infrastructural barrier such as internet connectivity, electrical connection, etc. might interfere with how the music system will work.

1.5 Report Organization

This report is divided into six chapters. Each chapter is further divided into different headings.

- **Chapter 1** gives introduction about Music Classification System. The problem definition, objectives, scopes and limitation of this system are discussed here.
- **Chapter 2** focuses on the analysis part. It contains literature review section where the research works done in the field of the Music Streaming platform and Classification System. This chapter also includes feasibility study, requirement analysis and diagram like ER, DFD.
- **Chapter 3** discusses in details about the design of the system. This chapter also discusses about databases design, interface design and flowchart of the system built.
- **Chapter 4** gives information about implementation and testing process. It discusses about how the system is implemented and what tools and software are used to implement this system. The testing process is also included in detail in this chapter.
- **Chapter 5** includes conclusion of whole project. This chapter shows major achievements in the system and also shows how it can be enhanced later in the future so that it can be made more productive and useful than the existing streaming platforms.

CHAPTER 2

REQUIREMENT AND FEASIBILITY ANALYSIS

2.1 Literature Review

Seth A. Carver from the University of Tennessee, Knoxville published a supervised undergraduate student research and creative work named "Changing the Industry, Spotify" where they mentioned that in 2006 Daniel Ek and Martin Lorentzon changed the music industry forever when they founded the music streaming service Spotify. Music consumption before that point had typically occurred either through direct ownership of the content or through radio listening. The beginning research on the effect of streaming services on the music industry argues that with the introduction of streaming services there has been a fundamental change in the way that music is distributed. The industry has largely shifted from physical distribution to online distribution and at a declining rate. This is noted as the democratization of music. Although individuals are now purchasing more digital copies of music than physical, overall fewer people are purchasing music and shifting to streaming services. Another very interesting point is that most streaming services currently operate at a loss because of the large amount that they are required to pay for copyrighted content [1].

Spotify is a music streaming service that offers alternative and legal ways for users to listen to music. It allows for users to build personalized radio stations and playlists, through both free and paid subscriptions. This music streaming service offers users an opportunity to socialize through music by allowing them to share music on various social media sites such as Facebook and Twitter (Spotify, n.d.). Spotify's target market mainly consists of traditional early adopters and opinion leaders which includes tech-savvy, music enthusiasts, musicians, and record labels. 50% of the users are aged 18-34, and 24% of Spotify's users are from households making roughly $100,000 [2].

Spotify's main competitors are Pandora and iTunes Radio. Pandora is considered the leader in the internet radio with more than 76.2 active monthly users. Unlike Spotify, Pandora users do not have the option to select individual songs to listen to, instead, Pandora selects songs based on the user's music channel preferences. iTunes Radio is significantly less expensive than Spotify at $25 a year. Like Pandora, iTunes radio does not allow users to

choose which songs they will listen to, instead, songs are randomized and based on the user's preferences [3].

Roughly 24K tracks are uploaded to Spotify, Apple Music, Napster, and other streaming music services every 24 hours. That's 1 million tracks every 6 weeks. Spotify confirmed in November last year that its platform now played host to around 70 million tracks. Therefore, it's reasonable to assume that, by the end of 2021, Spotify will be home to over 90 million tracks. And that in the early part of next year, it will surpass a catalog of 100 million for the first time. In April 2019, Spotify founder Daniel Ek confirmed that his service was seeing "nearly 40,000" new tracks uploaded daily. In less than two years, that figure has increased by 50% [4].

2.2 Requirement Analysis

2.2.1 Functional and Non-Functional Requirement

The functional and non-functional requirements are necessary to analyze the system requirements before developing and implementing. As the system design evolves, requirements analysis activities support allocation and derivation of requirements down to the system elements representing the lowest level of the design.

Two types of requirements are analyzed in two different ways:

1) Functional requirements and
2) Non-functional requirements

The functional requirements specify the documentation of the system and activities that a system must be able to perform.

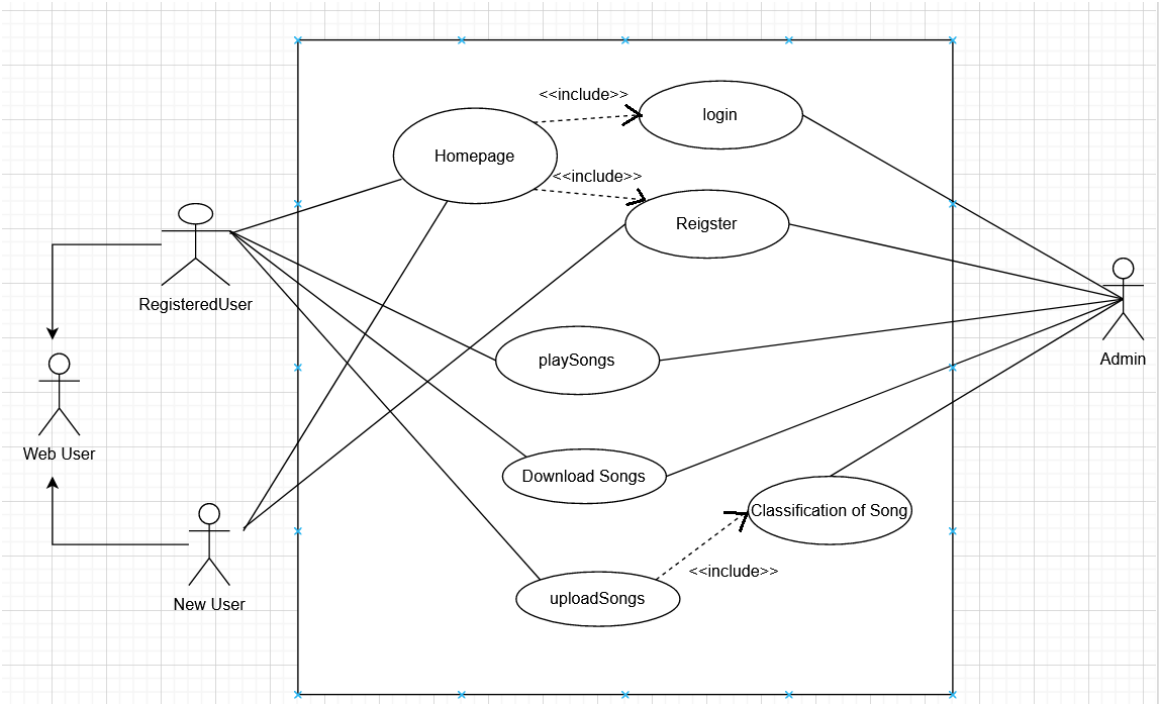


***Fig 1**: Use case diagram*

Non-functional requirements are those type of requirements which is not directly concerned with the system functionality but in absence of it reduces the quality of the system process. The non-functional requirements in the context of the Hamro music follow an interactive interface along with good performance providing scalability and reliability with maintainability.

2.3 Data Collection

The dataset is collected through the Kaggle available online. It is a freely available collection of different datasets to work with. Kaggle, a subsidiary of Google LLC, is an online community of data scientists and machine learning practitioners. It allows users to find and publish data sets, explore and build models in a web-based data-science environment.

2.4 Feasibility Study

Feasibility studies aim to objectively and rationally uncover the strengths and weaknesses of an existing or proposed system, opportunities and threats as presented by the environment, the resources required to carry through, and ultimately the prospects for success.

2.4.1 Technical Feasibility

It is a web-based application that uses HTML, CSS, JSP, and JavaScript as frontend and Java Technology as a backend with python. It will be based on a client-server architecture and the technical supports such as developing software, tools and, framework as freely available as open-source making it technically feasible.

2.4.2 Operational Feasibility

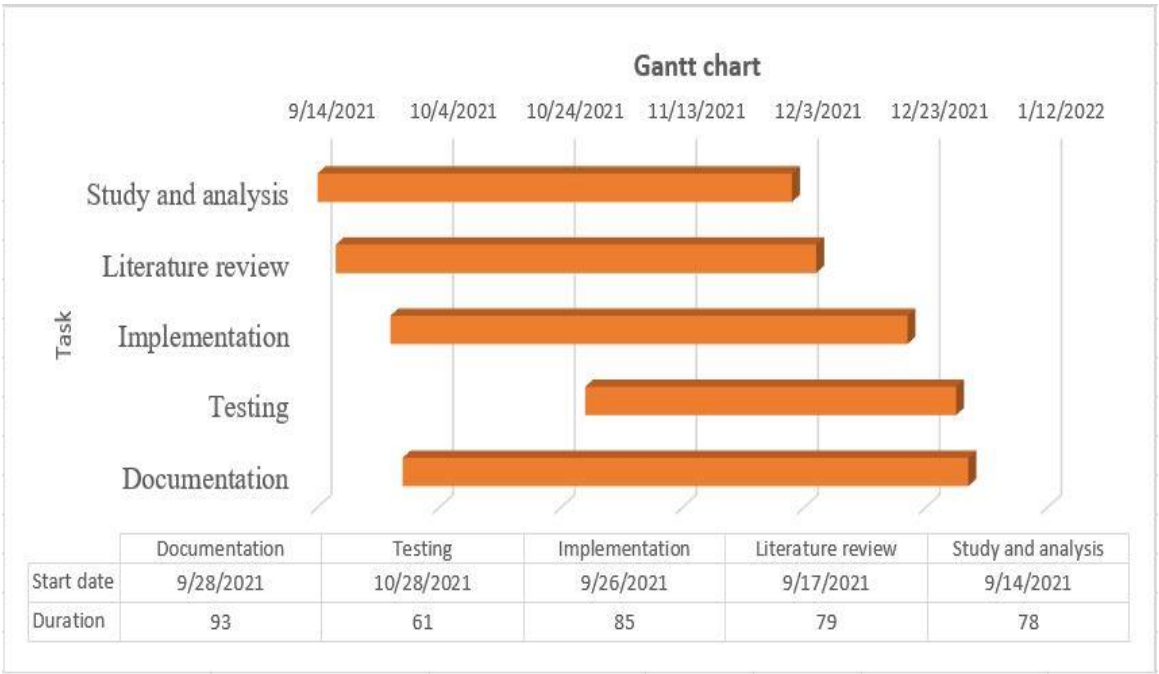
The end users are the client of the application. End-users may be the artist who uploads their originals and the normal users as fans are the one who searches for the various songs for streaming. The database keeps the record of the various information about the users and songs. The application is accessible from anywhere at any time with a proper internet connection. Thus, it can be operated easily.

2.4.3 Economic Feasibility

It is used for the evaluation of the effectiveness of the system. Hamro Music is economically feasible as existing tools and software are being used for developing and deploying the system is open source.

2.4.4 Schedule Feasibility

It is the most important for the completion of the project on time. The project that we are proposing will too be completed within time constraints.



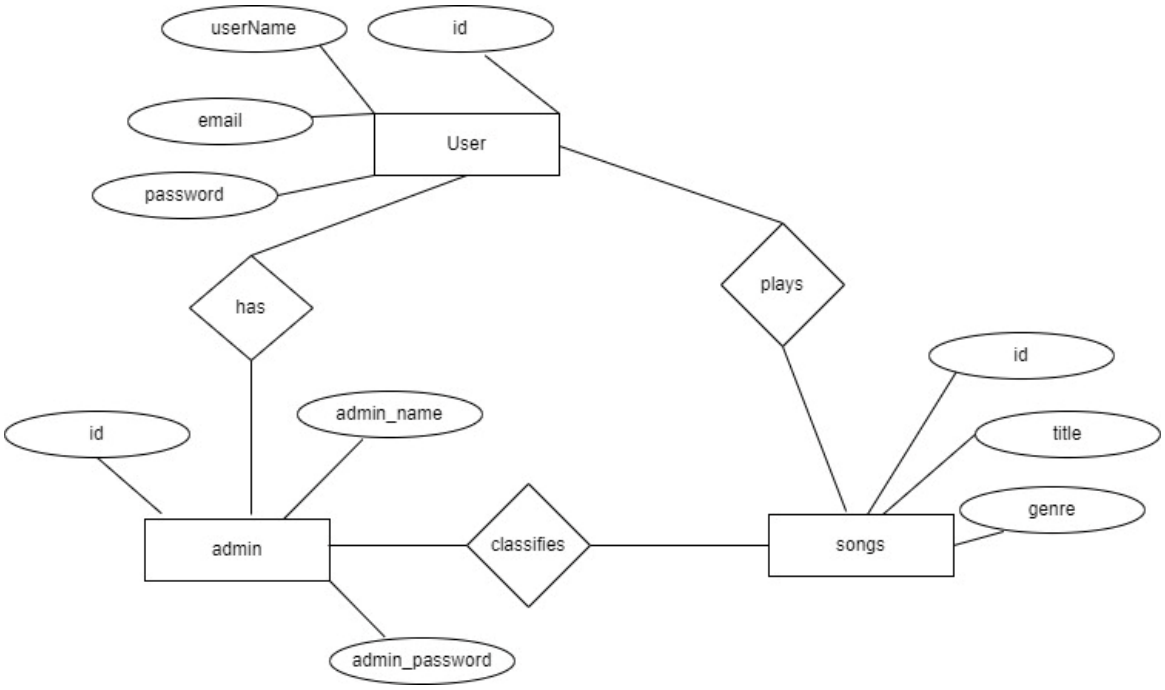
	Documentation	Testing	Implementation	Literature review	Study and analysis
Start date	9/28/2021	10/28/2021	9/26/2021	9/17/2021	9/14/2021
Duration	93	61	85	79	78

2.5 Structuring System Requirements

2.5.1 Data Modeling

Data modeling is the analysis of data objects and their relationship to other data objects. It is the process of documenting a complex software design into an easily understood diagram, using text and symbols to represent the way data needs to flow. Data modeling involves a progression from conceptual model to logical model to physical schema.

ER-Diagram



DFD Diagram

CHAPTER 3

SYSTEM DESIGN

3.1 System Design

3.1.1 Database Schema Design

Database

The overall database consists of the following:

3.1.2 Interface Design

3.1.3 Hierarchical Module Design

CHAPTER 4

IMPLEMENTATION AND TESTING

4.1 Implementation:

System implementation is mainly concerned with the building of a properly working system. The classification of the songs is performed using K-nearest algorithm implemented using ML and recommendation of the songs is performed using cosine similarity algorithm.

K-Nearest Neighbors algorithm

The k-nearest neighbors (KNN) algorithm is a simple, supervised machine learning algorithm that can be used to solve classification problems. The algorithm is used to classify the songs into specific genres.

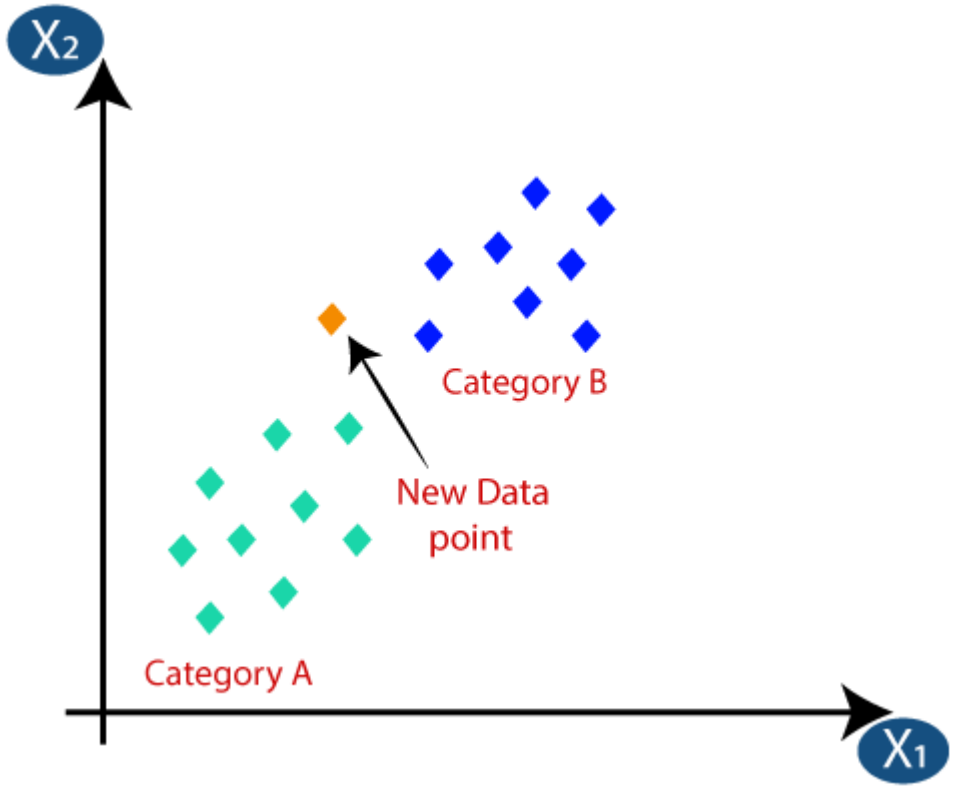


Fig 3: *k-nearest neighbors algorithm*

Cosine Similarity

The cosine similarity between two vector spaces is a measure that calculates the cosine of the angle between them. The Cosine Similarity procedure computes the similarity between all pairs of items. In cosine similarity, the listed songs are acted as of two vector spaces and thus the similarities between them are given by,

$$\text{similarity}(\text{A}, \text{B}) = \frac{A.B}{\|A\| \times \|B\|} = \frac{\sum_{i=1}^{n} A_i \times B_i}{\sqrt{\sum_{i=1}^{n} A_i^2} \times \sqrt{\sum_{i=1}^{n} B_i^2}}$$

Where A and B be the two vectors for comparison.

||A|| is the Euclidean norm of vector A and ||B|| is the Euclidean norm of vector B.

4.2 Tools used

4.2.1 HTML, CSS and Bootstrap

HTML is a formatting language and CSS as a Cascading Style Sheet is a styling language. Both are used to design our user interface in JSP pages.

4.2.2 Java

Java is an object-oriented programming language that we use for backend development. Similarly, Java Server Page (JSP) is a server-side programming technology we use.

4.2.3 MYSQL

MySQL is an open-source relational database management system where we manage all our tables and entities in managed order for performing different queries.

4.2.4 Python

Python is used for building a model that can be used to classify and recommend different music based on the genre for the users. Machine learning algorithms are implemented here.

CHAPTER 5

MAINTANANCE AND SUPPORT

CHAPTER 6

CONCLUSION AND RECOMMENDATION

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