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Section 1 - Project Description

1.1 Project

MusicPalette

1.2 Description

MusicPalette is modeled from Spotify Wrapped except it aims to allow users to view their music statistics on a daily, weekly, monthly, or yearly basis. It will utilize Spotify's API to retrieve and analyze user data, capturing listening statistics and preferences. MusicPalette helps users analyze their music listening habits while encouraging users to engage with their music and artists more deeply. We aim to create an engaging app for Spotify users that provides comprehensive statistics about users' music listening trends. We also want to make the product shareable and social to help users connect through music.

1.3 Revision History

Date	Comment	Authors/Editors
10/3/2023	Initial Draft • Created document • Document read through for understanding each section of the document	Brett Denette Jose Lopez Aubry Mouanoutoua Praise Okoli Gurmanjot Singh Padda
10/8/2023	Revisions and formatting changes • Sections 2.1-2.3 (created drafts for the purpose and scope of the project. Included estimates for application production) • Section 5.2 (created a draft explaining Spotify API's role in the user's interaction with the app) • Sections 6.1-6.4 (specified the app's use of certain aspects of Spotify API information, including user profile, genres, songs listened to, etc.) • Sections 7.1-7.3 (created basic framework of application navigation with the first draft of UX page designs) • Section 8 (specified which devices will be able to access the application and tech stack for backend development) • Section 9 (explained the tech stack for quality assurance testing. Also specified security protocols used within the application) • Section 11 (added general vocabulary from project proposal and important abbreviations)	Brett Denette Jose Lopez Aubry Mouanoutoua Praise Okoli Gurmanjot Singh Padda
10/17/2023	Updated Section 5.1 (added Use Case diagram)	Brett Denette Jose Lopez

		Aubry Mouanoutoua Praise Okoli Gurmanjot Singh Padda
10/29/2023	Revisions and Updates ● Section 3 (added description of system architecture) ● Section 4 (added string and integer fields) ● Section 5.2 (revised Use Case diagram, added Class Diagram)	Brett Denette Jose Lopez Aubry Mouanoutoua Praise Okoli Gurmanjot Singh Padda
11/14/23	Revisions and Updates ● Sections 2.1-2.3 (revised purpose and requirements specifically for the document. Revised key roles for team members) ● Section 3 (added visual representation of system architecture) ● Sections 7.1-7.3 (descriptions, updated images of UX design and interface layout. Moved the Use Case diagram from sections 5 to 7) ● Section 10 (added links to references that were utilized in making the application)	Brett Denette Jose Lopez Aubry Mouanoutoua Praise Okoli Gurmanjot Singh Padda
11/28/23	Revisions and Updates ● Sections 1.1-1.3 (added to the description of the application and updated the document updates section from previous revisions) ● Sections 2.1-2.3 (added purpose, scope, and requirements for the application in general) ● Section 3 (added Spotify API's role and Spotify's Database for System Architecture)	Brett Denette Jose Lopez Aubry Mouanoutoua Praise Okoli Gurmanjot Singh Padda
12/2/23	Revisions and Updates ● Section 1.3 (updated the revision history from previous revisions) ● Sections 2-11 (conducted a general grammatical revision for each section. Added details to ambiguous descriptions)	Brett Denette Jose Lopez Aubry Mouanoutoua Praise Okoli Gurmanjot Singh Padda
12/3/23	Revisions and Updates ● Section 1.3 (updated the revision history from previous revisions) ● Sections 2, 3, 5, 8, 9 (added more updates and descriptions) ● Updated the following diagrams: System Architecture, Sequence Diagram, Stateflow Diagram, User Interface Navigation Flow, Use Case Diagram	Brett Denette Jose Lopez Aubry Mouanoutoua Praise Okoli Gurmanjot Singh Padda

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Section 2 - Overview

2.1 Purpose

The purpose of this module is to lay the foundation for the development and deployment of the MusicPalette application, a tool aimed at enhancing the experience of Spotify users by offering them detailed insights into their music listening trends more frequently.
MusicPalette is a visually interactive application that provides data about a Spotify user's music listening habits. It specifically provides information about a user's top artists, genres, the number of songs listened to, and the number of minutes listened to in a given time period. The time periods provided are Daily, Weekly, Monthly, and Yearly statistics.
Upon receiving these statistics, the user is encouraged to share this information with their friends on social media. The application provides a method to share an image of these statistics to their camera roll and through other applications. This can increase Spotify's usability since users can find common interests with provided information, as seen in sharing the yearly Spotify-wrapped images on Instagram.

2.2 Scope

MusicPalette creates and displays users' top artists, songs, genres, and listening stats into their personalized "music palette". It takes inspiration from Spotify Wrapped but instead of only being available annually, users can view their listening stats daily, weekly, monthly, and annually. The app encourages users to be engaged with music and artists as well as encourages engagement and connectedness with friends and family through sharing on social media.

2.3 Requirements

Given the nature of the project, our primary requirements involve ensuring seamless integration with the Spotify API, user-friendly interface designs, efficient data management and processing, and shareability across platforms.
The design requirements include being user-friendly to navigate through the app as well as be visually appealing to the user and to be able to share. The app will also be compatible for various screen sizes and also include accessibility. Some graphic requirements include interactive features to engage the user in the app. There will also be easy-to-follow charts and ways to compile and display the music listening habits in a way that users could quickly view and comprehend easily. The app will also have high-quality graphics and an appealing color scheme. For the operating system, the app will be compatible with IOS devices and be compatible with various servers. There will also be a usage of the Spotify API Integration. The minimum hardware requirements for the software include any compatible iPhone version that works as well as software update version. End-users should not have much difficulty navigating through the app. We will aim to minimize the amount of navigation to certain screens. Other non-functional requirements include the loading time for everything to be kept at a maximum of 2 seconds and the default language to be English.

2.3.1 Estimates

#	Description	Hrs. Est.
1	Integration with Spotify AI	60
2	App User Interface Design	40

3	Backend Development & Database Management	80
4	Testing & Quality Assurance	30
	TOTAL:	210 # est tot

2.3.2 Traceability Matrix

Cross-reference this document with your requirements document and link where you satisfy each requirement

SRS Requirement	SDD Module
Integration with Spotify API	5.2.1
App User Interface	7.1, 7.2, 7.3
Backend Development	5.2.1.1
Testing	8.1

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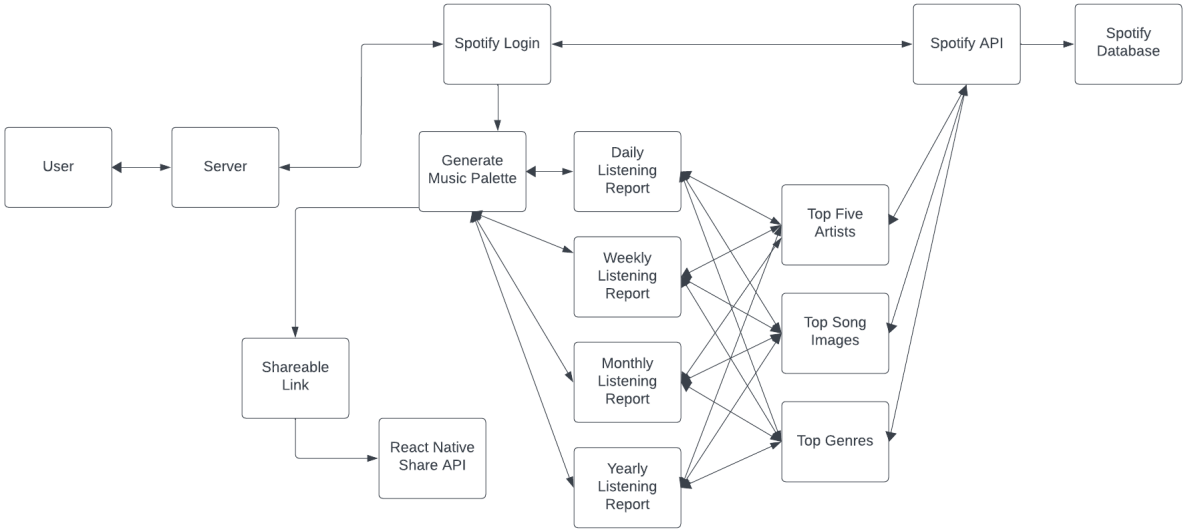
Section 3 - System Architecture

The MusicPalette system will be designed as a client-server model, where the mobile app (client) communicates with a server, which interacts with the Spotify API to retrieve user data. The server will handle data processing and send the processed data back to the mobile app for display. The server also includes a login page which the user will login using their Spotify account which then connects to the Spotify API and Spotify Database. From here they can generate a music palette which includes the daily, weekly, monthly, and yearly listening reports. All of these reports include finding the top artists, song images, and genres which are fetched from Spotify's database through the Spotify API. The user can also then get a shareable link of their music palette that is generated from React Native's Share API.



Section 4 - Data Dictionary

Table

Field	Notes	Type
UserID	Unique Identifier for User	INTEGER
SongID	Unique Song Identifier from Spotify API	STRING
ListenCount	Number of times listened	INTEGER
ListenDate	Date of listening	DATE
SpotifyUser	Unique Identifier for User's Spotify	STRING
ListeningReport	Music Listening Report Statistics	INTEGER

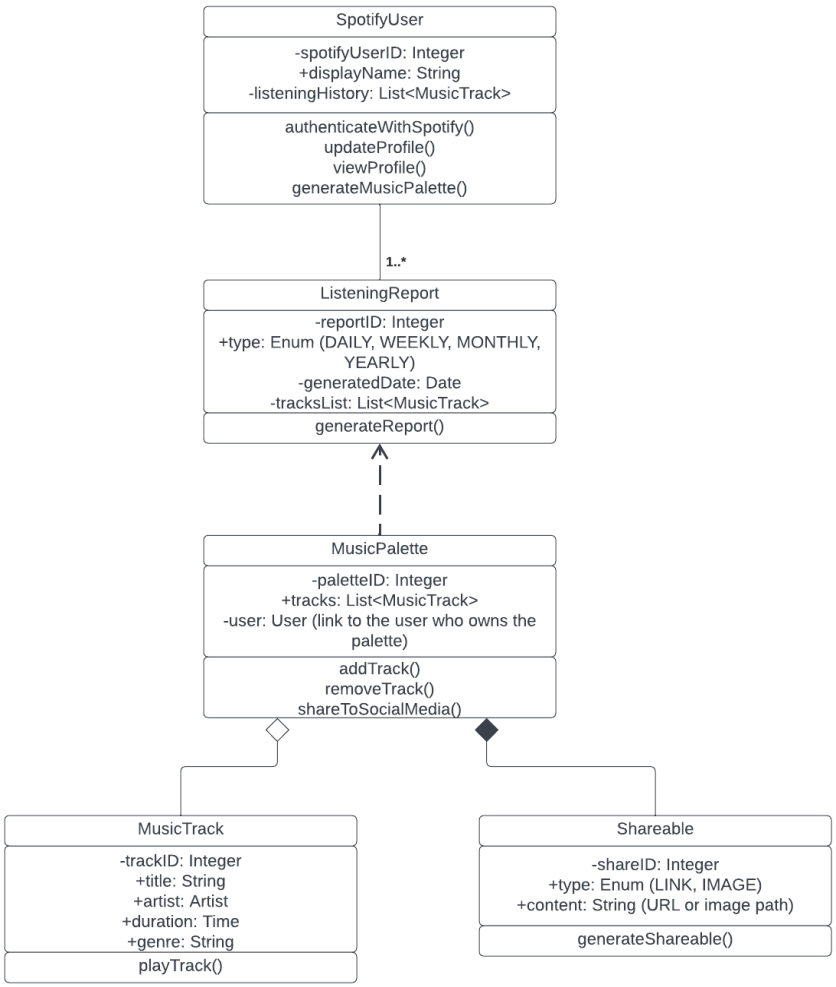
MusicPalette	Unique listening report and statistics for user	INTEGER
MusicTrack	Name of Music Track	STRING
Artist	Name of Music Artist	STRING
Shareable	Shareable link or image	INTEGER

Section 5 - Software Domain Design

5.1 Software Application Domain Chart

The MusicPalette software application domain that is used is Spotify API.

Class Diagram



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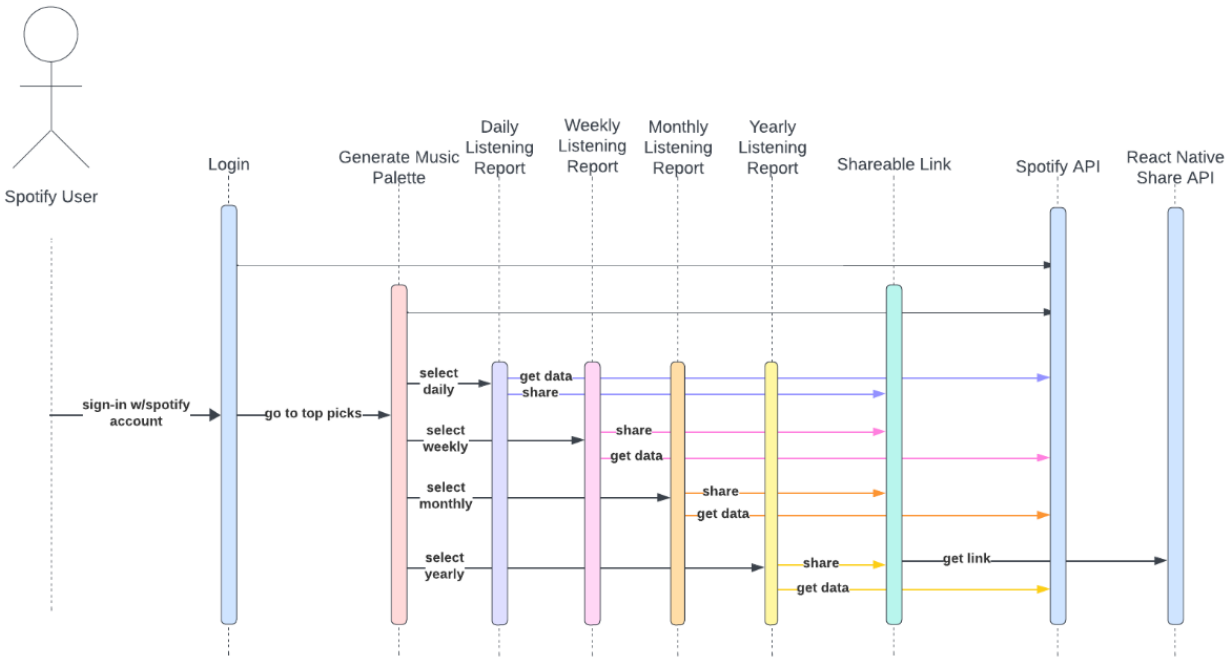
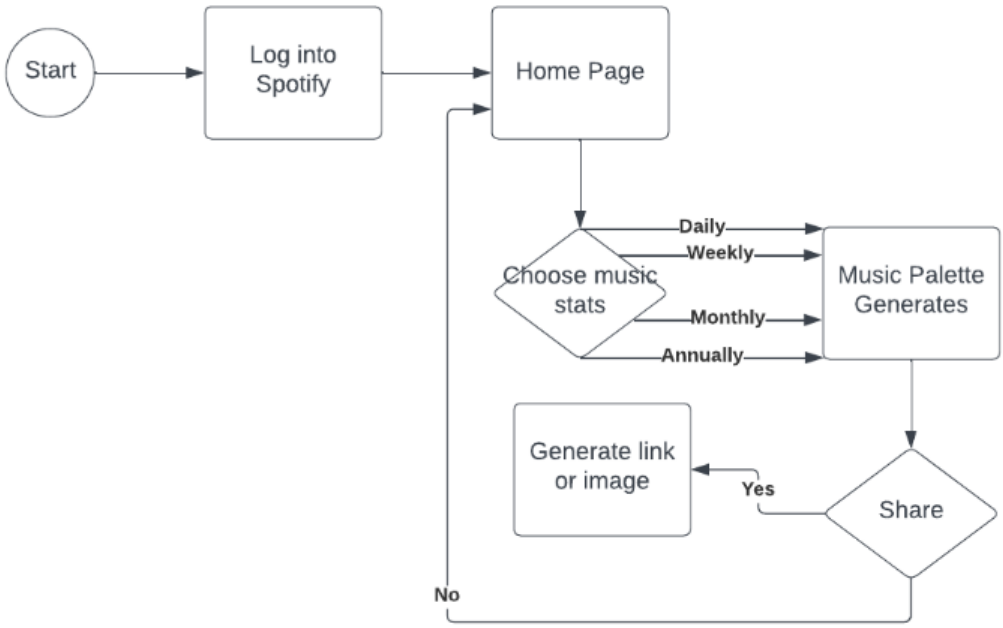
Sequence Diagram



Stateflow Diagram



5.2 Software Application Domain

The MusicPalette application revolves around key domains, each catering to different functionalities and interactions, which include User Interaction, Data Retrieval from Spotify, Data Storage, Data Analysis, and Data Sharing.

5.2.1 Domain X

This domain is crucial in interfacing with the Spotify API. It deals with authenticating the user, fetching listening data, and interfacing with Spotify's rich database to collect insights.
Components within this domain include:

- Authentication Module: Handles user login via Spotify.
- API Call Module: Sends requests to Spotify's API endpoints to fetch user listening history.
- Data Fetch Scheduler: Schedules periodic fetching of data based on user settings (daily, weekly, etc.).

5.2.1.1 Component Y of Domain X

This component is responsible for ensuring that the user can securely log in via their Spotify credentials, allowing MusicPalette to access their listening data.
Data flow/control:

1) User initiates login.
2) Redirect to Spotify OAuth page.
3) User grants permission.
4) Receive authentication token.
5) Store token securely for subsequent API calls.

5.2.1.1.1 Task Z of Component Y1 of Domain X

The OAuth Redirect task manages the redirection of a user to Spotify's authentication page and subsequently handles the callback with an authentication token.
Data flow/control:

1) User clicks 'Login with Spotify'.
2) System redirects user to the Spotify OAuth page.
3) After permission, Spotify redirects back with a token.
4) Capture and securely store the token.

5.2.1.2 Component Y of Domain X

This component is responsible for the stats screen which fetches the top artists or tracks for the authenticated user from Spotify.
Data flow/control:

1) Uses expo-app-auth for OAuth 2.0 authentication.
2) The access token's validity is checked upon loading
3) User is redirected based on its validity.
4) Fetches user profile data from Spotify.

Section 6 – Data Design

The MusicPalette application primarily interacts with user-specific data fetched from the Spotify API. This data comprises the listening history, preferences, and user-specific metadata. This section delves into the intricacies of data design for the application.

6.1 Persistent/Static Data

6.1.1 Dataset

- User Profile: Contains information related to the Spotify user such as User ID, Name, Premium Status, Country, etc. This establishes the identity of the user in the app.
- Listening History: This dataset consists of user-specific listening records, capturing data points like Song ID, Date & Time of listening, Duration, etc.
- User Preferences: Categorizes user's genre preferences, favorite artists, most listened tracks, etc.

Relationships:

- User to Songs: One-to-Many, as one user can listen to multiple songs, but each song listening instance belongs to one user.
- Songs to Artists: Many-to-One, as a song is associated with one artist (or a band), but an artist can have multiple songs

6.1.2 Static Data

- Genres List: A predefined list of music genres fetched initially from Spotify, which helps classify songs and determine user preferences.
- App Configuration Data: Data related to the app's configuration, settings, display preferences, etc.

6.1.3 Persisted data

- Shared Links: Unique links or QR codes generated by users for sharing their music statistics. These links, once generated, are stored for future retrieval and access.
- User Statistics Summary: Post-analysis data, such as yearly or monthly summaries, top songs, or artists, might be persisted for quicker access without the need for reanalysis.

6.2 Transient/Dynamic Data

- Session Data: Information about the current user session, including tokens, temporary preferences, current playlist being viewed, etc.
- Current Playback: Data about the song currently being played or paused, its position, and related real-time information.

6.3 External Interface Data

- Spotify API Data: All the raw data fetched from Spotify, including but not limited to user playlists, daily listens, saved tracks, etc. This data is fetched real-time or in batches, processed, and then stored in the app's database or displayed to the user.

6.4 Transformation of Data

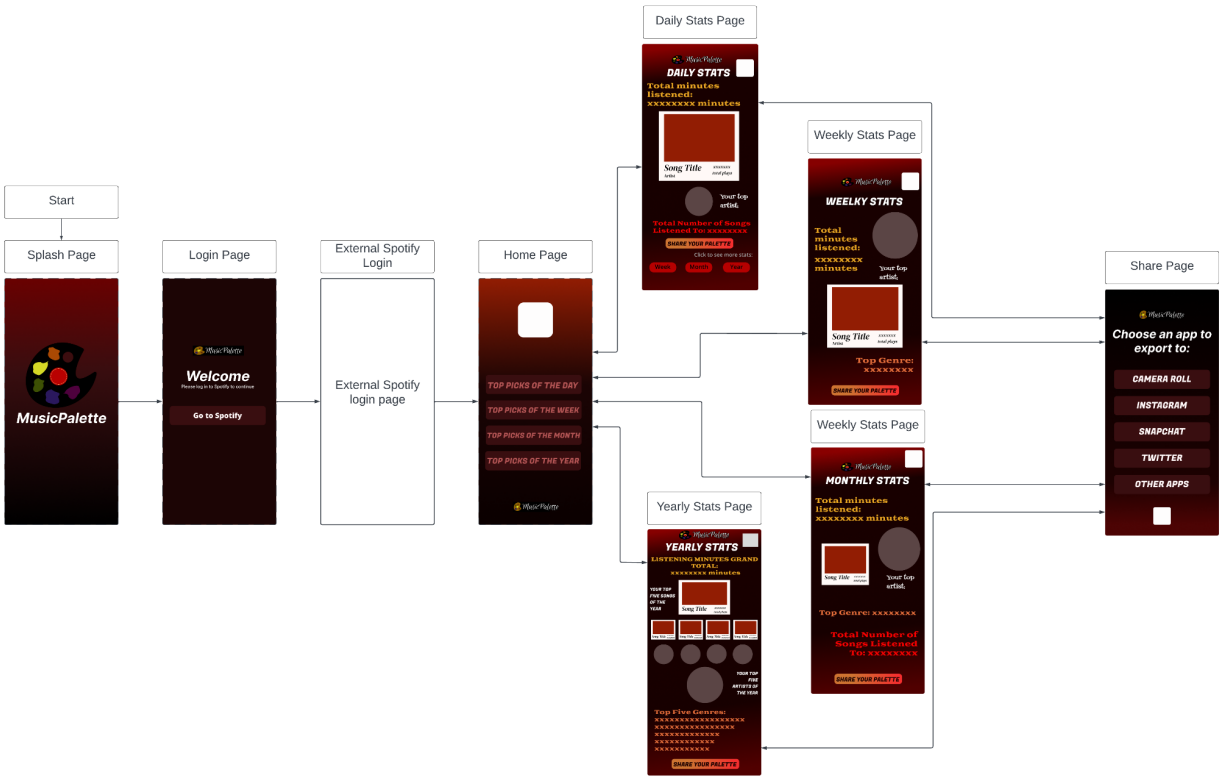
- Genre Classification: Songs fetched from Spotify are classified into predefined genres based on Spotify's data, aiding in user preference analysis.
- Listening Trend Analysis: Raw listening data is processed to derive trends such as the frequency of listening, preferred times of the day, etc.
- Summary Creation: After data analysis, the raw and processed data are transformed into visually appealing summaries, charts, or graphs for user consumption.

Section 7 - User Interface Design

7.1 User Interface Design Overview

The screen layouts will be compatible with all IOS devices. The app will also be easy to navigate for the user. The user will be able to see several options for different stats from their homepage, specifically Daily, Weekly, Monthly, and Yearly stats. The other stats can be accessed from the daily page, and the sharing page can be accessed from any of the stat pages. The app's color scheme will be red with a dark layout, with different variations to highlight select features.

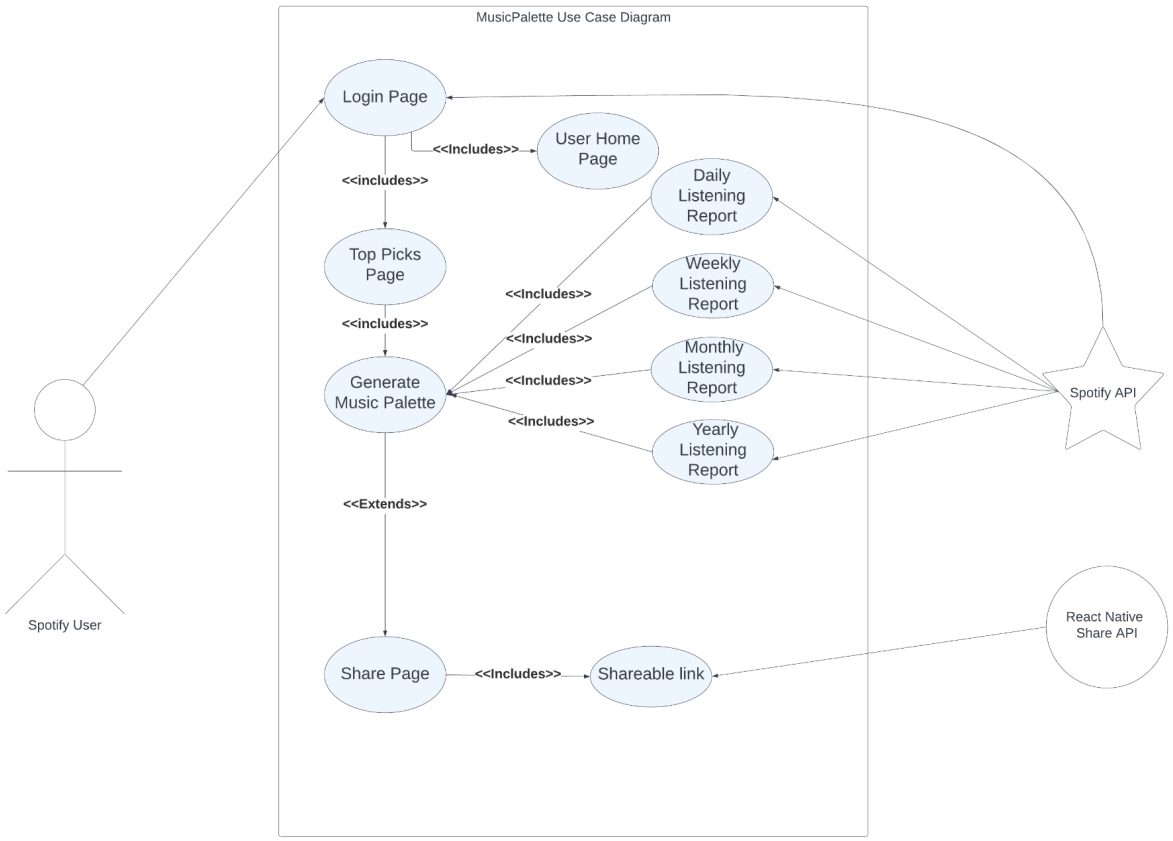
7.2 User Interface Navigation Flow



7.3 Use Cases / User Function Description

The user will open the app and log into the app using their Spotify account. This will then connect to the Spotify API and fetch their data so they can log into the MusicPalette app. After that, the homepage will display options to view different datasets from daily, weekly, monthly, and yearly collections. Each button can navigate to different tabs that will display each group of music-listening statistics that are categorized differently. They then can choose to share their music listening statistics which will take them to a share page where a shareable link will be generated from the React Native Share API.

Use Case Diagram



Section 8 - Other Interfaces

8.1 Interface X

This project is intended to be supported on IOS devices as it is a mobile app. For the network, the user would need to connect to wifi or use cellular data to access it. For the software interface, we will be using react-native for IOS. For the backend and the libraries, we will primarily be using the node.js and the Spotify API.

Section 9 - Extra Design Features / Outstanding Issues

9.1 Extra Design Features

The app will adhere to GDPR and other relevant privacy regulations. Secure HTTPS protocols will be used for data transmission, and user data will be encrypted. Currently, because we are using Spotify's API Integration we will only need a bit of storage. For the future, if we wanted to expand and add more features to accommodate then we would need more storage. We would like to add more features such as a friends list and custom palette maker. We would also like to include a friends list and be able to see other friends' palettes and have a "feed" similar to other social platforms. Incorporating a custom palette maker would also allow users to pick and choose what is displayed in their palette such as their top female artist, newest genres listened to, or how many minutes listened to a specific artist or song. We also would like to make the application more visually appealing and eye-catching to make the users feel the need to interact or share their palette similar to Spotify. Other additional features include adding transitions to statistics such as a fade in or out and playing the user's top song for them when they click on a specific palette. One thing we were unable to implement but would like to have included was a QR code for users to scan that will improve sharing and interactions. We also would like to include data from other music platforms for a more unified experience that isn't limited to Spotify and lastly be able to publish the application.

9.2 Outstanding Issues

Jest and POSTman were used for Unit testing and API call testing respectively. During development of the backend a few bugs found regarding authentication with Spotify that have now been addressed and resolved. At the moment, we have one outstanding issue where the app can get overloaded with requests and lock up. Then after the lockup ends it attempts all requests that happened during the lockup and can crash the app. All issues are being assigned through Github's issue tickets and are currently either resolved or being worked on. The main issue we ran into was the limitations with Spotify's API Integration Free Version, which limited the user data available to access. In order to implement more features, we would need to request access and have the funds for the enhanced development API to have more or better requests.

Some other issues include the ability to add the daily, weekly, monthly, and yearly functions that calculate the amount of time a user has been listening to music, but they are not completely accurate due to Spotify API restrictions. This is because the Spotify API only allows for 50 songs to be retrieved in one API call. Other challenges that come with these functions are that if a user skips songs, the full duration of the song will be counted towards their time listened. As well as if a user listens to a song at 11:59pm and it finishes at 12:00am, it may not be counted since it overlaps between days. These issues may cause a user's time to be a little inaccurate.

Github Repository: https://github.com/CSCI150-LAB01/MusicPallete

Section 10 – References

Figma UI Design Tutorial: Get Started in Just 24 Minutes

https://www.youtube.com/watch?v=FTFaQWZBqQ8&ab_channel=AJ%26Smart

Let's build Spotify with React Native! (Spotify API, Expo App Auth)
https://www.youtube.com/watch?v=mVd8XQ9Pl-0

Generate and Download QR code using React | Node JS
https://www.youtube.com/watch?v=THnLOll4wsU

Getting Started with Spotify API
https://developer.spotify.com/documentation/web-api/tutorials/getting-started

Section 11 – Glossary

Terms

User Interface (UI): The space where interactions between humans and machines occur, aiming to be effective, efficient, and enjoyable.
Backend: The server-side operations of an application, which handles logic, database interactions, and server configuration.
Frontend: The client-side part of an application that interacts with the user.
API (Application Programming Interface): A set of rules and protocols for building and interacting with software applications.
HTTPS (HyperText Transfer Protocol Secure): An extension of HTTP that is used for secure communication over a computer network.
GDPR (General Data Protection Regulation): A regulation in EU law on data protection and privacy.
Uptime: The time during which a machine, especially a computer, is in operation.
CI/CD (Continuous Integration/Continuous Deployment): A DevOps practice where code changes are automatically built, tested, and deployed.
SDK (Software Development Kit): A collection of software tools and libraries used for developing applications for specific devices or operating systems.
Latency: A measure of time delay experienced in a system, the precise definition of which depends on the system and the time being measured.

Acronyms

UI: User Interface
API: Application Programming Interface
HTTPS: HyperText Transfer Protocol Secure
GDPR: General Data Protection Regulation
CI/CD: Continuous Integration/Continuous Deployment
SDK: Software Development Kit