



# echoscape

**Echoscape**

**Mobile Applications Laboratory 2023/24**

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# Chapter 1

## Introduction

In this project we are asked to implement an interactive application that will let the user interact with the music the users have uploaded throughout the city.

"Echoscape" is a React Native-based application which is compatible with both Android and IOS operative systems. Our application allows users to record audio through their phone's microphone, geo-tag the recordings, and view them on a map. The backend service is provided by the University and it processes these recordings and returns detailed information about each song, such as genre, mood and instrumental content.

Users can explore audio data across the city, view the recordings and interact with them.

# Chapter 2

## Authentication

The first screen displayed upon launching the application is the **login screen**, where users can log into their existing accounts or navigate to the registration screen if they need to create a new account. An account is required for all users, as audio recordings uploaded to the map are tied to the user who recorded them, allowing for user-specific tracking and statistics.

Each user profile includes a **level and experience points (XP)** system, which rewards users for actions within the app. For example, uploading audio recordings to the map or collecting badges (a feature that will be detailed in a later section) earns users experience points, which contribute to their level progression. The profile also features a **profile picture** that users can select from their device gallery. Users can log out at any time and log back in with a different account if they wish.

However, there are a few limitations regarding audio storage and access:

1. **Local Audio Storage:** Recordings are saved locally on the user's device, not on the backend. This means that when a user logs into their account from a different device, previously uploaded recordings won't be accessible on that device.

2. **User-Specific Access:** Due to security and privacy considerations, audio files saved on a device are only accessible to the account that uploaded them. This prevents different users on the same device from accessing each other's saved recordings.

Additionally, each profile contains **statistics on uploaded audio**, including favorite genres, with accompanying visualizations like charts that give users insights into their listening patterns and genre preferences over time. This data allows users to engage with their audio history and gain a personalized view of the types of music they have been recording around the city.

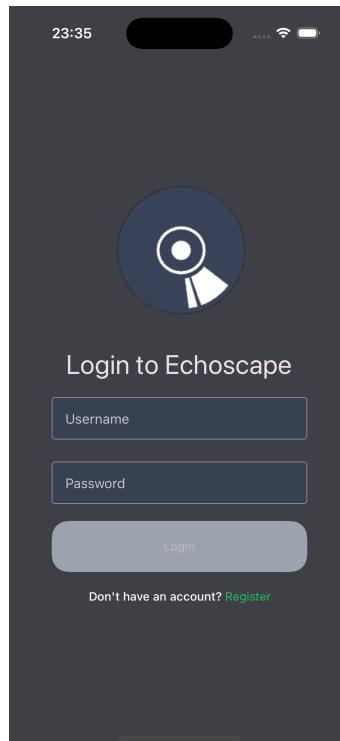


Figure 2.1: Login page

## Chapter 3

# Audio Recording and Uploading

Users can record audio clips directly through their phone's microphone, enabling them to capture soundscapes or music around them. The app allows users to preview each recording before uploading, providing the option to re-record if needed to ensure audio quality and accuracy. Once a user is satisfied with the recording, they can upload it to the backend.

If a stable Wi-Fi connection is not available, users can choose to delay the upload. In this case, the app will send a notification once Wi-Fi connectivity is restored, reminding users that their recording can now be uploaded. The upload functionality is conveniently accessible via a button below the audio component in the recording menu, allowing users to initiate the upload with a single tap.

Once an audio clip is successfully uploaded, the backend processes it and sends back a detailed metadata report. This report includes information such as the genre, detected instruments, and additional audio characteristics (e.g., tempo and mood). All metadata is stored locally on the device, allowing users to access and review their recordings and associated information even while offline.

Additionally, users have control over the visibility of their uploaded recordings. A “**hide**” feature allows users to make a recording temporarily invisible to others on the map without deleting it from the backend. This option uses a backend route to modify the audio’s visibility status, making it inaccessible to other users downloading the audio until it is unhidden. In contrast, a separate “**delete**” button permanently removes the recording, both from the backend database and from local storage on the device, freeing up space and maintaining privacy.

From the **Profile** page, which provides a summary of all audio files a user has uploaded, users can quickly locate each recording on the map. Selecting an audio file will navigate back to the map view, centered on the recording’s location, offering an intuitive way for users to revisit and interact with their uploaded soundscapes across the city.

## Chapter 4

# Map Interface and Navigation

The app includes a **map interface** that displays all audio recordings uploaded within the city, with each file marked by its geolocation. Users can interact with individual map markers to view metadata about the associated recordings. To optimize performance, the map is designed to load details only for recordings in close proximity, minimizing data load and providing a smoother user experience. Additionally, the app offers some **filtering options** that allow users to view recordings based on specific characteristics, such as music genre or mood, to further personalize the user’s experience.

The **interactive map** contains two types of markers: **audio markers** and **points of interest** (POIs). Audio markers represent locations where users have recorded audio, while POIs highlight specific landmarks, which can include historical monuments, parks, notable buildings, tourist attractions, and places of worship. Each POI is inspectable through its dedicated page, and users can even associate audio recordings with a POI if they are within a certain proximity to it.

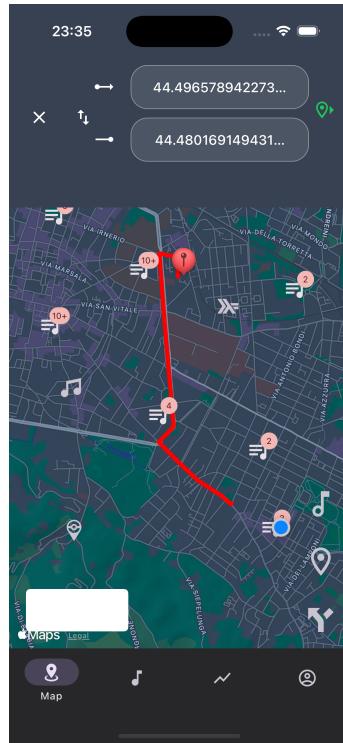


Figure 4.1: Routes

## 4.1 Backend Data Retrieval and Filtering

Audio markers on the map are dynamically loaded from the backend server. Initially, the app performs a backend request to retrieve *basic information* for all audio files within the database, such as coordinates and unique identifiers. Detailed statistics and metadata for each audio recording are then fetched individually by providing the specific audio ID, triggered only when a certain zoom level is reached on the map. When the user zooms in, the app requests complete metadata for all visible audio markers within the viewable area, ensuring that data retrieval is efficient and scaled according to the user's focus on the map.

Since the backend provides genre information for each recording, the app allows users to filter audio markers based on their preferred genre. Users can select a genre to display only audio files of that type or view all recordings without any genre-based filtering. The **markers** on the map are fully interactive; clicking on a marker generates a *callout* bubble that the user can further interact with to view a detailed page for that specific marker.

## 4.2 Points of Interest (POIs)

Each POI marker on the map opens a small, clickable callout when selected. By clicking this callout, users access a **POI information page**, containing details about the specific point of interest. The app includes various categories of POIs, such as historical sites, parks, important buildings, tourist spots, and places of worship. For each category, users can explore detailed descriptions on the dedicated POI pages. Furthermore, if an audio recording was associated with a POI, users can view this association within the POI's information page, deepening the context around the recorded audio.

Users can also hide certain categories of markers for a customized map view. For example, they can choose to display only audio markers, only POIs, or both. This functionality allows users to focus on specific map elements, improving the map's usability for different contexts and preferences.

### 4.3 Navigation and Suggested Routes

The app provides a flexible **navigation menu** that enables users to choose a starting point and a destination on the map. Each location can be set to the user's current position if desired. An easily accessible button allows users to swap the selected start and end points. When a location is chosen, its nearby street name appears at the top of the screen, allowing users to verify they have selected the correct location.

Once both the starting point and destination are set, the map displays a recommended route that remains visible, providing easy navigation toward the destination. Alongside the route, a *suggested POI window* appears, listing all points of interest located near the route and relevant to the user's journey. These suggested POIs provide users with cultural and navigational context, offering an engaging way to explore the city while en route.

Each POI in the list is categorized by type, with clear labels such as "Historical" or "Park," making it simple for users to identify the nature of each point of interest. POIs with no previously associated audio recordings are highlighted with a colored border, encouraging users to explore and contribute recordings to these locations.

For each suggested POI, users can choose to either access a detailed POI page within the app or visit the corresponding *Wikipedia page* directly if one is available. This integration allows users to expand their knowledge of the POI quickly, leveraging external resources for a richer experience.

## Chapter 5

### Song page

The Song Page displays all information received from the backend service about the selected song, and then the application provides the user with an overview of all of the attributes of the selected song. The retrieved information includes:

- **BPM:** The beats per minute of the recording.
- **Loudness:** The overall loudness of the recording, represented as a percentage.
- **Danceability:** A percentage value indicating the recording's suitability for dancing.
- **Associated POI (Point of Interest):** A geographic marker associated with the recording, displayed on the Map page within the application.



Figure 4.2: Map



Figure 4.3: POI page

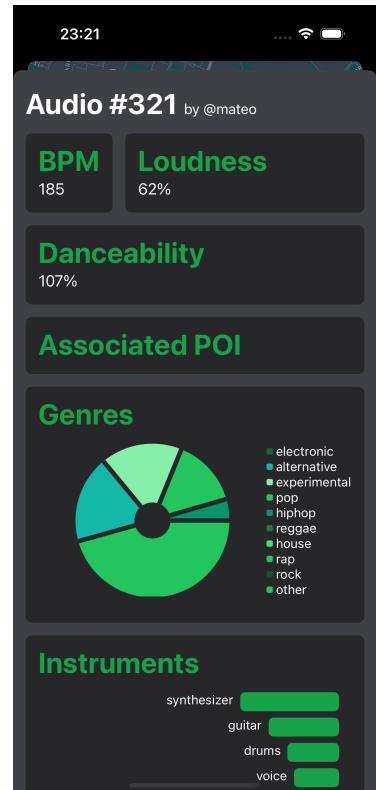


Figure 4.4: Audio page

- **Genres:** A pie chart displaying genre distribution. This chart is rendered using Victory Native.
- **Instruments:** A bar chart representing the distribution of prominent instruments in the recording. This chart is created using Victory Native. .
- **Moods:** A bar chart illustrating the emotional or thematic mood profile of the recording. This is also implemented with Victory Native.

The backend provides all necessary data points for these attributes, which the frontend processes to generate the visualizations. The song audio is available only to the user, while

the backend handles all metadata processing and serves it to the application.

## Chapter 6

# POI (Point of Interest) Page

The POI Page provides users with detailed information for a selected Point of Interest (POI). The page includes the following components:

- **POI Photo:** A high-resolution image of the POI, retrieved dynamically using the Wikidata API to provide accurate and visual representation.
- **POI Description:** A detailed description of the POI, obtained via the Wikipedia API. This text offers historical, cultural, or contextual information about the location.
- **Audio Recording Button:** An interactive button that enables users to record audio and associate it with the selected POI. This feature is only accessible if the user's current location is verified to be within a specified proximity to the POI.
- **Associated Recordings:** A list of audio recordings previously linked to the POI.

## Chapter 7

# User Profile and Experience System

The **Profile page** provides users with a complete overview of all audio recordings they have uploaded. For each uploaded audio file, users have several management options:

- **Delete:** Users can permanently delete the audio recording from both the backend and local storage.
- **Hide:** This feature allows users to make the recording temporarily inaccessible to other users. While hidden, the audio remains stored on the backend and locally but is unavailable to others until it is reactivated.
- **View on Map:** Users can quickly locate the recording on the map, centered on its original upload location.

- **Audio Detail Page:** Each audio recording has a dedicated page where users can explore its metadata.

## 7.1 Experience Points and Level Progression

Each user profile is connected to a **level and experience points (XP)** system. Users earn XP through specific actions within the app, such as uploading audio recordings to the map and associating recordings with points of interest (POIs). A **progress bar** on the Profile page visually represents the user's current level, showing both the total XP and the amount needed to advance to the next level. This feature encourages users to explore new POIs.

## 7.2 Badge Collection and Achievements

The app also incorporates a **badge collection system**, providing users with additional ways to earn XP and track their achievements. Badges, or "pins," are scattered throughout the map and can be collected when users are physically close enough to them. Collecting these badges rewards users with experience points and records the badges in a dedicated collection on the Profile page. This feature motivates users to explore different locations in the city, leveling up their profile.

## 7.3 Profile Settings and Account Management

From the Profile page, users can easily navigate to the **Settings page**, which provides essential account management options. Users can log out of their current session or, if desired, **delete their account**. Account deletion removes all user data from the backend and local storage, ensuring privacy and security for users who choose to discontinue the app. The Profile and Settings pages are designed to give users complete control over their data, experience level, and account preferences.

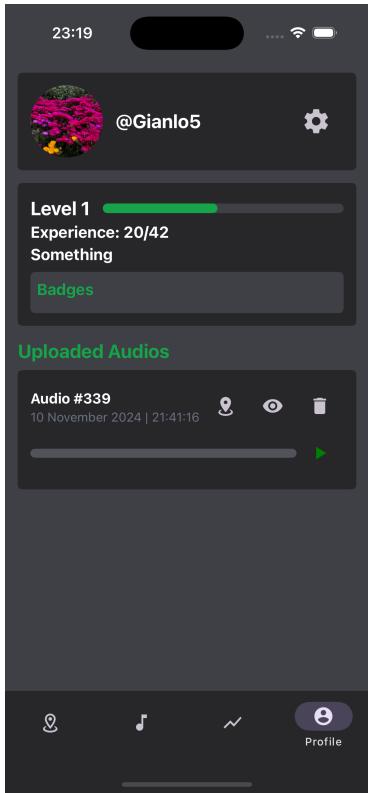


Figure 7.1: Profile

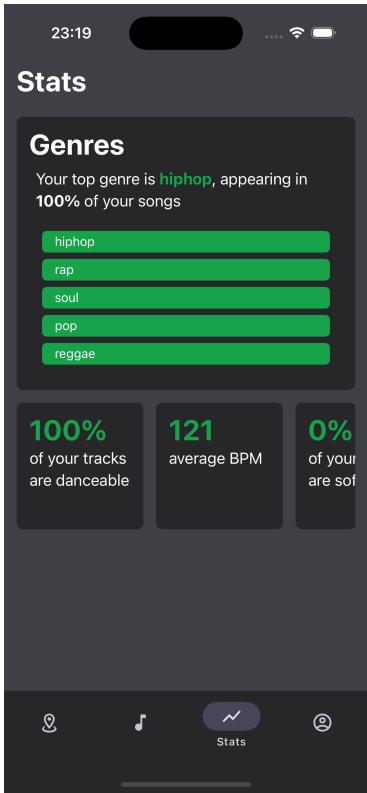


Figure 7.2: Stats

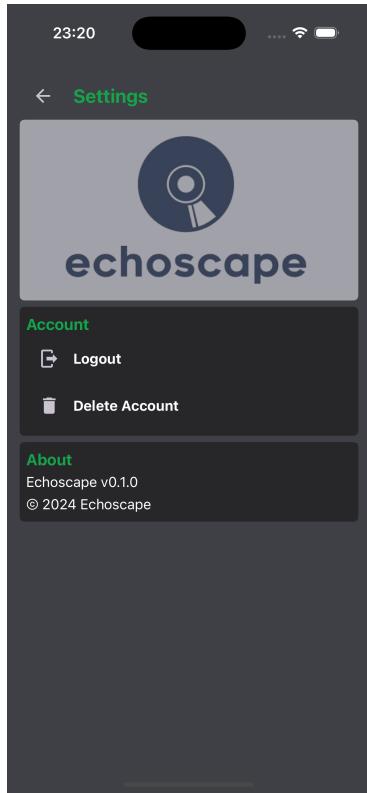


Figure 7.3: Settings

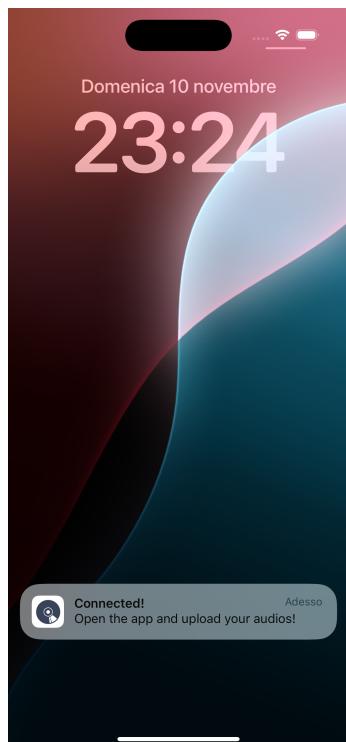


Figure 7.4: Notification

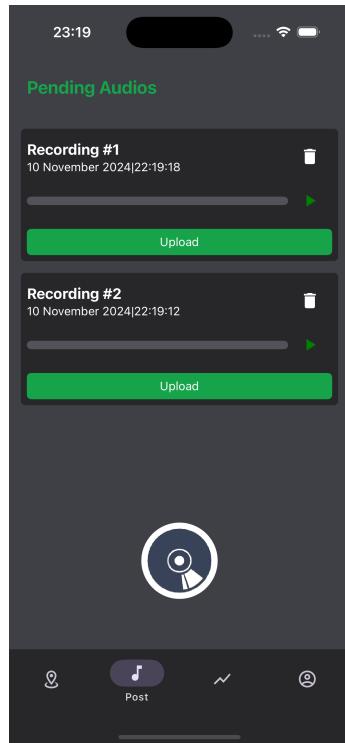


Figure 7.5: Post page

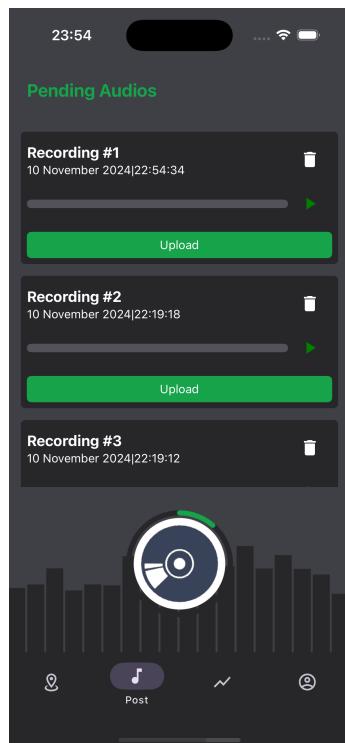


Figure 7.6: Post page 2