

UNIVERSITI TEKNOLOGI MARA

**ALUNAN: A MOBILE APPLICATION
FOR LOCAL MUSICIANS' ONLINE
COMMUNITY
AND MUSIC DISCOVERY**

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**BACHELOR OF INFORMATION
TECHNOLOGY (HONS.)**

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Thesis submitted in fulfillment
of the requirements for the degree of
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Mathematics**

February 2024

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Universiti Teknologi MARA, regulating the conduct of my study and project.

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CHAPTER ONE

INTRODUCTION

An outline of this project is given in this chapter. This chapter includes the problem background, problem statement, project aim, objective, scope, significance of the study and chapter summary.

1.1 Problem Background

The current digital environment reveals symptoms of local independent musicians having a divided online presence, being underrepresented, and lacking effective methods for discovery and marketing. These symptoms point to a broader perceived issue. This issue is defined by the presence of various websites and applications, a lack of features specifically tailored for musicians and fierce competition for visibility. In this particular field, the lack of a specialized online community platform is a notable challenge for local independent musicians who aim to connect, explore, and gain knowledge within the music industry.

The evolution of the music scene in Malaysia corresponds to the symptoms and perceived issues, as emphasized by Ong (2019), by emphasizing the cultural and social dynamics of musical expression. The evident importance of digital platforms is highlighted by the influence of alternative media, blogs, and websites in creating the music community. Nevertheless, the divided online existence and insufficient visibility of local musicians indicate the necessity for a unified platform that tackles the issues within the specified problem area.

Mohd Azhar Abu Bakar @ Azmeer (2021) stresses the importance of conserving Malaysian music traditions while embracing modern influences, thereby contributing to the solution. An online community platform, as suggested in the issue domain, could provide a space where modern and conventional elements can live together. This platform serves as a medium for musicians to authentically express themselves, addressing the absence of promotional resources and promoting a sense

of community among music listeners.

The difficulties identified by Haynes and Marshall (2018) about the obstacles faced by young musicians in the overcrowded internet music industry are closely linked to the indications of intense rivalry for exposure. The recognition of the critical importance of social media for independent artists corresponds with the perceived issue of inadequate features tailored specifically for musicians. An exclusive online community platform serves as a strategic remedy for these difficulties, offering a unified place that acknowledges the advantages and constraints of social networking for musicians.

In short, the efforts made in the field of Malaysian music, motivated by the views mentioned, seek to address the symptoms and perceived issues by promoting the establishment of a specialized online community platform. This platform serves as the central hub for addressing the difficulties faced by local musicians, providing a comprehensive solution within the specific problem area.

1.2 Problem Statement



Figure 1.1 Challenges in Music Industry Recognition

Post by Utusan Malaysia (2022, September 16) [Media Mulia, 2023]

The primary topic for the problem statement is closely aligned with the findings of Silahudin (2019), who discussed the significance of the music scene's evolution in Malaysia, as well as the cultural and social dynamics of musical expression among specific audiences and musicians. Similar to the challenges faced by folk music in the music industry awards, the present problem relates to the lack of a specialized digital community platform tailored to Malaysian independent musicians. The issue at hand exhibits several clear indications, such as the fragmented digital pres-

ence of local independent musicians, their insufficient exposure in the world of online media, and the obvious lack of efficient collaboration and promotion tools.

The spread of local independent musicians across multiple websites and applications is one of the principal symptoms. The lack of consistency in their online presence hinders their capacity to establish a strong identity, thereby creating difficulties for supporters and potential collaborators in locating and interacting with them. Moreover, current platforms frequently lack musician-specific functionalities and struggle with intense competition for attention. As a result, a considerable number of highly talented musicians in the area experience a sense of detachment from the music industry and appreciation, which hinders their ability to build significant relationships with their peers and audience.



Figure 1.2 Social Media's Impact on Local Musicians

X post by @zharifikml (2023, December 12) [X Corp., 2023]

The user @zharifikml's concerns expressed on X align with the findings discussed by Zanuar and Md Noor (2022) regarding the effectiveness of social media platforms in marketing for independent artists, emphasizing the need for local independent musicians to acquire the skills required to showcase their creations on the internet. The absence of a dedicated platform for musicians may result in cultural loss, as the multifaceted Malaysian music landscape might remain unexplored and uncelebrated. Furthermore, the challenges in social media marketing mentioned in the article parallel the user's concerns about the need for musicians to acquire internet exposure skills. The depreciation of local musical expertise, as mentioned by the

user, can adversely affect the financial stability of musicians, echoing the challenges faced by independent artists in using various social media platforms to engage with different segments of their audience. Additionally, the absence of a suitable platform for growth and visibility, as emphasized by the user, aligns with the evolving role of social media in music promotion discussed in the article by Järvekülg and Wikström (2021), highlighting the importance of addressing the challenges independent musicians face in the digital age and the need for a dedicated platform to support their growth and visibility.

To summarise, the present issue pertains to the lack of a dedicated digital community platform catering to Malaysian independent musicians. It is important to acknowledge and resolve the symptoms and perceived issues associated with this problem domain to facilitate the empowerment of local independent musicians, promote connections between them and their supporters and colleagues, and actively contribute to the conservation and advancement of Malaysia's vast musical heritage.

1.3 Project Aim

This project aims to develop a mobile application named 'Alunan' that serves as an online community and music discovery platform exclusively for local independent musicians and music enthusiasts to connect and discover music within their local music scene.

1.4 Project Objectives

The project objectives are as follows:

- To identify system requirements for Alunan as a mobile application for local independent musicians' online community and music discovery.
- To design Alunan as a mobile application for local independent musicians' online community and music discovery.
- To develop Alunan as a mobile application for local independent musicians' online community and music discovery.

1.5 Project Scope

Below are the scopes of the project:

1.5.1 Platform

- Android Studio

This project will be developed using Android Studio as the platform for the mobile application development.

- Firebase

This project will be using Firebase as the platform for the database management system.

- GitHub

This project will be using GitHub as the platform for the version control system.

- Figma

This project will be using Figma as the platform for the user interface design.

1.5.2 Social Stakeholders

- *Local Independent Musicians*

Alunan provides local independent musicians with a platform to showcase their talent, develop connections with other artists, and promote their music. Users can create profiles, upload music snippets, and obtain useful feedback from the community. Alunan provides networking opportunities, enabling independent musicians to engage with event organizers and industry professionals. Moreover, the platform may provide significant assistance and significant knowledge that encourage the growth and triumph of artists in the music industry, making it a vital asset for both growing and experienced musicians.

- *Music Enthusiasts*

Alunan provides an engaging setting for music enthusiasts to delve into their local music scene. Users can discover skilled musicians and music genres, and obtain educational material to enhance their understanding of music. Enthusiasts play a crucial role in boosting local musicians by actively engaging with

their favorite local musicians and providing reviews or ratings. Alunan motivates individuals to actively engage in the music industry, establishing a strong sense of inclusion and community among music enthusiasts. Alunan is a platform that enhances the music experience for lovers and supports and celebrates local talent.

1.5.3 Context of Study

Alunan focuses on creating a feature-rich mobile platform that meets the particular needs of local independent musicians and music enthusiasts. Features like profile creation are part of the initiative, which helps musicians interact with their fans and create a unique online brand. In order to build anticipation for upcoming releases, musicians can simultaneously share teasers of their songs. By adding favorites and bookmarking any local musicians, users may interact and improve their experience finding new music. Furthermore, by encouraging honest feedback and collaboration, music ratings and reviews help to build a strong local music scene. The goal of the project is to close the gap that exists between performers and fans by encouraging creativity, collaboration, and a greater understanding of local music.

To put it briefly, Alunan intends to completely reshape the local music industry by offering a flexible mobile platform that connects artists and fans via profiles, favorites, music snippets, and reviews. This dynamic ecosystem encourages innovation and community involvement.

1.5.4 Language

The Alunan online community mobile application project will primarily use the English language for its interface and communication. This choice of language aims to ensure accessibility and usability for a broad user base, including local musicians and music enthusiasts who are comfortable with English as a means of interaction within the platform.

1.5.5 Tools/Equipment Needed for Project

A. Hardware

- Mobile Device: A smartphone or tablet that runs on Android operating system and can support the Alunan mobile application.

B. Software

- Android Studio: A popular integrated development environment (IDE) for Android app development.
- Figma: A vector graphics editor and prototyping tool which is primarily web-based.
- Firebase: A mobile and web application development platform developed by Firebase, Inc. in 2011, then acquired by Google in 2014.
- GitHub: A provider of Internet hosting for software development and version control using Git.

1.5.6 Features and Functions

These are the features and functions of the Alunan mobile application:

A. User Profile Creation

The user profile creation process in Alunan, a mobile application designed for the online community and music discovery of local musicians, provides a smooth registration procedure where users provide crucial information such as their email, username, and password. Users have the option to select one of two separate profiles, either as musicians or enthusiasts. This allows for a personalized experience tailored to their preferences. Upon joining, members are granted the freedom to enhance their profiles by incorporating profile images and hyperlinks to their social networking and music streaming platforms. This enables a seamless integration of their Alunan presence with their wider online musical persona. Enthusiasts are motivated by gamification components, which reward them with badges for their contributions to music ratings and reviews. These extensive features collectively improve user involvement, promoting creative expression, connections, and active discovery of local music within the Alunan community.

B. Music Snippet Sharing

Alunan, the mobile application, includes an important function called Music Snippet Sharing. This feature aims to strengthen the online community and make it easier for music enthusiasts to find new music. This feature offers musicians a versatile platform for showcasing their talent by sharing captivating snippets of their musical works. Artists can share snippets of their songs, instrumentals, or melodies, providing an appealing glimpse into their creative realm. These snippets function as auditory previews, enticing users to go deeper into their body of work and cultivating a devoted fan following. In addition, Alunan utilizes the capabilities of Apple Music, Spotify, and SoundCloud APIs, allowing musicians to effortlessly distribute these brief sections on these widely-used music platforms, expanding their audience and visibility both within and outside the Alunan community. Alunan's dedication to supporting and promoting local musicians in their musical efforts is emphasized by this integration.

C. Favourite / Bookmark Musician

The "Favourite / Bookmark Musician" function in Alunan, provides music enthusiasts with an effective way to curate their musical experience. Using this functionality, devoted supporters may choose their preferred musicians within the Alunan community, establishing a customized list of artists they hold in high regard. By adding these performers to their bookmarks, enthusiasts may effortlessly remain informed about their latest artistic works, cultivating a more deeper connection with their musical influences. This function surpasses passive consumption, enabling enthusiasts to actively engage with and provide support to their selected artists. Alunan's dedication to improving the music discovery process and fostering a vibrant online community allows fans to actively support and celebrate their preferred local musicians.

D. Music Ratings and Reviews

The "Music Ratings and Reviews" function of Alunan allows music enthusiasts to engage directly with musicians' discography. Enthusiasts can contribute important suggestions and feedback by rating and reviewing the musical offerings of local musicians. This feature functions as a bridge between artists and their

audience, enabling enthusiasts to express their admiration, evaluation, and endorsement of musicians' creations. Musicians, in return, gain advantages from constructive criticism that facilitates their artistic development. Alunan fosters an environment that promotes open communication and cooperation, allowing musicians and lovers to work together in defining the local music scene. Alunan is a dynamic platform that enhances the sense of community and shared passion for music, promoting both discovery and artistic development.

1.5.7 Project Limitations

The limitations of this project are as follows:

1. The Alunan mobile application is exclusively compatible with the Android mobile platform. iOS users would be impacted by this, as they are unable to install the application and must instead use a smartphone running Android.
2. Alunan's focus is on serving only local musicians and enthusiasts in Malaysia. Thus, it can limit its growth potential and reach. Expanding beyond this geographic boundary could be challenging.
3. Restricting the platform to local musicians may limit the diversity of music genres and styles available to users. This could hinder the platform's ability to cater to a wide range of musical tastes.
4. A geographically limited user base may result in a smaller number of users compared to global music discovery platforms. This could affect the level of engagement and interaction within the community.

1.6 Significance of Study

The significance of this project is as follows:

1. Local Independent Musicians

Alunan provides a dedicated platform for local independent musicians to exhibit their talents, gain exposure, and engage with a community of music enthusiasts who value their artistic works. Such exposure can play a crucial role in supporting emerging musicians in establishing their careers and expanding their reach to a wider audience. Alunan encourages the sharing of music snippets among musicians, enabling them to get feedback. This platform creates an environment that promotes artistic growth and improvement, thereby contributing to the overall development of the local music scene.

2. Music Enthusiasts

Alunan serves as a central platform for music enthusiasts to discover and interact with local musicians and their music, providing them with several advantages. The website provides a customized music exploration experience, enabling enthusiasts to discover local musicians and genres that they may not have otherwise come across. Enthusiasts can actively support and participate with their preferred artists by bookmarking them as favorites and submitting ratings and reviews. This enhances their connection to the local music community.

3. Local Music Industry

The Alunan platform has the potential to greatly enhance the local music business by actively encouraging and supporting local musicians. It offers a virtual platform where musicians can acquire acknowledgment and potentially draw opportunities such as collaborations, live shows, and partnerships with nearby establishments. Alunan's expansion has the potential to support the economic development of the local music industry by generating greater demand for local music, hence leading to increased earnings for musicians, music producers, event organizers, and affiliated enterprises.

4. Mobile Application Developers

The development of the Alunan mobile application presents possibilities for mobile app developers. As the platform progresses and grows, there will continue to be a requirement for technical expertise to improve user experience, integrate new functionalities, and guarantee platform security. The successful outcome of Alunan can also function as a good subject of analysis for mobile application developers, offering unique perspectives on developing platforms that cater to certain communities and promoting user involvement through innovative and interactive elements.

1.7 Chapter Summary

The summary for every chapter in this thesis is as follows:

1. Chapter 1: Introduction

This chapter of the introduction provides context for the Alunan project, offering an overview of the problem that the platform seeks to address. It also outlines the objectives, scope, and the project's significance within the realm of the local music community and discovery.

2. Chapter 2: Literature Review

This chapter explores key elements that are crucial for the development of Alunan, a specialized mobile application designed for the local music community. The text dives into a study of the regional music scene, investigating patterns, challenges, and effective marketing strategies. The discussion revolves around the complex characteristics of online communities, user-generated content, the integration of social media, and the incorporation of gamification features. The review also examines the exploration of music, including a wide range of genres, concerns related to underrepresentation, and the influence of popular streaming sites. A comprehensive evaluation of established mobile applications such as Letterboxd, Spotify, Twitch, Bandcamp, and SoundCloud offers valuable guidance and insights for the creation of Alunan. This chapter serves as a crucial resource, establishing the basis for the following chapters and the general development of the Alunan platform.

3. Chapter 3: Research Methodology

This chapter provides an in-depth look at the research and development process carried out in this project. It begins with an introductory section, further expanding into the Mobile Application Development Lifecycle (MADLC), encompassing stages such as identification, design, development, prototyping, and testing. The chapter explores the process of developing the methodology and the activities associated with it. It provides insight into the activities, tools, techniques, hardware, and software used in the project. Furthermore, it provides a summary of the documentation process, guaranteeing transparency and quality.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter will explore the current state of literature regarding the creation of Alunan, a mobile application designed to promote a vibrant online community among local musicians and enhance music exploration. This chapter provides a thorough analysis of the local music environment, focusing on notable trends, obstacles encountered by musicians, and successful music promotion tactics. This study examines the interactions within online communities, with a focus on content created by users and the integration of social media. Additionally, it investigates the process of discovering music, including the variety of genres and the influence of popular music streaming platforms. In addition, the chapter assesses different categories of mobile applications, emphasizing crucial characteristics and difficulties, thereby preparing for the eventual development of Alunan.

2.2 Problem Domain

The problem addressed in this literature review arises from apparent indicators within the local music scene. Local independent musicians encounter obstacles such as a divided web presence, insufficient representation, and a lack of suitable tools for exposure and marketing. These symptoms are worsened by the apparent issue of numerous separate websites and applications, a lack of features specifically designed for artists, and increased competition for attention in the digital domain. The absence of a specialized online community platform for local independent musicians poses a huge problem in this complex setting. There is currently a lack of a centralized platform for musicians to effectively connect, find opportunities, and get the necessary skills for navigating the music industry.

In the specific problem domain, previous studies provide additional understanding of the difficulties encountered by local independent musicians in the digital

environment. Ong (2019) highlights the significance of social and cultural influences in the realm of musical expression, particularly the influence of alternative media, blogs, and websites on the formation of music communities. This highlights the significant impact of digital platforms in shaping the local music scene. Zanuar and Md Noor (2022) highlights the importance of social media platforms in marketing for independent artists, recognizing their effectiveness and the difficulties associated with operating within this realm. Gaining insight into how artists employ different social media platforms to interact with specific audience groups is essential for finding a solution to the problem area. Moreover, Edlom and Karlsson (2021) emphasizes the significance of fan communities in generating value for music companies, offering significant perspectives on the factors that drive fans to interact with musicians. Incorporating various viewpoints into the problem area improves the thorough comprehension necessary for the creation of Alunan, a specialized online community platform aimed at tackling the complex obstacles encountered by local independent musicians.

The proposed solution to this problem domain involves the creation of Alunan, a mobile application specifically tailored to tackle the observed symptoms and perceived concerns. Alunan seeks to enhance connections among local independent musicians by creating a dedicated internet platform, promoting increased visibility, and facilitating networking possibilities. The platform is designed to be an efficient platform that not only enables interaction but also supports the cultural and professional development of artists. Alunan aims to address the gaps in the problem domain by providing a comprehensive solution that caters to the specific requirements of local independent musicians in the constantly changing digital music industry.

2.3 Local Musicians

Local musicians are highly regarded in any community. These unsung music heroes perform in local hotels, tiny venues, and community events, sharing their love of music with their communities. These outstanding musicians lend a unique flavor to the local music industry by delivering a variety of styles and genres to suit their audience. Local musicians are storytellers who express their community's experiences,

traditions, and emotions via their music. They become part of the local culture since their performances unite the audience.

According to Mohd Azhar Abu Bakar @ Azmeer (2021), Local musicians in Malaysia play a crucial role in maintaining and promoting Malaysia's unique musical heritage. Malaysia's local singers serve as cultural ambassadors, representing the country's rich culture through the genres of Malay, Chinese, Indian, and indigenous music. They showcase the historical development of distinct Malaysian musical styles (Mohd Azhar Abu Bakar @ Azmeer, 2021). By blending both traditional and modern sounds, they construct an evolving musical world that deeply connects with enthusiasts of music, establishing an inclusive identity where venues and events act as main places for gathering (Ong, 2019). Malaysian musicians incorporate international musical trends while showcasing the nation's diverse heritage, encompassing traditional gamelan music to contemporary urban hip-hop. They perform at festivals, night markets, and cultural events, fostering solidarity among individuals from various origins through the unifying power of music in this global community.

2.3.1 Types of Musicians

2.3.1.1 Independent Musicians

According to Ardit (2021), independent musicians represent an exclusive segment of the music business that does not receive backing from large record labels. These musicians are outstanding examples of self-sufficiency because they are in charge of independently overseeing all facets of their professions, from booking shows to handling finances. Martinez (2021) emphasizes, even more, how crucial social media is to independent bands' marketing campaigns. These musicians, who have total creative control over their songs and careers, use social media sites like Twitter and Instagram to promote themselves and interact with fans. These musicians' independence not only permits artistic freedom but also modifies the conventional dynamics of the music business by creating close relationships between performers and their audience.

2.3.1.2 Hobbyist Musicians

As stated by Ardit (2021), hobbyist musicians represent a special category of the music industry. These people pursue music as a rewarding hobby rather than as their main source of income. The money they make from their musical endeavors is sometimes viewed as extra money, which sets them apart from professional musicians who rely only on their trade as a source of income. This distinction highlights the variety of reasons people listen to and participate in music; hobbyist musicians, for example, find joy and comfort in their work while continuing to pursue other primary sources of income or careers. This multimodal approach to music highlights its global appeal by allowing people to use it as an instrument for both personal expression and relaxation.

2.3.1.3 Independent Label Musicians

According to Ardit (2021) and Martinez (2021), musicians who have ties with independent record labels are a unique group in the music business. These musicians enjoy a special set of benefits because they are signed to smaller labels that run independently from larger corporations. Independent labels give musicians more creative freedom over their music and career choices because they concentrate on more specialized genres or local specialties. This independence gives musicians the freedom to try out other genres and take unconventional approaches to production and marketing. In addition to enhancing artistic authenticity, the cooperative dynamic between musicians signed to independent labels and their smaller, more specialized associations adds to the energy and diversity of the music industry.

2.3.1.4 Major Label Musicians

As noted by Ardit (2021) and Martinez (2021), musicians affiliated with large record labels play a crucial role in the music business. Major-label musicians have access to a wealth of marketing and promotional support because they are part of larger organizations with greater financial resources. This allows them to reach a worldwide audience. But working with big labels is not without its costs, as it frequently means giving up some creative freedom and control. Given that large labels place a

premium on wider distribution and economic success, their influence over decisions about artistic direction and career choices is noteworthy. Major label musicians often gain public acclaim despite possible concessions, highlighting the delicate balance that these artists must strike in their careers between financial backing, artistic freedom, and industrial significance.

2.3.1.5 Postlabel Musicians

Post-label musicians represent an informed departure from the traditional form of recording contracts, in response to the issues highlighted by Ardit (2021). These musicians have a more decentralized and independent approach, deliberately trying to avoid any exploitation by major labels. In the post-label era, musicians address the concerns that come with the possibility that signing a record label may result in a loss of artistic independence by placing a higher priority on retaining creative control and autonomy over their work. Post-label musicians move through the unstable music industry by utilizing independent distribution and digital platforms. They aim to establish a more fair and artist-focused model that confronts the possibility of exploitation that those who work in the conventional record label system may experience.

2.3.2 Local Music Scene Trends

Ong (2019) has observed that the local music scene in Malaysia has undergone substantial development in recent years, particularly in Kuala Lumpur, where a vibrant Indie Rock music community has emerged. This community prioritizes online connection and collaboration with the international and regional music scenes, promoting the development of independent labels that endorse regional Indie music. These labels offer a forum for musicians to produce music that departs from the worldwide popularised local rock and pop music genres. However, there are ongoing difficulties, mainly due to a lack of suitable locations for Indie Rock music performances. This issue has been further aggravated by the closing of major venues, resulting in a significant impact on the local Indie Rock music scene. Despite these obstacles, the community displays persistence by actively pursuing additional performing spaces and events that increase musical exposure and promote the develop-

ment and endurance of local Indie Rock performers.

In addition, as emphasized by Mohd Azhar Abu Bakar @ Azmeer (2021), the music industry in Malaysia has seen an engaging pattern of blending traditional Malaysian musical components with contemporary genres, resulting in a unique and varied musical environment. This fusion has not only gained popularity in Malaysia but has also attracted international acclaim, hence enhancing the global prominence of Malaysian music. Moreover, there is an emerging pattern of Malaysian artists engaging in partnerships with musicians from other countries, leading to the exchange of cultural elements and the integration of many musical influences into the domestic music landscape. This instance highlights the adaptability and creativity of Malaysian musicians in connecting different cultures through their music.

Furthermore, Silahudin (2019) has seen an increasing popularity of indie and alternative music genres in Malaysia, with local and worldwide acclaim being achieved by independent musicians and bands. This phenomenon has played a significant role in fostering a dynamic and varied music scene within the nation. In addition, Malaysian musicians have been engaging in the exploration of traditional sounds, combining them with modern elements to produce unique and different musical expressions. The expansion of digital platforms and social media has additionally furnished Malaysian musicians with fresh opportunities to exhibit their work, establish connections with listeners, and participate in partnerships with artists from various countries, leading to a more interconnected and globalized music scene in Malaysia. These trends collectively demonstrate the ever-changing and progressive nature of Malaysia's local music landscape.

2.3.3 Local Music Scene Challenges

The local music scene in Malaysia encounters substantial obstacles, mostly due to the lack of performance venues for Indie Rock music (Ong, 2019). The closing of major venues has hurt the visibility of the local Indie Rock music scene, underscoring the urgent requirement for additional performance spaces and concerts that promote the development and longevity of local Indie Rock musicians. The limited number of available venues has presented challenges for musicians and organizers, limiting the growth and visibility of Indie Rock music in the local music scene.

In addition, as highlighted by Mohd Azhar Abu Bakar @ Azmeer (2021), the music industry in Malaysia has numerous challenges. A notable obstacle comes in the attempt of local artists to acquire exposure and recognition in the highly competitive industry. The lack of resources and opportunities for independent musicians, coupled with the growing popularity of mainstream commercial music, present significant challenges to the development of the local music scene. Moreover, the problems associated with music piracy and copyright infringement have significantly affected the financial well-being of musicians and the long-term survival of the music industry in Malaysia. These challenges emphasize the necessity for increased assistance for the development and promotion of talents within the local music scene.

Furthermore, the music industry in Malaysia encounters specific challenges. An important obstacle is the insufficient assistance and promotion available to native musicians, particularly those who produce music in native languages or dialects (Silahudin, 2019). This presents an obstacle to the preservation and development of Malaysia's diverse musical legacy. Moreover, the growing popularity of popular commercial music and global music trends could surpass the importance of local talents, posing a challenge for up-and-coming Malaysian artists to establish themselves in the industry. Moreover, the pressing concerns of copyright protection, fair compensation, and sustainable income for artists in the digital age emphasize the necessity for improved support structures to guarantee the livelihood of traditional music artists in Malaysia.

2.3.4 Electronic Press Kit

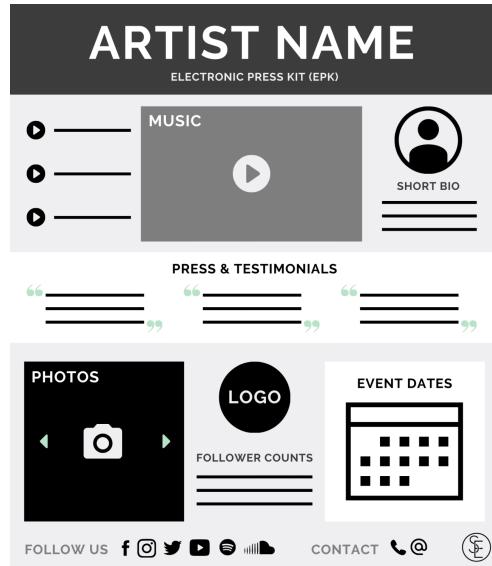


Figure 2.1 Template of Electronic Press Kit

Electronic Press Kit 101: Why an EPK is Vital for Every Artist (2020, August 3)

<https://www.linkedin.com/pulse/electronic-press-kit-101-why-epk-vital-every-artist-tyler-schurb/>

An electronic press kit (EPK) is a crucial promotional tool for musicians aiming to showcase their skills and capture the interest of industry experts, media platforms, and prospective supporters. An EPK, or electronic press kit, is a digital compilation of essential information about an artist presented in a user-friendly and easily accessible way, as opposed to traditional physical press kits. EPKs, as emphasized by Wilson (2020), serve as a customized tool for artists and bands to tell their stories to booking agents, tour managers, record labels, and radio stations. The objective is to obtain opportunities such as performances, interviews, and contracts. The EPK, similar to a concise downloadable publication, contains essential details about the artist, with a particular emphasis on visually appealing aspects such as high-quality images. These photographs should not only prioritize resolution but also emphasize captivating composition.

An EPK often consists of a well-constructed biography that showcases the musician's background, influences, and notable achievements. Additionally, it showcases top-notch promotional photographs, guaranteeing a visually captivating portrayal of the artist. The EPK should exhibit the artist's musical expertise through audio and visual materials, such as sample tracks, music videos, or live performance footage. By employing an interactive method, industry specialists can promptly evaluate the artist's artistic style and prospects. In addition, the EPK includes essential social media links, emphasizing the crucial importance of having an online presence in the modern era. Moreover, the inclusion of direct hyperlinks to the artist's music, highlights the significance of making the music easily available to listeners, regardless of its quality, as a crucial factor for achieving success (Wilson, 2020). In general, an electronic press kit functions as a thorough and adaptable tool, enabling musicians to create a memorable impact in the highly saturated music market.

2.4 Online Community

An online community is described as a digital space where individuals who have similar interests, objectives, or affiliations gather to communicate, share information, and participate in discussions or activities. Communities may exist in diverse formats, including forums, social media groups, or specialized platforms, offering members a virtual space to communicate, cooperate, and develop connections without being constrained by geographical limitations. Online community platforms such as Facebook Groups, Reddit, LinkedIn Groups, Discord servers, and niche-specific forums like Stack Overflow for programming enthusiasts or GitHub for software developers serve as examples. These platforms enable the establishment of communities centered around diverse subjects, spanning from personal interests and professional connections to mutual aid organizations and enthusiast associations.

2.4.1 User-Generated Content

According to V K Shyni (2022), User-Generated Content (UGC) in online communities offers a diverse range of values, including functional, emotional, and social components. Functionally, user-generated content (UGC) frequently functions as a valuable source of information, guidance, and resolutions for members of a community. Emotionally, it cultivates a feeling of inclusion and mutual experiences, fostering emotional bonds among users. From a social perspective, user-generated content (UGC) plays a significant role in encouraging the development of a unified community, where individuals join based on common interests or objectives. This multidimensional value enhances participation and connection among community members.

The trust-building influence of user-generated content (UGC) in digital media, which is favored above traditional advertising (V K Shyni, 2022). UGC is characterized by its authenticity, making it widely regarded as more genuine and reliable compared to content produced by professionals. Online communities place high importance on the thoughts and experiences given by their members, acknowledging them as genuine and trustworthy sources. The confidence and authority that is built through User-Generated Content (UGC) significantly impact the dynamics of a community and the level of influence its members have.

The quality of user-generated content (UGC) in online communities is impacted by multiple factors, as outlined by Luca (2021). These elements include promotional content, peer effects, biases, and self-selection. UGC of superior quality frequently arises when individuals are driven by non-monetary incentives, such as badges or social standing, to provide excellent content to the community. These incentives can guide user contributions in a good manner, promoting the development of significant and influential content (Luca, 2021). Hence, the interaction between the standard of content and the motivating factors has an important effect on the structure of user-generated content inside digital media platforms.

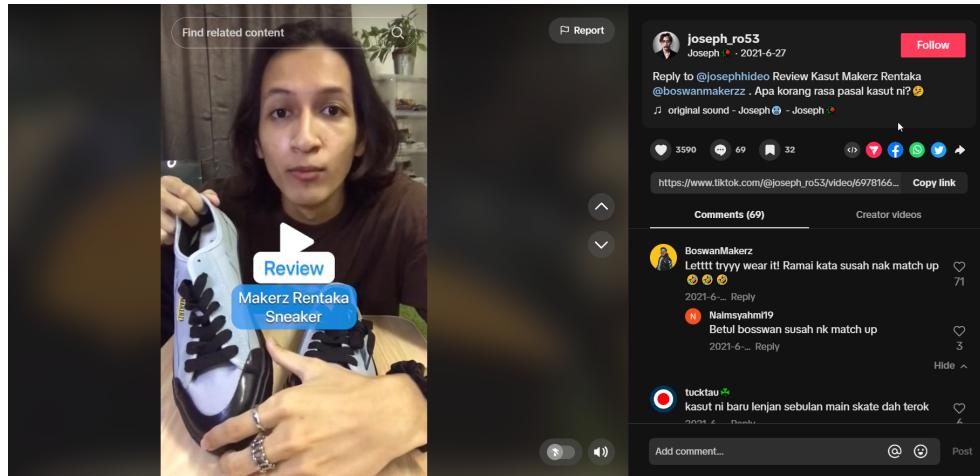


Figure 2.2 User-Generated Content (UGC) in TikTok

TikTok post by @josephro53 (2021, June 22) [ByteDance, 2023]

Within the realm of user-generated material in online communities, it is useful to analyze two illustrative examples that demonstrate its influence and variety. The first figure involves a TikTok video review conducted by user @josephro53, which explores the realm of those who hold a deep passion and knowledge about sneakers. This user-generated material has a reviewer who offers a perceptive and subjective evaluation of the Makerz Rentaka sneakers. This content provides analytic value to viewers seeking product knowledge and a sense of connection with fellow sneaker enthusiasts who share a passion for the topic.

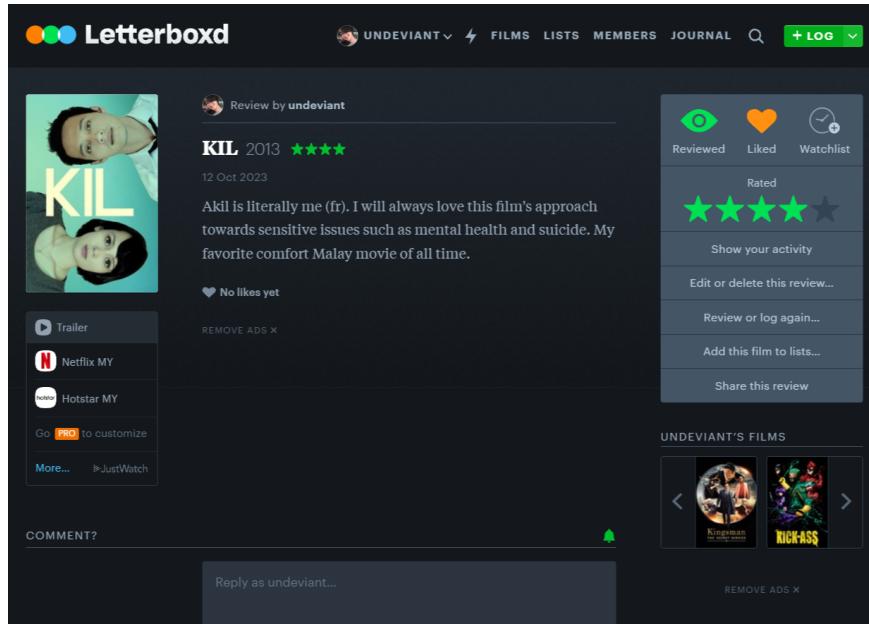


Figure 2.3 User-Generated Content (UGC) in Letterboxd

Letterboxd post by @undeviant (2023, October 12) [Letterboxd, 2023]

The second figure, a movie review of "KIL (2013)" by user @undeviant on Letterboxd, illustrates the significance of user-generated content (UGC) in the area of cinema critique and admiration. In this review contributed by @undeviant, a perspective evaluation of the Malaysian movie is presented, presenting an original viewpoint that enhances the discussion about the film. This material represents the trust and authority that users give to other community members when they are looking for recommendations or insights in their areas of interest.

2.4.2 Social Media Integration

The integration of social media into online communities has become an essential feature of modern digital interactions. This integration utilizes the capabilities of platforms such as Facebook, Twitter, and Instagram to improve the overall community experience. Online communities promote enhanced user involvement and exposure by enabling the seamless linking of social media profiles and content sharing. Integrating social media not only expands the audience for community content, but also promotes immediate conversations, exchange of valuable knowledge, and fast distribution of information (Zanuar & Md Noor, 2022). This technology bridges the boundaries between virtual communities and the wider online social environment, al-

lowing members to easily interact, cooperate, and contribute across several platforms, hence enhancing the overall community experience.

2.4.3 Types of Interaction

Interactions in online communities are complex and diverse, with different forms that each have their importance. Primarily, likes and reactions provide members with a convenient and efficient means to show their approval or appreciation for a post or comment. These confirming actions aim to inspire content authors and communicate that their efforts are highly esteemed in the community. Moreover, comments serve as the vital essence of discussions, offering a platform for individuals to express their opinions, pose inquiries, and participate in important conversations. Comment threads frequently develop into rich sources of knowledge, deep opinions, and varied points of view, promoting a feeling of community unity.

Sharing content is a crucial method for interaction within internet communities. When a member shares a post or discussion topic, it expands the visibility of that information to a wider audience, potentially recruiting new members and improving the overall reach of the community. Upvotes and downvotes, frequently observed on sites such as Reddit, allow users to indicate their approval or disapproval of particular posts or comments. This voting method helps the curation of content, guaranteeing that the most relevant and significant contributions rise to popularity, while irrelevant or improper content is dismissed. Furthermore, ratings and reviews have a crucial significance, particularly among communities that prioritize items, services, or information. Users can allocate ratings and submit comprehensive reviews, providing essential input and impacting the decisions of others. These assessments enhance knowledge and assist members in selecting the best services.

In addition to these interactions, mentions and tags play a crucial role in engaging particular community members in discussions and recognizing their expertise. Direct messaging enables confidential individual conversation, but polls and surveys provide a systematic approach to collecting community comments, opinions, or preferences. Emojis and reaction buttons serve to enhance the expression of emotions and

sentiments towards content, providing additional depth and subtlety. These various types of interaction collectively enhance the overall experience of online communities by promoting communication, collaboration, and engagement among members, hence increasing their appeal and effectiveness as platforms.

When discussing online communities, it is essential to acknowledge the influence of incorporating social media on the dynamics of the community and the level of involvement from its members. Zanuar and Md Noor (2022) highlight the effectiveness of social media tactics for independent artists. These tactics encompass actively interacting with supporters, revealing exclusive content, and maintaining genuineness and consistency in social media posts. Through the incorporation of social media platforms into their digital communities, independent artists can establish direct connections with their audience, providing exclusive perspectives into their creative approaches, and developing a loyal following that actively engages in conversations and promotional activities.

In addition, Järvekülg and Wikström (2021) discusses the differences between brand-centric and community-focused strategies for promoting music on social media. The difference is important in the context of online communities, as it indicates the different ways through which community members and artists interact with each other. The brand-centered method prioritizes promotional gatekeeping and conventional marketing techniques, whereas the community-oriented approach places importance on establishing significant ties with fans and fellow artists. By incorporating these methods into online communities, a comprehensive music promotion plan may be developed that addresses both user involvement and brand establishment, resulting in a well-rounded experience for community participants. In short, the incorporation of social media into online communities acts as a connection between artists and their audience, encouraging interaction, genuineness, and a variety of promotional approaches.

2.4.3.1 Gamification Elements

Introducing gamification features into an online community can significantly influence its dynamics and enhance member participation. Gamification, as defined by Hsu and Chen (2018), refers to the utilization of game components in non-game situations to modify individuals' behavior and enhance their level of involvement. This concept has attracted significant attention in several fields, such as online communities, where it can play a crucial role in improving the overall user experience.

An essential aspect commonly employed in online communities to enhance user engagement is the incorporation of points, badges, and levels. According to Mauroner (2019), these elements can be effective strategies for identifying and inspiring community members. Points and badges provide individuals with a feeling of accomplishment and status, motivating them to actively engage and demonstrate their expertise. Through the process of measuring their contributions and evaluating them based on leaderboards, individuals are motivated to consistently enhance and make valuable additions to the community's discussions and activities.

Furthermore, the incorporation of technical challenges and quests in the community is consistent with the user engagement concepts emphasized by Hsu and Chen (2018). These challenges offer an exhilarating opportunity for cooperative learning and problem-solving. These activities enhance the problem-solving abilities of participants and promote a feeling of togetherness as they collaborate to overcome obstacles.

In addition, the introduction of virtual currencies and rewards can significantly influence the dynamics of an online community. These elements can be utilized to encourage participation and reward members for their contributions (Mauroner, 2019). Virtual currencies can be used to purchase virtual goods, which can be utilized to enhance the user experience. These elements can be used to encourage participation and reward members for their contributions. Virtual currencies can be used to purchase virtual goods, which can be utilized to enhance the user experience.

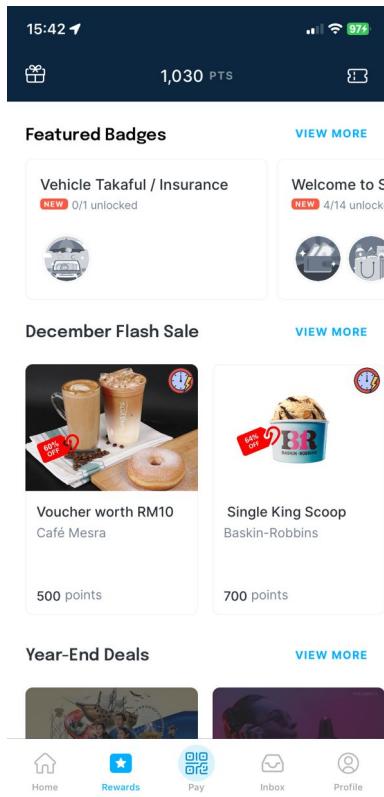


Figure 2.4 Gamification Elements in Setel

Screenshot of Rewards page in Setel [Setel Ventures Sdn. Bhd., 2023]

Figure 2.3 illustrates the gamified rewards page of the Setel mobile application, which is a comprehensive platform designed for the Malaysian audience, offering services such as fuel, parking, EV charging, eWallet, and more. This page utilizes gamification to prominently display users' earned points, promoting engagement by transforming routine transactions into chances to earn rewards. Users are motivated to actively engage in Setel's products, earning points that can be redeemed for practical vouchers in various categories such as food, fashion, and entertainment. The implementation of gamified design in Malaysia aims to provide an engaging and captivating experience for users. By using the principles of incentive and achievement, this design strategy fosters user loyalty. Additionally, it offers real and appealing rewards to further enhance user engagement.

2.4.4 Technology Growth in Online Community

Within the context of online communities, the profound impact of technology is obvious as it allows individuals to connect, exchange information, and engage with one another regardless of their physical location. The increasing availability of cell phones, high-speed internet, and easily accessible digital gadgets has facilitated the decentralization of membership in these communities, resulting in their increased accessibility and popularity. With the advancement of technology, online platforms have become more complex and engaging, providing a wide range of ways for people to express themselves and work together.

Leger (2021) underlines the unique features of sites such as Twitch and Bandcamp within the music industry. Twitch's distinctive monetization system differentiates itself by enabling musicians to directly generate revenue from their audience via subscriptions and virtual gifts. This promotes a more immediate and mutually beneficial connection between creators and fans, hence improving financial viability. On the other hand, Bandcamp's emphasis on selling albums and merchandise, rather than streaming, corresponds with evolving patterns of fan interaction, offering more concrete methods for audiences to show their support for their preferred artists.

Users actively interact with these platforms through various methods utilizing functionalities such as Twitch's real-time broadcasting or Bandcamp's direct sales approach. Nevertheless, difficulties remain, specifically in the realm of copyright concerns. These problems highlight the intricate nature that platforms encounter when trying to strike a balance between providing fair compensation for artists and safeguarding intellectual property rights (Leger, 2021). Within the constantly changing digital environment, the integration of AI and machine learning is improving user experiences by providing personalized content recommendations and addressing security and privacy issues. With the advancement of technology, online communities are ready for further innovation, offering thrilling opportunities for individuals to interact, collaborate, and establish communities in the digital world.

2.5 Music Discovery

2.5.1 Music Genre Diversity

The concept of an extensive variety of genres in the process of discovering music has seen significant growth throughout recent years, driven by user-focused observations and developments in recommender systems. Robinson et al. (2020) clarify the complex and varied aspects of diversity in music recommendation lists, underscoring the significance of integrating both internal and external diversity. Internal diversity, in this context, pertains to the assortment of subgenres and styles within a specific genre, whereas external diversity incorporates recommendations from entirely separate genres. These subtle and precise categories have fundamentally changed the way music enthusiasts explore and value varied musical landscapes.

In current recommender systems, measures such as variety, creativity, and randomness have become essential in addition to accuracy. When utilized in music discovery systems, these measures have a crucial impact in promoting genre exploration and expanding listeners' musical horizons. Diversity, as per the definition provided by Robinson et al. (2020), extends beyond the mere inclusion of random music. It encompasses the goal of achieving a well-proportioned representation of various genres and subgenres within recommendation lists. The presence of variety in music drives users to explore unfamiliar and unexplored musical categories, while randomness adds an element of pleasant unexpectedness, allowing listeners to come across genres they may not have encountered otherwise.

By utilizing user-centric information and metrics, modern music discovery services employ algorithms and curated playlists to direct listeners toward a wider range of genres. Through the integration of diverse elements from both internal and external sources, these platforms provide customized experiences that surpass the limitations of specific genres, promoting a wider musical exploration for users. Despite these circumstances, the recognition and enjoyment of many musical genres not only demonstrate the progress of technology but also highlight the influence of recommender systems in creatively influencing our musical preferences and tastes.

2.5.1.1 Underrepresented Genres

Traditional and local pop music, which is strongly influenced by tradition, frequently encounter difficulties in establishing a presence within popular music that appeals to a wider audience. However, online platforms have created an opportunity for enthusiasts to interact, exchange, and celebrate these genres. Online communities have arisen, attracting enthusiasts and musicians who are passionate about preserving and developing traditional music genres. Within these digital platforms, traditional and regional pop music genres receive acknowledgment and active involvement from an avid group of enthusiasts.

Digital platforms have a larger impact that goes beyond the establishment of genres. They facilitate the creation of music communities, surpassing geographical limitations and enabling persons with similar interests to unite. According to Silahudin (2019), social media and online forums offer an environment for conversations, music sharing, and cooperation between musicians and their supporters. These groups not only cultivate admiration for underrepresented genres but also promote the production of novel music that combines traditional aspects with modern influences.

Eventually, the less popular music genres in the Malaysian music industry are discovering their expression and following the impact of digital platforms and online communities, as highlighted by Silahudin (2019). These platforms facilitate the creation of genres such as traditional and regional pop music and promote the development of enthusiastic music communities. Thus, the music scene in Malaysia has grown in variety and comprehensive, preserving traditional practices while embracing originality and experimentation.

2.5.2 Music Streaming Services Platforms

Within the era of streaming, the process of discovering music has evolved and been shaped by both subjective experiences and social divisions based on socioeconomic status. Ellis (2022) explores the concept of "phenomenological moment" in the context of music discovery. He highlights the significant role these moments play in influencing individuals' interpretations and understandings of music. Music streaming platforms have emerged as a means of facilitating such experiences, allowing users to delve into a wide range of musical genres and artists that are customized to their preferences. These systems employ recommendation algorithms to enable users to find new music that connects with them, hence boosting the experiential aspects of music exploration.

In addition, users have progressively turned to music streaming sites as a method of storing and organizing their playlists (Ellis, 2022). This method enables individuals to establish meaningful relationships with music over time, forming personal stories and connections with the songs they choose. Playlists surpass being simply collections of songs; they reflect an individual's musical journey and ever-changing preferences. This phenomenon highlights the fact that music streaming platforms not only make it easier to discover new music but also allow users to actively define their musical preferences and tastes.

Webster (2019) also explores the impact of music streaming platforms on individual preferences for music and the differentiation of cultural identities. These platforms have equalized access to music, erasing social class distinctions and enabling individuals from various backgrounds to explore and appreciate a wide variety of genres. Streaming services break common perceptions of modern and popular music by promoting user exploration free from the limitations of traditional class-based musical classifications. Music streaming platforms have played a significant role in creating a more inclusive and diversified music scene, prioritizing individual preferences over social class distinctions.

2.5.2.1 Apple Music



Figure 2.5 Web Player for Apple Music

Web Player Interface for Apple Music [Apple Inc., 2023]

Apple Music is a subscription-based music streaming service offered by Apple Inc. It provides users with access to a wide database of songs, albums, and playlists from various artists and genres. With features like personalized suggestions, curated playlists, and the opportunity to create your playlists, Apple Music offers a seamless and interactive music listening experience. Users can also download music for offline listening and enjoy exclusive content like music videos and artist interviews. It's available across numerous Apple devices and platforms, making it a simple alternative for people heavily ingrained in the Apple ecosystem.

2.5.2.2 Spotify

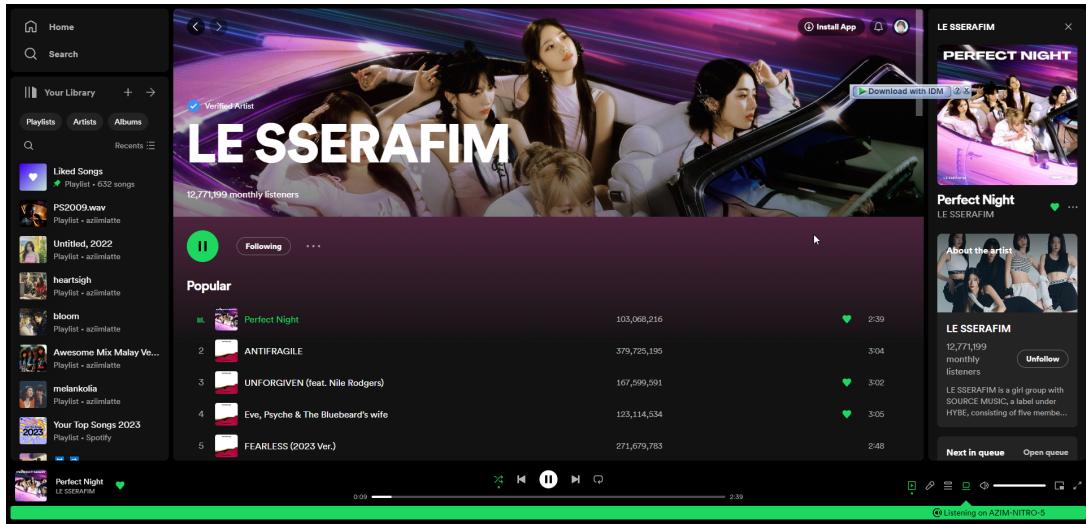


Figure 2.6 Web Player for Spotify

Web Player Interface for Spotify [Spotify Technology S.A., 2023]

Spotify is a popular music streaming platform that offers a wide catalog of songs, albums, and playlists from across the world. With both free and premium subscription options, it helps users discover, play, and share music effortlessly across numerous devices. Spotify's notable features include tailored playlists like Discover Weekly and Release Radar, as well as collaborative playlists, podcast streaming, and a social component that lets users follow friends and artists. It's known for its user-friendly interface, cross-platform compatibility, and a large range of music genres and content, making it a go-to pick for music enthusiasts searching for a diverse and accessible streaming experience.

2.5.2.3 YouTube Music



Figure 2.7 Web Player for YouTube Music

Web Player Interface for YouTube Music [YouTube and Google, 2023]

YouTube Music is a music streaming service provided by YouTube, specifically created to provide users access to an extensive collection of songs, music videos, and live performances. Within the broader YouTube ecosystem, this platform provides customized playlists, suggestions, and the option to discover music based on genre, artist, or mood. YouTube Music offers features such as offline downloading and background listening, making it a comfortable option for both free and paid members. YouTube Music appeals to a diverse audience of music lovers by offering a distinctive combination of authorized songs, content created by users, and music videos. This makes it a preferred option for individuals who appreciate visual elements in addition to their music.

2.5.3 User Music Behavior

The emergence of music streaming platforms and advanced recommendation algorithms has led to a significant transformation in user music behavior for music discovery. Conventional methods of exploring music, like radio broadcasts and physical record stores, have been replaced by more individualized and interactive techniques. This transition is consistent with the discoveries made by Liang and Willemse (2022), who investigated the progression of users' musical preferences over time. The significance of tailored forcing in genre exploration recommenders, emphasizes the function of exploration-oriented systems in fulfilling users' desires for novelty and diversity.

Moreover, the research conducted by Perera et al. (2020) highlights the difficulties encountered by music recommendation systems in the current digital environment. These issues encompass a variety of brief song durations, huge music collections, and an excess of song recommendations. To address these problems, contemporary music recommendation systems have transitioned towards offering consumers personalized and varied recommendations, in line with the changing interests of users who desire a wider range of musical experiences.

Modern users need recommendations that not only align with their current interests but also promote exploration and discovery of new genres and artists, while also valuing certain views. This trend is especially apparent among users with greater musical expertise, who demonstrate more consistent tastes and a wider range of listening behaviors. Modern music discovery platforms place a high value on personalization, social engagement, and genre diversity to meet the changing interests and preferences of their users. This results in a more engaging and interactive music discovery experience.

2.5.4 Music Promotion Strategies

2.5.4.1 Digital Marketing

Music promotion has experienced an important shift in the current era of technology, with digital marketing emerging as a crucial element for both musicians and record companies. The proper utilization of online platforms can determine an artist's success in the fiercely competitive music industry. According to Haynes and Marshall (2018), social media enables direct interaction with the audience, which is a crucial aspect of promoting digital music. Nevertheless, their research also underscores the limitations of social media in accessing new audiences.

Digital marketing involves using several platforms to effectively target a wide demographic. Social media networks like Instagram, Facebook, and Twitter have a crucial impact. Artists and labels ought to consistently keep dynamic profiles, interact with fans, and regularly release captivating stuff. Musicians utilize social media channels to communicate with their audience, yet these platforms may have limitations in terms of reaching new audiences (Haynes & Marshall, 2018). This emphasizes the significance of expanding promotional techniques.

Developing and distributing captivating content is essential in the promotion of digital music. In addition to releasing music, artists can give exclusive insights into their creative process, music videos, and live performances. Employing visual media like YouTube and TikTok can also produce favorable outcomes. Basaran and Ventura (2022) highlight the importance of customizing digital material and its influence on consumer happiness in the era of digital entertainment. In addition, they analyze the impact of social media on digital marketing, highlighting the fact that having a strong online presence does not always result in financial success for musicians.

Effective music promotion in the current digital context heavily relies on the implementation of digital marketing methods. To advance their music career, artists and labels should utilize social media, email marketing, and other content forms to engage with their audience, expand their influence, and eventually propel their music

careers. By adopting these strategies and acknowledging their limitations, musicians can distinguish themselves in a saturated market and develop a loyal following, as evidenced by the studies conducted by Basaran and Ventura (2022) and Haynes and Marshall (2018).

2.5.4.2 Fan Engagement

Interactive creation of content is a highly successful method for engaging fans. This includes live streaming sessions, question and answer sessions, and exclusive insights into the artist's personal life. This type of content cultivates a feeling of closeness and relationship between the artist and the fans. Edlom and Karlsson (2021) argue that fans actively participate in the creation of value within music brand communities by establishing emotional bonds and aligning their values with those of the artists. Lee and Nguyen (2020) explore participatory fandom, which emphasizes the active role of fans in shaping music promotion and exercising influence on commercial music services.

Personalization plays a crucial role in promoting fan involvement. Artists and labels can utilize email marketing and social media platforms to establish direct communication with their fans. This allows them to personalize the content by addressing fans by their names and personalizing it to their interests. Delivering customized messages for important occasions such as birthdays or album celebrations, expresses gratitude and strengthens the bond between the artist and their fans. Customized communication creates a sense of appreciation among followers and motivates them to maintain their loyalty and support. This is consistent with the dynamics of fan networks and their interactions with artists in a digital context, as explored by Edlom and Karlsson (2021).

Establishing a digital community focused on the artist's music is an effective approach to engage fans. Artists can establish fan clubs, forums, or exclusive groups on popular platforms such as Facebook or Discord. These spaces provide opportunities for fans to interact, express their enthusiasm for the music, and participate in conversations. The artist's active engagement in these groups develops a feeling of

belonging and guarantees that fans receive sufficient details about upcoming releases and activities. Lee and Nguyen (2020) found that the connection between music enthusiasts and commercial music platforms is shaped by participatory fandom, highlighting the significance of fan involvement in music promotion.

Fan engagement is more than an aspect of music promotion; rather, it serves as the core foundation upon which successful music careers are established. Strategies such as creating interactive material, engaging in personalized contact, and promoting a sense of community are crucial for establishing deep connections with followers. Both Edlom and Karlsson (2021) and Lee and Nguyen (2020) emphasize that these connections can result in increased audience pleasure, collaborative value creation, and sustained support for the artist's work. By placing audience involvement as a top priority, musicians and record labels can establish a durable and successful music ecosystem in the digital age.

2.6 Mobile Application

A mobile application, usually referred to as a mobile app or just an app, is a software program designed specifically to run on mobile devices such as smartphones, tablets, or smartwatches (Ramdurai, 2021). These applications provide a broad range of functions, including basic operations like weather checking and more complex objectives like financial management. These applications can be accessed through platforms such as Apple's App Store or Google Play Store. They make use of touchscreen interfaces and device-specific technologies, such as cameras and GPS, to provide customized and interactive experiences. Mobile app development involves the process of writing, testing, and optimizing applications for different mobile platforms such as iOS and Android. This is done using programming languages like Swift, Objective-C, Java, and Kotlin. User experience (UX) and user interface (UI) design are essential elements that guarantee both functionality and visual appeal. In the current era of digitalization, mobile applications have become an essential component of everyday life, providing comfort, entertainment, and productivity tools readily accessible.

2.6.1 Type of Mobile Application

Mobile applications can be classified into three primary categories: native applications, web-based applications, and hybrid applications (Syeed et al., 2021). Native apps are designed for a specific platform and are created using the programming languages native to iOS or Android. They provide excellent performance and smooth user experiences, while also allowing access to capabilities exclusive to the device. On the other hand, web-based applications can be accessible via mobile web browsers, ensuring compatibility across different platforms, eliminating the need for installation, and enabling easier development through the use of common web technologies. Hybrid applications combine components from both native and online apps, using web technologies enclosed within a native container to facilitate development across many platforms, partial utilization of native functionalities, and dissemination through app stores. The selection among these categories is dependent upon aspects such as performance requirements, target demographic, and development resources, with each method having its unique variety of benefits and limitations.

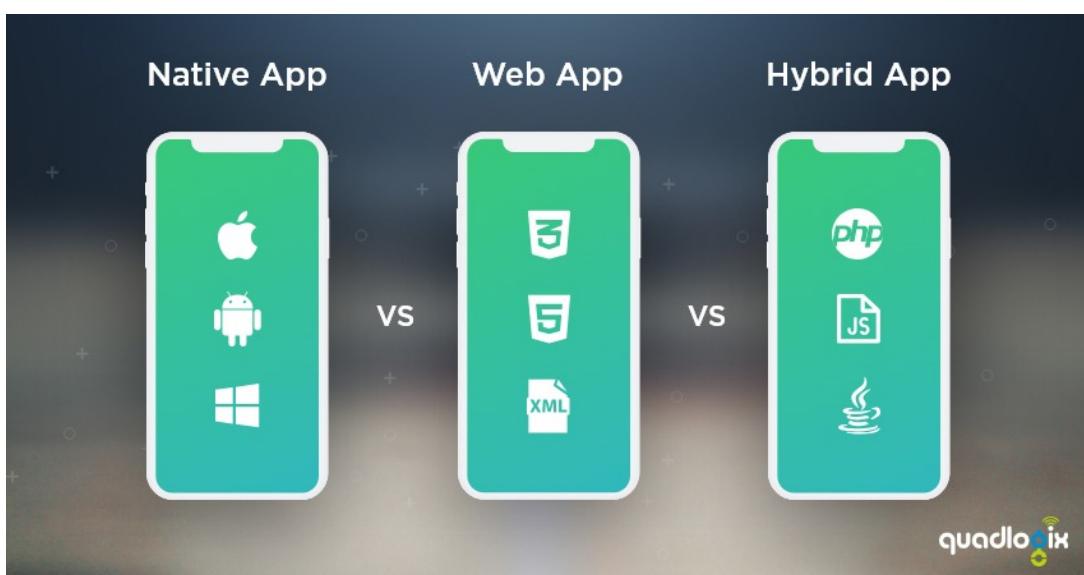


Figure 2.8 Type of Mobile Application

NATIVE VS WEB VS HYBRID MOBILE APPS [QuadLogix, 2019]

<https://www.quadlogix.com/blog/web-vs-native-vs-hybrid-mobile-apps-the-right-way-for-enterprises/>

2.6.1.1 Native Application

A native application, as defined by Syeed et al. (2021), is a software program that is carefully created to work exclusively on a particular operating system, such as Android or iOS. This application is specifically designed to maximize the utilization of the built-in functionalities and capabilities of the intended platform. Native apps offer enhanced speed compared to cross-platform or web programs due to their strong integration with the operating system, utilization of platform-specific tools, and support for advanced features including gestures, notifications, and hardware functionality such as Bluetooth, NFC, sensors, and cameras. In Android development, the programming languages Java or Kotlin and the software Android Studio are used. On the other hand, iOS development makes use of either Objective-C or Swift, along with XCode. Native apps offer several benefits, including improved speed and efficiency, better use of resources, and the ability to provide a secure and engaging user experience. Nevertheless, there are certain disadvantages associated with this approach, such as the requirement for distinct development for each platform, increased development expenses, and proficiency in platform-specific programming languages.

2.6.1.2 Web Application

According to Syeed et al. (2021), web applications are websites that are created to imitate the look and behavior of responsive websites. These applications are created using HTML5, CSS, and JavaScript. They are designed to run on web browsers and can be installed by creating bookmarks on the corresponding pages. Web apps do not possess the same level of functionality and performance as native apps. Their development encompasses technologies such as HTML5, CSS, and JavaScript for the client side, as well as server-side technologies like PHP, Perl, Python, or Ruby. The benefits of web applications include their ability to be deployed on any platform, their minimum storage requirements on the device, and their simpler maintenance through automatic web-based updates. Nevertheless, there are certain disadvantages to consider. This approach cannot produce performance-focused apps like 3D games, has poor user interface customization, and performs poorly compared to native applications due to Web View limitations.

2.6.1.3 Hybrid Application

Hybrid applications, as explained by Syeed et al. (2021), are a combination of native and online applications, combining the advantages of each. These applications are offered via app stores and can take advantage of specific built-in functionalities while using HTML within a web browser for display. Hybrid apps, although they may seem and work like native apps, are online apps that run on a browser. This strategy expands the developer's scope to a wider audience, allowing for app distribution via app stores and facilitating the tracking of downloads. Several frameworks, including React Native, Flutter, Cordova, Ionic, and Xamarin, offer options for developing hybrid applications. The benefits of hybrid apps include accelerated and cost-effective development in comparison to native versions, the ability to maintain a single code base that updates simultaneously on targeted platforms, offline availability, and suitability for swiftly releasing a Minimum Viable Product (MVP). However, this approach has drawbacks like the inability to create performance-focused applications like 3D games, reduced performance compared to native applications due to Web View restrictions, and poor user interface customization.

2.6.2 User Experience Design

As stated by Olawole (2018), User Experience (UX) design and Human-Computer Interaction (HCI) are essential components in the development of efficient and user-friendly digital interfaces. UX design aims to optimize the whole user experience during product interaction, incorporating factors such as usability, accessibility, and emotional reaction. Human-Computer Interaction (HCI) is a comprehensive discipline that explores the relationship between humans and computers, with a particular focus on designing and utilizing computer systems from a human-centric standpoint.

The objective of UX design is to develop interfaces that are user-friendly, visually appealing, and effective, guaranteeing seamless navigation and task completion for users (Olawole, 2018). This entails performing user research, establishing user personas, and implementing design principles to steer the development process. Usability testing is an essential component of UX design, enabling designers to collect

feedback and refine their designs based on actual user interactions.

Human-Computer Interaction (HCI) is a field that explores the scientific study of human-computer interaction and the development of innovative technologies that facilitate human-computer interaction. The field of study incorporates insights from several fields including psychology, cognitive science, and ergonomics to comprehend how people perceive, interpret, and react to digital interfaces. Human-Computer Interaction (HCI) spans the entirety of the user's experience, analyzing elements such as methods of input, mechanisms of feedback, and the general design of interactive systems (Olawole, 2018).

The collaboration between UX design and HCI is crucial for developing digital interfaces that not only fulfill functional needs but also deliver a favorable and significant user experience. Practitioners in the domains of user research, psychology, and design approaches utilize a combination of knowledge to ensure that technology is not just usable but also fun and satisfying for users.

2.6.3 Challenges of Mobile Application Development

The process of developing mobile applications presents significant opportunities but also poses many problems. An important obstacle lies in the fragmentation among many mobile platforms, such as iOS and Android, each requiring different development methodologies. Developers frequently encounter the task of providing uniform functioning and user experience across a wide range of devices, screen sizes, and operating systems (Syeed et al., 2021). To bridge this gap, it is necessary to have a thorough comprehension of the complexities of each platform and conduct careful testing to ensure the best possible performance.

Mobile app development is significantly challenged by security considerations. Given that mobile applications manage sensitive user data, it is crucial to prioritize the implementation of strong security mechanisms (Wambua, 2023). Developers must incorporate encryption, secure data storage, and authentication procedures to safeguard user information from potential risks like as data breaches and unauthorized

access. Keeping up with advancing security requirements and mitigating vulnerabilities requires ongoing attention throughout the whole development process.

The rapid advancement of technology presents the difficulty of keeping up-to-date with the most recent trends and upgrades. Mobile platforms, programming languages, and development frameworks undergo regular modifications, necessitating developers to adjust and take advantage of new capabilities and improvements (Syeed et al., 2021). Staying competitive in the ever-changing field of mobile app development requires dedicating time and effort to continuously learn and improve.

Finally, meeting user expectations for smooth and instinctive experiences poses a continuous challenge. As users become more knowledgeable, developers must consider usability, responsiveness, and overall user pleasure. As explained by Olawole (2018), achieving a harmonious balance between usefulness, a visually appealing and intuitive design, and achieving performance standards is a complex task that necessitates a deep comprehension of user behavior and preferences.

2.6.4 Features of Mobile Application

2.6.4.1 Profile Creation

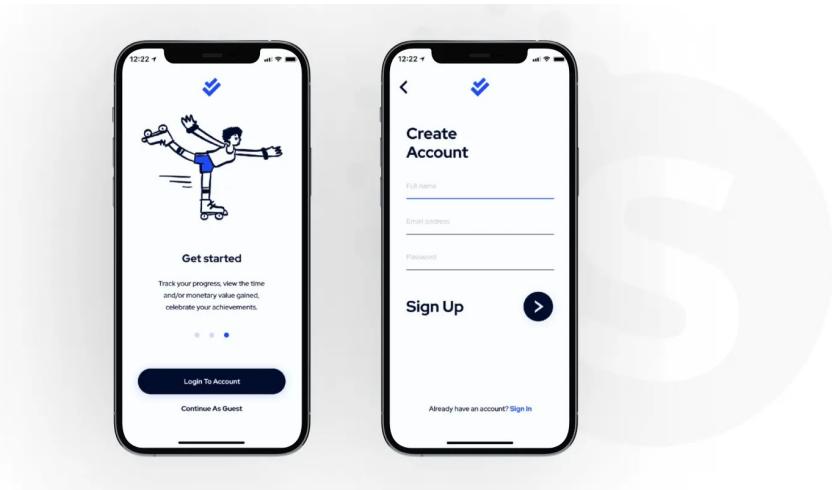


Figure 2.9 Registration Page User Interface (UI) Design

Registration form UX [Softermii, 2022]

<https://www.softermii.com/blog/19-ux-design-tips-for-shopping-app-with-examples>

The user profile creation feature in a mobile application plays a fundamental role in establishing a deeper connection between users and the app's ecosystem. It enables users to establish their distinct digital identity, hence increasing their entire experience. Throughout the profile creation procedure, users commonly provide essential details such as their name, email address, and password, which are securely maintained for account management and communication. Establishing this foundation is crucial for building confidence and guaranteeing the protection of data.

In addition to providing fundamental details, the process of creating a user profile frequently presents possibilities for customization. Users can post a profile photo, which enhances the visual appeal of their account and promotes a sense of familiarity and identification among the app's community. Moreover, the ability to customize settings and preferences empowers users to precisely adjust their experience. Users can customize notifications, select theme colors, and establish preferences for content recommendations, resulting in the app seeming like a personalized extension of their digital existence.

Abdulrahman and Khder (2022) highlight the increasing importance of creating a mobile application that includes a function for users to create profiles. This functionality enables users to create and control their profiles within the application, so improving their capacity to customize their experience and interact with the platform according to their preferences and experiences. Incorporating such a characteristic aligns with the insights made by Weichbroth (2020) regarding the user-friendliness of mobile applications.

Weichbroth (2020) also highlights the significance of guaranteeing an efficient and accessible procedure for creating user profiles. To tackle this usability element, mobile application developers must give priority to the creation of an intuitive and easily navigable user interface. It is important to provide concise instructions and a streamlined process to enable users to easily finish their profiles. Furthermore, it is vital to offer consumers the capability to effortlessly modify and update their profile details, allowing for adjustments in their preferences or conditions.

2.6.4.2 Music Snippet Sharing

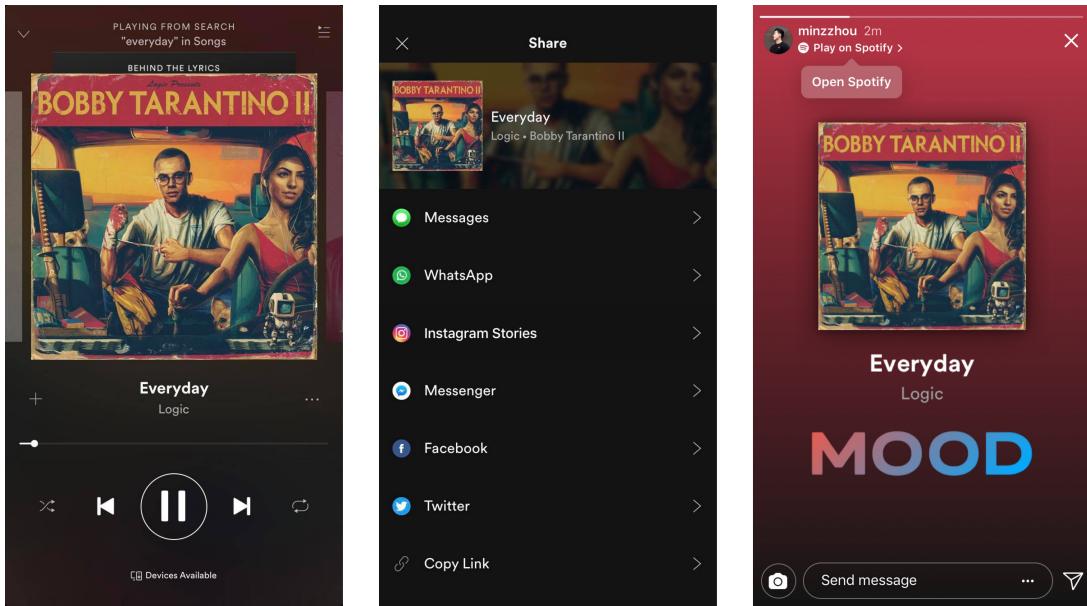


Figure 2.10 Spotify Sharing to Instagram Stories

Instagram Adding Spotify Content-Sharing to Stories [Variety, 2018]

<https://variety.com/2018/digital/news/instagram-stories-spotify-ar-video-chat-1202793586/>

The music snippet-sharing option in a mobile application is a versatile and captivating tool that enables users to share their preferred music moments with friends and followers. This functionality enables users to choose and distribute brief sections or "snippets" of songs, resulting in a customized and engaging musical encounter. It improves the social dimension of music consumption and encourages the exploration of music enjoyably and engagingly.

Music snippet sharing is a popular function in mobile applications, such as Apple Music, Spotify, and SoundCloud. Users can readily utilize this feature by picking music from their library or the streaming service's catalog and subsequently selecting a specific segment of the track to share. These snippets can be customized to capture the most engaging parts of the music, be it a catchy chorus, a memorable guitar riff, or a stunning vocal performance. After users generate these snippets, they may easily distribute them on other platforms, such as popular social media networks like Facebook and Twitter, messaging apps like WhatsApp, or within the application's social network. This function amplifies the process of finding new music, promotes

interaction with others, and introduces a dynamic element to the overall user experience in these mobile applications that prioritize music.

The music snippet-sharing feature in mobile applications has surely transformed the way users connect with music and each other. Moreover, a recent study by Abdulrahman and Khder (2022) on user-generated content and reviews in mobile applications suggest a potential connection with music snippet sharing. The creation of a mobile application that encourages users to post reviews based on their experiences with a service suggests a bigger user-generated content feature. This bigger functionality might potentially involve the sharing of music snippets or related content within the program. By incorporating user-generated music elements alongside reviews, mobile apps may build a more comprehensive and engaging platform that caters to users' different interests and preferences.

From a usability aspect, Weichbroth (2020) underlines the significance of simplicity and intuitiveness in the sharing process. To make music snippet sharing effortless, mobile applications must prioritize an easy-to-navigate user interface with clear instructions and few actions required to share a snippet. Furthermore, offering users the opportunity to share snippets through numerous channels, such as social media or messaging apps, guarantees that users can effortlessly spread their favorite music moments and communicate with their friends and followers on their preferred platforms.

2.6.4.3 Favourite/Bookmark

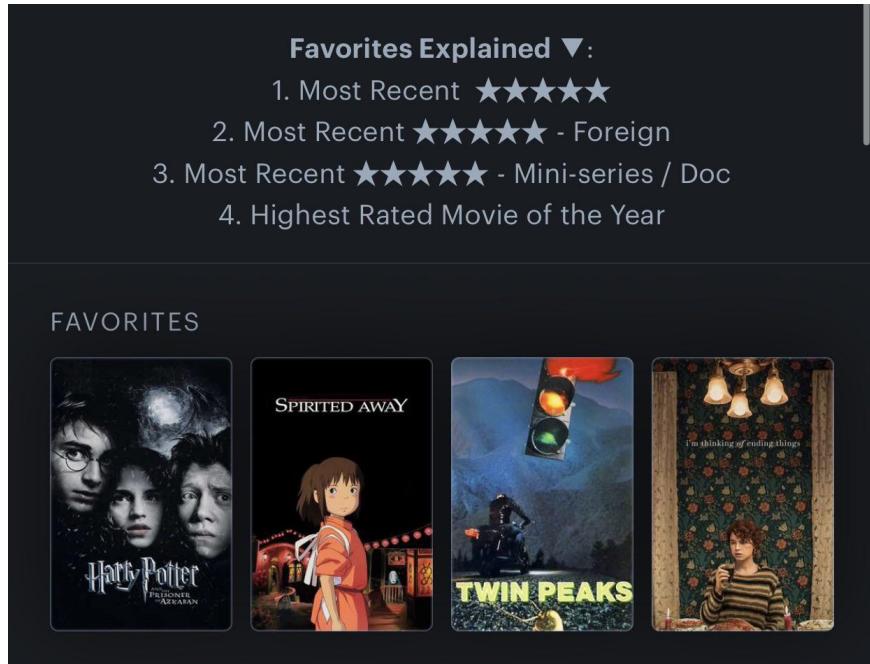


Figure 2.11 Screenshot of Letterboxd Favourite/Bookmark Feature

Letterboxd Favourite/Bookmark Feature [Reddit, 2020]

https://www.reddit.com/r/Letterboxd/comments/iyxsay/how_i_arrange_my_favorites-how_do_yall_arrange/

The favorite or bookmark feature in a mobile application is an essential feature that empowers users to save and organize content that carries personal meaning or interest. Whether it's articles, movies, products, or any other type of digital material, this feature allows users to curate their digital collections for simple access and reference. By simply marking material as a favorite or bookmarking it, users may easily manage their digital life and increase their overall user experience.

Users can often access this function by clicking on a specific icon or option within the application, which subsequently saves the selected content to a personalized list. This list can be readily sorted and categorized, ensuring that users can quickly recover their saved things whenever they need them. Additionally, the favorite/bookmark feature sometimes provides opportunities to add notes or tags, further boosting information organization and retrieval.

The favorite or bookmark feature in a mobile application not only allows content management but also aligns with the findings of a recent study. Abdulrahman and Khder (2022) explore how mobile applications allow users to bookmark or save chosen material, essentially adding a functionality similar to a favorites or bookmark feature within the program. This shows the relevance of such features in appealing to user preferences and enabling content management.

From a usability standpoint, as noted by Weichbroth (2020), it is crucial to ensure that the process of adding information to favorites or bookmarks is user-friendly. Mobile applications must offer an intuitive user experience that is easy to navigate, with clear instructions and few steps required to add material to favorites or bookmarks. Additionally, allowing users to modify and organize their favorites or bookmarks in a way that makes sense to them enhances the usability and customization of the function.

2.6.4.4 Ratings or Reviews

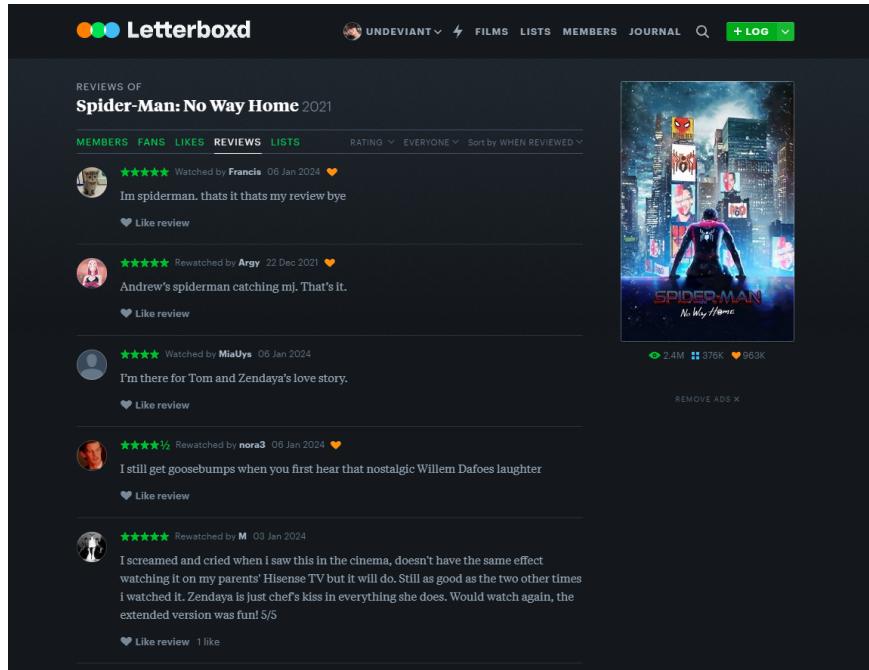


Figure 2.12 Screenshot of Letterboxd Reviews Page

Letterboxd Reviews Page [Letterboxd, 2024]

<https://letterboxd.com/film/spider-man-no-way-home/reviews/by/added/>

The ratings and reviews functionality in a mobile application is an essential tool that enables users to provide feedback, interact with the app, and make informed decisions. Users can utilize this functionality to express their experiences, viewpoints, and evaluations of the app, products, services, or material offered within the application. Typically, it entails assigning a numerical rating and providing textual comments to articulate their opinions, resulting in a valuable collection of user-generated content.

Users can utilize the ratings and reviews functionality by accessing it through the application's interface, typically by browsing to a dedicated section or tapping on a specified icon. This feature offers prospective users or customers crucial information regarding the excellence and trustworthiness of the app or its offerings. Ratings, commonly depicted as star ratings or numerical scores, provide a concise and immediate visual indication of user contentment, whereas reviews offer detailed analysis and commentary that can assist individuals in making well-informed choices.

The ratings and reviews function in a mobile application is important from both a user-centric and usability standpoint. Abdulrahman and Khder (2022) emphasize the significance of genuine content evaluations and comments provided by users who have experienced a service. The focus on genuine user-generated evaluations and ratings underscores the crucial function this feature serves in aiding users to make well-informed choices. It guarantees that the feedback given is trustworthy and accurately represents genuine user experiences, enhancing the trustworthiness of the evaluated app or service.

According to Weichbroth (2020), it is crucial to ensure that the rating and review process is user-friendly and easy to understand. The user interface should be created with maximum clarity, explicit instructions, and a simplified method to evaluate or review information, minimizing the number of steps required. Furthermore, enhancing the usability of this feature can be achieved by offering users the option to conveniently access and organize ratings or reviews according to their preferences, such as by date or by rating. Moreover, it is essential to uphold transparency and equity in the rating and review system, with clearly established criteria for determining a high or low rating. This guarantees that the feature maintains its reliability and worth for both consumers and developers.

2.7 Reviews of Existing Mobile Application

2.7.1 Letterboxd

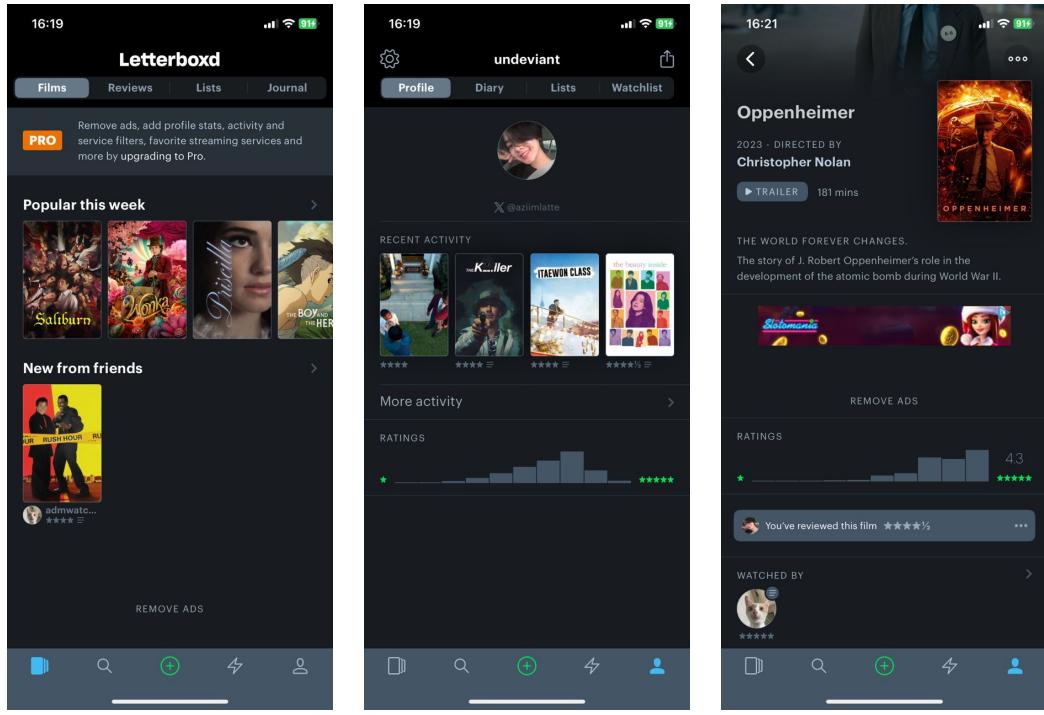


Figure 2.13 Screenshots from Letterboxd Mobile Application

Mobile Application Interface for Letterboxd [Letterboxd, 2024]

Letterboxd is a widely-used mobile application designed for film enthusiasts, offering a platform for tracking, evaluating, and exploring films. The application enables users to establish and manage a customized film diary, where they can record films they have viewed, assign ratings, and write reviews. The UI is designed to be easily understandable and accessible to users, and it includes an extensive database of films, with comprehensive information such as the cast, crew, release date, and genre. In addition, Letterboxd promotes a feeling of community by enabling users to track one another, provide feedback on reviews, and exchange their cinematic encounters. The application is compatible with both Android and iOS platforms, ensuring its accessibility to a wide spectrum of users.

Advantages

A vital feature of Letterboxd is its extensive film database, which allows users to effortlessly explore and find new films. The app's social component promotes engagement among film enthusiasts, creating a feeling of relationship and offering a platform for conversation on cinematic topics. The app's personalized cinema diary function serves as a great tool for users to thoroughly record their viewing history, hence facilitating recommendations and enabling them to delve into unexplored genres or directors. Furthermore, Letterboxd's intuitive design and compatibility with many social media platforms facilitate a smooth process for users to disseminate their cinematic choices within their network.

Limitations

Although Letterboxd provides a comprehensive movie library, its information may not be as extensive as certain specialized movie databases. Occasionally, users may encounter instances where information is missing or insufficient, particularly for lesser-known or independent films. Furthermore, this platform is limited by the absence of specific sophisticated functionalities when compared to other movie monitoring platforms. Users seeking detailed analytics regarding their watching patterns may perceive Letterboxd as very basic in this aspect. In addition, certain users may suffer a sense of being overwhelmed by the social components of the program, and individuals who prioritize a more secluded movie-tracking experience may find the community-oriented elements of the application less appealing. Despite these limitations, Letterboxd continues to be a favored option for numerous moviegoers due to its intuitive interface and large community.

2.7.2 Spotify

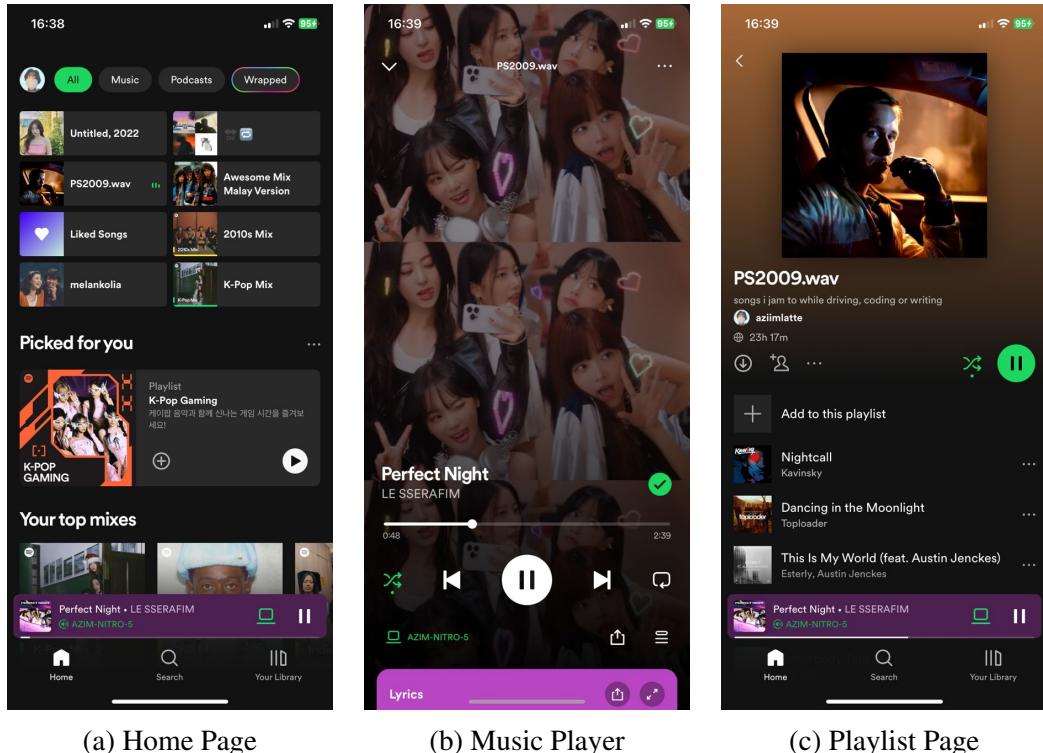


Figure 2.14 Screenshots from Spotify Mobile Application

Mobile Application Interface for Spotify [Spotify Technology S.A., 2024]

Spotify is a famous music streaming platform that has transformed how individuals access and enjoy music on their mobile devices. The Spotify mobile app, accessible on Android and iOS platforms, provides an extensive collection of songs, albums, and playlists spanning diverse genres and artists. The application utilizes a freemium business model, offering users the choice to access a restricted version that includes intermittent adverts or upgrade to a premium membership for an uninterrupted experience without ads, along with supplementary functionalities like offline listening and higher audio quality. Spotify offers customers an intuitive and user-friendly interface that allows them to easily create and share playlists, explore new music based on personalized suggestions, and access a wide range of podcasts.

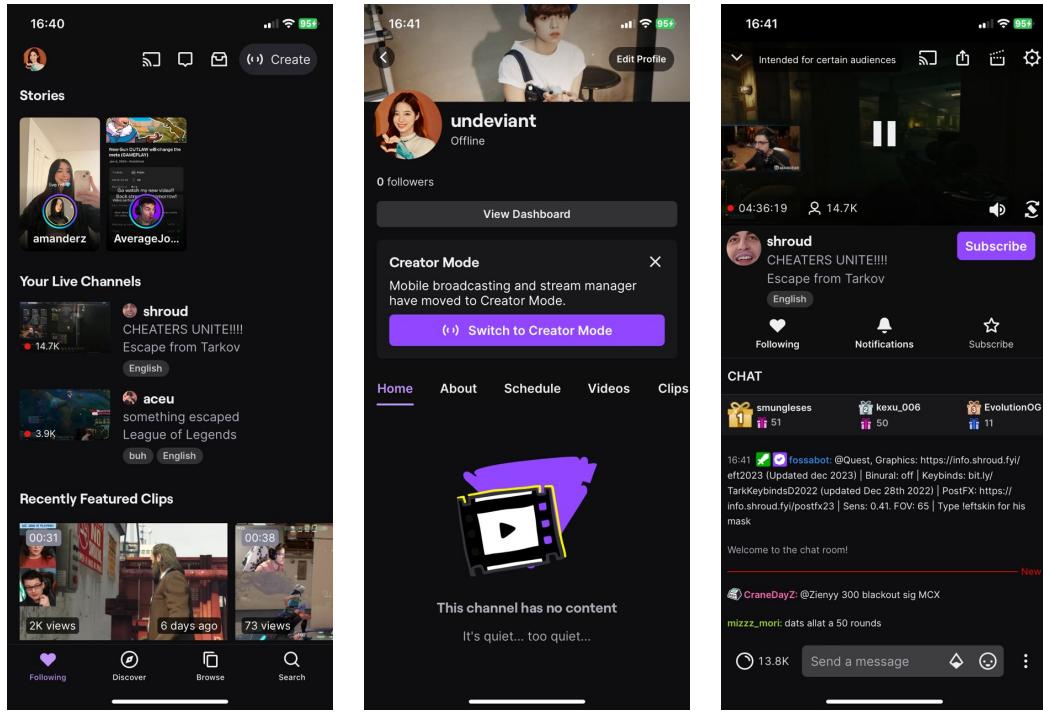
Advantages

The mobile application of Spotify offers numerous benefits, making it a preferred option for music enthusiasts. The vast music collection offers millions of songs, catering to a wide range of musical preferences. The app utilizes personalized recommendation algorithms, such as Discover Weekly and Daily Mixes, to assist users in exploring new music that aligns with their listening tastes. The offline listening option is especially beneficial for customers who are frequently mobile since it enables them to download their preferred songs or playlists for playback without the need for an internet connection. Furthermore, Spotify's collaborative playlist function promotes social engagement by allowing friends to contribute to a shared playlist, thereby boosting the community experience of discovering music.

Limitations

Although widely used, the Spotify mobile application has limitations. An evident disadvantage for users who do not pay is the existence of advertisements, which might disrupt the pleasure of listening to music. Moreover, the availability of content on Spotify is subject to regional variations caused by licensing limitations, which restrict access to individual tracks or albums in some regions. Additionally, certain users have raised concerns regarding the remuneration system for artists on the platform, which relies on stream count and may potentially put smaller or independent bands at a disadvantage. Although the app provides an extensive music collection, many artists or albums may not be accessible due to licensing arrangements with record labels. Despite these limitations, Spotify maintains an outstanding position in the music streaming sector, consistently adapting to fulfill customer expectations.

2.7.3 Twitch



(a) Home Page

(b) User Profile

(c) Livestream Page

Figure 2.15 Screenshots from Twitch Mobile Application

Mobile Application Interface for Twitch [Amazon.com Inc., 2024]

The Twitch mobile application, which is an essential component of the Twitch network, has experienced significant growth beyond its initial focus on gaming. Twitch, which was introduced in 2011, has expanded its scope beyond gaming and currently includes a diverse array of live streaming, such as music, talk shows, and creative content. The mobile application, accessible on both Android and iOS platforms, enables users to view real-time transmissions, interact with content creators through chat, and even initiate their live broadcasts directly from their mobile devices. During the COVID-19 epidemic, platforms such as Twitch played a vital role in facilitating connections among communities and providing assistance to video creators (Leger, 2021). In addition to gaming, Twitch's mobile app functions as a flexible platform for content creators to live stream other forms of entertainment, such as music concerts, while also promoting a sense of community through instant interactions.

Advantages

The mobile application offered by Twitch offers distinct benefits for content creators that aim to actively involve their viewers. The platform's unique monetization strategy, as highlighted by Leger (2021), incorporates elements such as Bits, channel subscriptions, and donations, providing content creators with direct financial backing from their audience. This concept not only enables creators but also enables viewers to actively contribute to the long-term viability of their favorite channels. The mobile app's intuitive layout promotes effortless interaction, allowing users to effortlessly explore and endorse live streams. Additionally, interactive elements such as channel points and Bits enhance the entire viewer experience. The platform's advantages facilitate its role in revitalizing the music industry by establishing direct relationships between performers and their audiences.

Limitations

Although Twitch's mobile application provides an exciting platform for content makers, it does come with several difficulties. The platform encounters copyright-related challenges, as emphasized by Leger (2021). Twitch, like other platforms, faces the continual challenge of effectively managing copyright concerns, particularly concerning music streaming. Another limitation is the necessity for a strong content control system to tackle improper or objectionable material. Furthermore, the mobile viewing experience may not offer the same level of engagement as larger displays, affecting the quality of interactions. Additionally, mobile viewers may encounter buffering or poor video quality in regions with weak signals, which might be a hindrance. Regardless of these challenges, Twitch continues to be a crucial platform, demonstrating the capacity for community-based models in the entertainment sector throughout extraordinary times.

2.7.4 Bandcamp

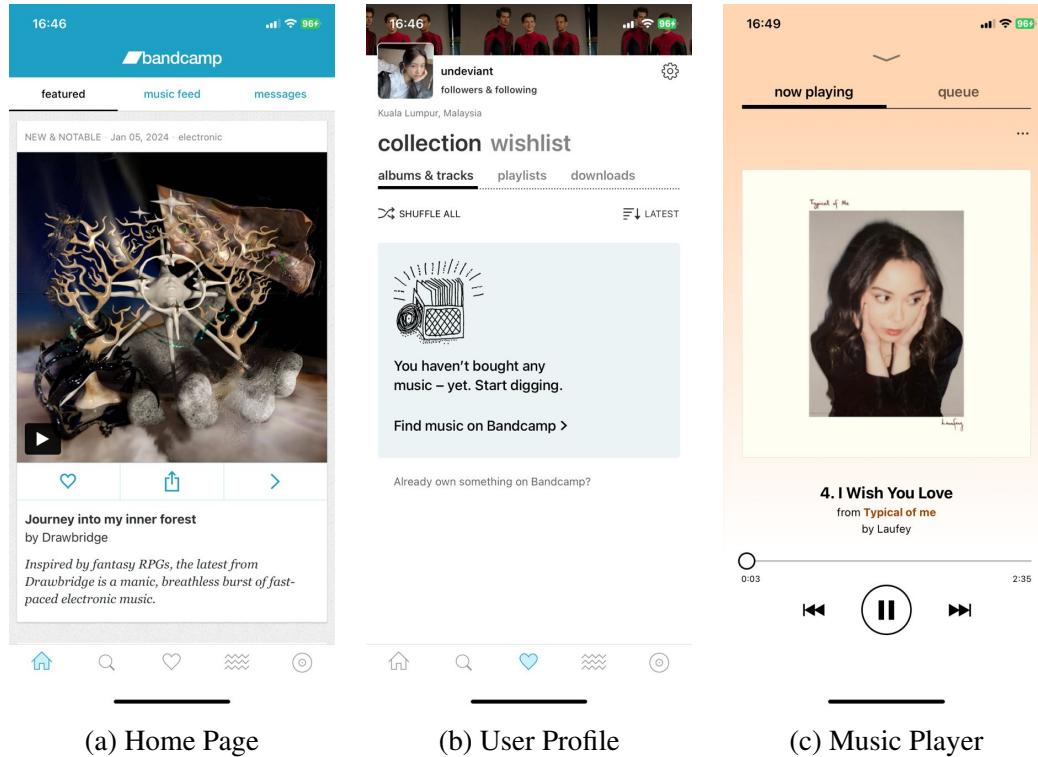


Figure 2.16 Screenshots from Bandcamp Mobile Application

Mobile Application Interface for Bandcamp [Songtradr, 2024]

The Bandcamp mobile application, which was introduced in 2008, serves as a music platform that enables independent artists and labels to establish direct connections with their audience. It serves as a crucial platform in the music industry, following a community-driven approach examined by Leger (2021) among the difficulties posed by the COVID-19 epidemic. Bandcamp stands out for its focus on empowering independent musicians by enabling them to directly sell their albums and goods, rather than depending entirely on money from streaming. The platform's mobile application, accessible on Android and iOS, offers musicians a platform to organize their work, establish pricing, and directly engage with their fan base. This strategy enables artists to give priority to record and merchandise sales, which is a crucial factor in revitalizing the music industry by promoting community involvement (Leger, 2021).

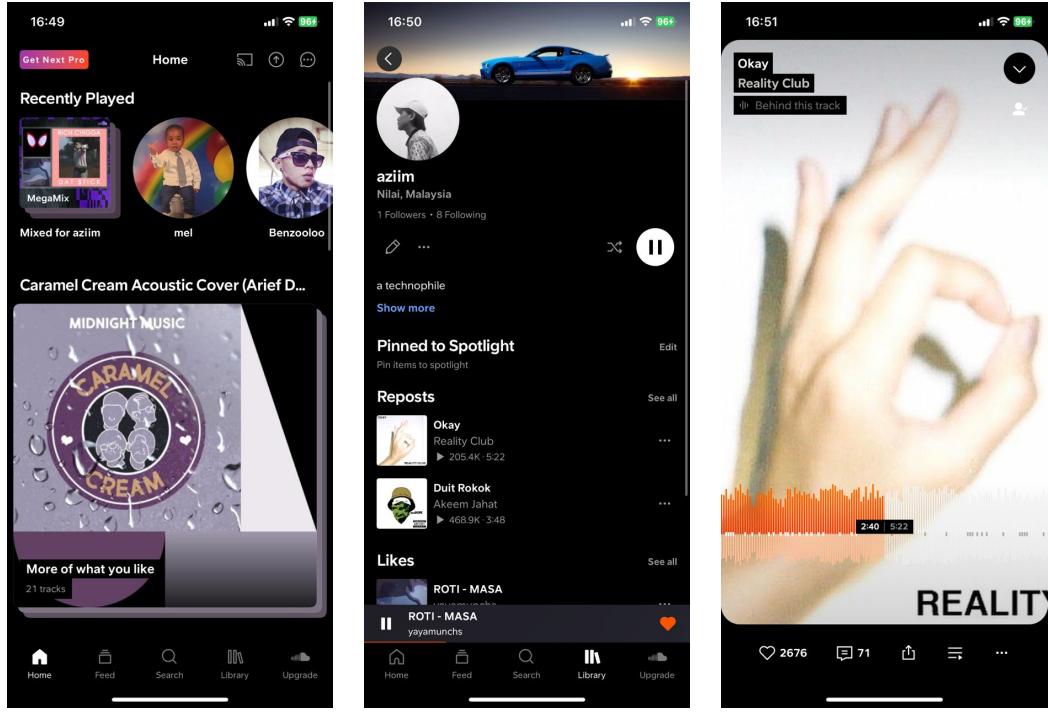
Advantages

The mobile application of Bandcamp provides distinct benefits that align with the community-oriented framework proposed by Leger (2021). The platform's emphasis on record and product sales enables artists to gain more control over their revenue streams and forge a more intimate bond with their audience. Users of the platform not only operate as consumers, but also are passionate supporters, as Bandcamp empowers them to make payments exceeding the predetermined price for songs, directly support their preferred artists, and take part in events such as Bandcamp Fridays. The mobile application acts as a direct channel for this interaction, offering users a customized and artist-focused encounter, strengthening the feeling of connection between musicians and their supporters.

Limitations

The Bandcamp mobile application exhibits limitations that mirror the difficulties encountered by platforms emphasized by Leger (2021), despite having significant qualities. The platform's dependence on album sales could provide difficulty in terms of being easily found, as Bandcamp may not provide the same algorithm-based suggestions as popular streaming services. The app's UI, albeit functional, may lack the refinement and extensive features found in larger platforms. In addition, the direct-to-fan technique employed by Bandcamp may restrict access to specific mainstream or major-label content, so impacting users who desire a broader range of music options. However, the platform's dedication to creating a direct and supportive connection between artists and their fan base overcomes these limitations.

2.7.5 SoundCloud



(a) Home Page

(b) User Profile

(c) Music Player

Figure 2.17 Screenshots from SoundCloud Mobile Application

Mobile Application Interface for SoundCloud [SoundCloud, 2024]

SoundCloud is a unique and extensively utilized mobile application that specifically emphasizes music material created by users. Introduced in 2007, the website enables musicians, producers, and fans to publish, distribute, and explore a wide array of audio content, encompassing music tracks, podcasts, and sound snippets. The SoundCloud mobile app, accessible on Android and iOS devices, offers users an extensive and diverse collection of music that encompasses a wide range of genres and styles. The platform's interface is specifically built to facilitate effortless navigation and exploration. As a result, it has become a popular choice for up-and-coming musicians who are hoping to gain attention, as well as for listeners who are interested in discovering new and often unconventional music.

Advantages

SoundCloud has numerous benefits, which contribute to its popularity among music enthusiasts. The online platform functions as an entry point for up-and-coming and independent artists, enabling them to showcase their artistic works to a worldwide audience. The application's social functionalities, such as the ability to leave comments and express approval through likes on music recordings, enable direct engagement between artists and fans, establishing a sense of communal connection. SoundCloud's recommendation algorithms promote the exploration of new music that is customized to users' preferences. Additionally, the platform's open and democratic environment fosters inclusiveness for creators of all skill levels. Furthermore, the app's free version offers an extensive amount of material without necessitating a subscription, rendering it accessible to a wide range of users.

Limitations

Although SoundCloud offers notable benefits it also encounters particular limitations. An issue arises from the disparity in audio quality among songs because the content is created by users and may differ in terms of production standards. The platform's complimentary edition is financed by adverts, and certain users may perceive the frequency of commercials as disruptive to their listening experience. Another constraint is the possibility of copyright infringement problems, as the unrestricted nature of the platform may result in the dissemination of unauthorized content. In addition, the extensive collection of music on SoundCloud can occasionally provide a challenge for users to find top-notch content amidst a large number of uploads. Furthermore, the lack of a complete catalog of popular music from major record labels may be a disadvantage for individuals looking for more mainstream songs. Notwithstanding these constraints, SoundCloud continues to be a prominent contender in the realm of online music streaming, especially for individuals who prioritize variety and active participation in their music exploration.

2.7.6 IMDb

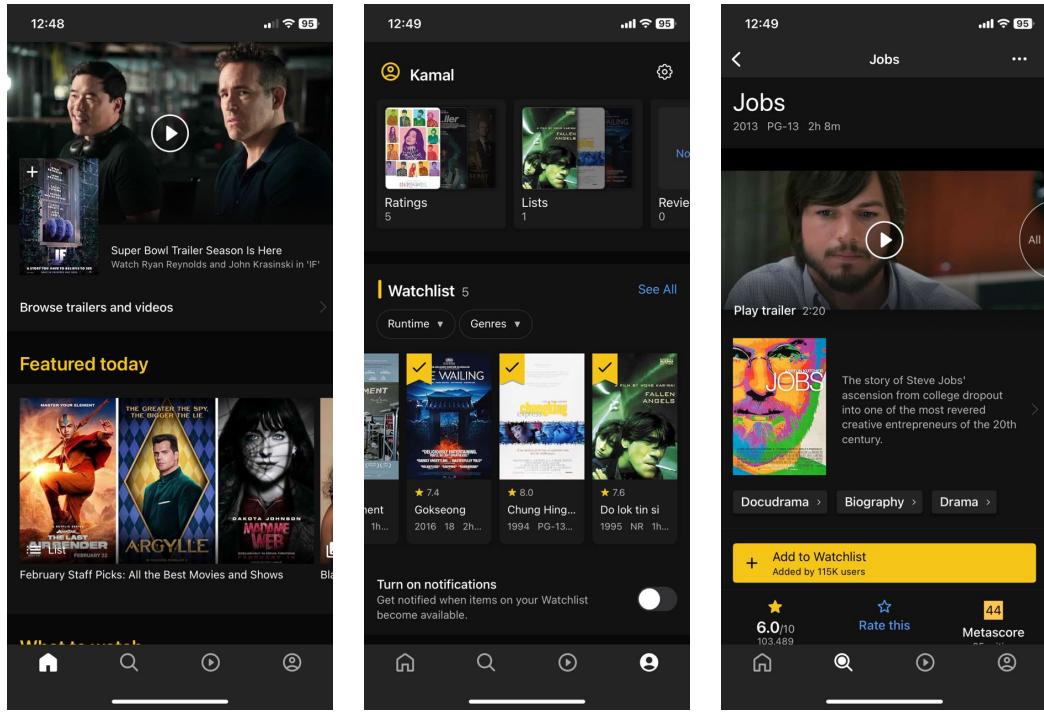


Figure 2.18 Screenshots from IMDb Mobile Application

Mobile Application Interface for IMDb [Amazon.com Inc., 2024]

The IMDb mobile application is a comprehensive and user-friendly platform designed for movie fans and TV series enthusiasts. The platform provides a wide library of data regarding films, TV series, actors, and production staff, allowing users easy access to comprehensive information about their preferred entertainment content. Users can navigate through comprehensive catalogs of films and television shows, see previews, explore critics, and uncover the most recent updates in the entertainment sector. Moreover, the application offers personalized functionalities such as the ability to rate and review films, create watchlists, and receive recommendations tailored to user interests. This makes it a valuable companion for individuals who are enthusiastic about the worlds of cinema and television.

Advantages

The IMDb mobile application provides a wide range of benefits to its users. Firstly, it offers instant access to a vast constantly updated library of films, television programs, and details about celebrities, rendering it a crucial resource for fans of entertainment. Users may efficiently access information, evaluations, and rankings for films and TV shows, facilitating well-informed choices when selecting what to watch. The app's customized functionalities, such as watchlists and personalized suggestions, enhance the user experience by enabling the discovery of material that is similar to their tastes. Moreover, IMDb's incorporation with streaming sites enables users to conveniently locate the platforms on which they may watch their preferred episodes and films, thus simplifying their entertainment options. Overall, the IMDb mobile app is a useful and essential tool for both film enthusiasts and television lovers.

Limitations

A disadvantage of the IMDb mobile application is the inclusion of advertisements and promotional material, which can occasionally interrupt the user's experience and provide distractions while searching for information or reading reviews. In addition, the application might require a reliable internet connection to access its functionalities and database, which can be troublesome for users residing in regions with restricted connectivity. In addition, IMDb offers a vast amount of information, but it depends on user-generated content for ratings and reviews, which may sometimes be subjective or unreliable. Finally, certain users can see the interface as crowded or overwhelming because of the substantial quantity of data displayed, thus leading to less natural navigation for beginners to the site.

2.7.7 Summary of Comparison between Existing Mobile Applications

Table 2.1 Comparison between Existing Mobile Applications

Existing Apps	<i>Letterboxd</i>	<i>Spotify</i>	<i>Twitch</i>	<i>Bandcamp</i>	<i>SoundCloud</i>	<i>IMDb</i>
Platform	iOS & Android	iOS & Android	iOS & Android	iOS & Android	iOS & Android	iOS & Android
Language	English	English	English	English	English	English
Features						
User Verification	✓	✓	✓	✓	✓	✓
User Profile	✓	✓	✓	✓	✓	✓
Content Snippet Sharing		✓			✓	
Favourite or Bookmark	✓	✓	✓	✓	✓	✓
Ratings or Review	✓					✓
Social Media Integration	✓	✓	✓		✓	
Premium Plans	✓	✓	✓	✓	✓	✓

When comparing Letterboxd, Spotify, Twitch, Bandcamp, and SoundCloud across multiple aspects, it becomes apparent that each site caters to distinct types of content and user engagements. All five services offer specialized applications for both iOS and Android, ensuring comprehensive accessibility across platforms. The language support is uniformly provided in English, ensuring constant user engagement and comprehension of the information.

These platforms include standardized authentication elements that necessitate users to create accounts to have personalized experiences. User profiles are a prevalent characteristic that enables individuals to showcase their preferences and engagement within the community. Content snippet sharing is widespread on platforms like Spotify and SoundCloud, allowing users to easily share their favorite snippets from media with others. Although many platforms provide a favorite or bookmark function for users to organize their selected material, the details may differ. Letterboxd specializes in films, Spotify specializes in music, Twitch specializes in live broadcasts, Bandcamp specializes in music and merchandise, and SoundCloud specializes in user-generated audio material.

On Letterboxd, ratings and reviews play a crucial role in evaluating films, offering a significant means of receiving feedback. The integration of social media is highly effective on various platforms, except Bandcamp, enabling users to effortlessly send their activity on other platforms. Subscription models vary depending on the type of content. Spotify, Twitch, and SoundCloud provide premium memberships that eliminate ads and offer extra functionality. On the other hand, Letterboxd and Bandcamp operate on a freemium model, where users have the option to subscribe for improved services or to support the site. These platforms essentially demonstrate the variety in how material is consumed, how users interact, and the different ways businesses operate in the fields of films, music, and live streaming.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section provides an in-depth description of the design and development characteristics of Alunan, including the tools, processes, and techniques used. The chapter additionally outlines the research technique utilized in the development of the Alunan application and its subsequent implementation inside the project. This project follows the five stages of the Mobile Application Development Lifecycle (MADLC).

3.2 Overview of Mobile Application Development Lifecycle (MADLC)

The methodology, as defined by Igwenagu (2016), relates to a systematic and detailed analysis of the steps used in a certain area of research. Within the realm of mobile application development, the technique functions as a structured framework for efficiently implementing an application. The methodology offers a systematic plan, outlining the sequential processes, tasks, techniques, and requirements entailed in the creation of an application. This chapter will discuss the research approach utilized in this project and its implementation. The selected methodology for this project is the Mobile Application Development Lifecycle (MADLC).

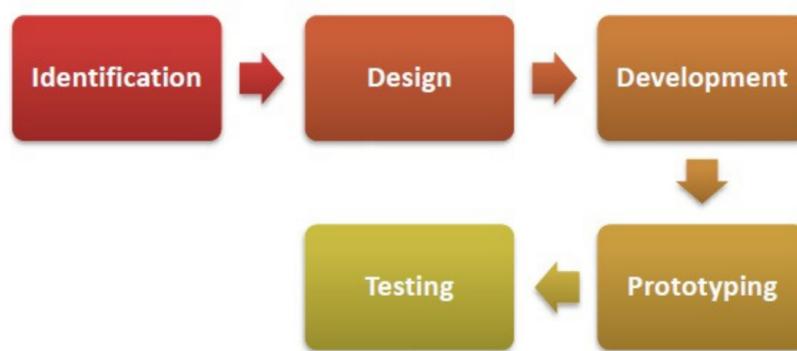


Figure 3.1 MADLC Phases Included in the Project

Source: Moharekar and Pol (2021)

Appropriated by: Shanmugam et al. (2019)

The Mobile Application Development Life Cycle (MADLC) is a systematic approach introduced by Vithani and Anandkumar (2014) to address various issues presented by mobile applications. These apps frequently include complex functionality that differs greatly from conventional desktop applications. The introduction of MADLC aimed to establish a structured framework for the development of mobile apps, recognizing the necessity for a customized approach (Vithani & Anandkumar, 2014).

Kaur and Kaur (2015) addressed the significance of a dedicated development strategy for mobile applications, acknowledging their unique characteristics. Kaur and Kaur (2015) also emphasize the necessity of adopting a unique methodology to address the unique characteristics and needs of mobile app development. MADLC addresses this requirement by providing a systematic and sequential approach that corresponds to the distinct difficulties and characteristics of mobile app development, including diverse screen sizes, device functionalities, and user expectations.

The Mobile Application Development Life Cycle (MADLC) consists of multiple stages that provide a structured framework for the development of mobile apps, as outlined by Wambua (2023) and explained by Wen (2021). The following stages are crucial for developing mobile applications that achieve success:

1. *Identification*: The identification step involves identifying the problem statement and establishing the goal and objectives for creating the mobile application. System requirements are collected and the target audience is determined. Market research is performed to evaluate the potential viability of the application, and specific project scope and objectives are established.
2. *Design*: After the identification phase, the design phase begins. Developers are responsible for developing the user interface (UI) and user experience (UX) elements of the application. During this phase, flowcharts, Use Case Diagrams (UCD), Entity Relationship Diagrams (ERD), and Sequence Diagrams are generated. Wireframes, mockups, and prototypes are created to visually represent the structure

and user experience. The selection of the suitable technology stack, databases, and architecture for the mobile application has been made.

3. *Development*: During the development phase, developers begin coding the mobile application, building its functionality according to the previously gathered design and specifications. This phase involves incorporating functionalities and ensuring consistency with the design and user experience principles. If necessary, backend systems, APIs, and server components are developed.
4. *Prototyping*: During this stage, the process of combining different systems and coding the front end and back end happens. Developers create a high-fidelity prototype of the mobile application, which includes important features and functions. The prototype plays a vital role in the development process by enabling the examination and verification of concepts and features. Early user feedback is sought and utilized to identify and address any design or functionality concerns before moving forward.
5. *Testing*: Quality assurance and testing are essential elements of MADLC. During this phase, a range of testing methods are employed, including functional testing, usability testing, performance testing, security testing, and compatibility testing across many devices and platforms. Testers detect and document defects and problems, which the developer then resolves to guarantee that the mobile application fulfills its functional specifications and provides a smooth user interface.

These phases offer a systematic approach to the creation of mobile applications, guaranteeing that the outcome is in line with objectives, displays a strong design, undergoes comprehensive testing, and fulfills the requirements of its intended users. Nevertheless, it is critical to acknowledge that the MADLC has seven essential stages: identification, design, development, prototyping, testing, deployment, and maintenance. Within the scope of this project, the primary focus is on the early stages of the MADLC, specifically covering the identification to testing phases.

3.3 Methodology Development and Related Activities

3.3.1 Identification Phase

Table 3.1 Overview of Identification Phase

Phase	Objectives	Activities	Tools & Techniques	Deliverables
Identification	To identify system requirements for Alunan as a mobile application for local independent musicians' online community and music discovery	Collecting, gathering information and identifying the problem, objective, scope, and significance	Techniques: Literature Review Tools: Online Database UiTM, ResearchGate, IEEE Xplore, ScienceDirect, Scopus, & Google Scholar	System requirements, Problem Statement, Objectives, Scope & Significance
		Define stakeholder characteristics	Technique: User Persona Tools: Canva	User Persona
		Plan the timeline of the project	Techniques: Gantt Chart Tools: Lucidchart & Canva	Project Timeline (Gantt Chart)

Within the context of mobile application development, the identification phase, as described by Shanmugam et al. (2019) and Wambua (2023), includes the creation of new concepts and the execution of extensive research to determine the extent of application solutions, following the principles of computational thinking. Furthermore, Wambua (2023) highlights the need to gather ideas through brainstorming, improving existing concepts to increase originality, and doing initial requirements gathering to develop a strong foundation for the project. The identification step is crucial as it promotes the development of innovative solutions while also establishing a well-defined project scope and objectives.

During this stage, key activities include gathering and collecting information to determine the problem, objectives, scope, and significance of the project. The process largely depends on performing an extensive literature review utilizing electronic resources such as Online Database UiTM, ResearchGate, IEEE Xplore, ScienceDirect, Scopus, and Google Scholar to acquire knowledge from previous research and solutions about the project's topic. The main outcomes of this phase include a well-defined problem statement, clear project objectives, and a properly defined scope and significance of the project. These deliverables serve as a guiding framework for the following stages of development, guaranteeing that the project stays in line with its objectives and effectively addresses the identified problem.



Figure 3.2 User Persona Example

Personas: Are they the Answer for Visualizing Your User Research? [Boagworld, 2022]

<https://boagworld.com/usability/personas/>

Furthermore, during the identification phase, stakeholder characteristics are determined by creating user personas, utilizing methods like user persona creation, and employing visual representation tools like Canva. Stakeholders are individuals or groups with a personal stake in the mobile application project, such as end-users and future clients. It is essential to understand the characteristics and needs of these stakeholders to customize the mobile application to properly fulfill their objectives.

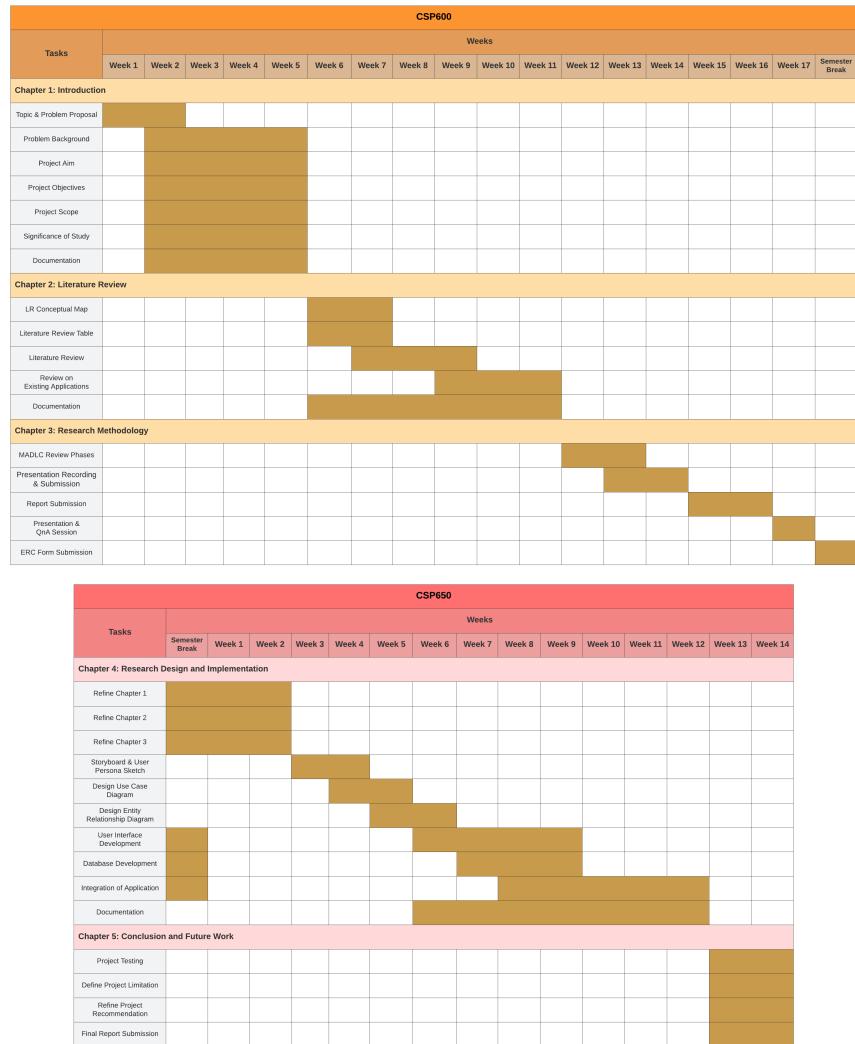


Figure 3.3 Gantt Chart for Project Timeline

In addition, project planning happens during this phase, which involves the development of a project timeline in the form of a Gantt Chart. The timetable for this project is created using online tools such as Lucidchart and Canva. These tools are used to visually represent the project's schedule, tasks, milestones, and dependencies. This enables effective control of the project's schedule, resources, and time limits, guaranteeing smooth progress through the development process.

3.3.2 Design Phase

Table 3.2 Overview of Design Phase

Phase	Objectives	Activities	Tools & Techniques	Deliverables
Design	To design Alunan as a mobile application for local independent musicians' online community and music discovery	Review existing apps and identify the hardware and software requirements	Techniques: Literature and research summary Tools: Google Play Store, Apple App Store, Microsoft Word, Laptop, Mobile Phone & Google Chrome	Summary of design features and functions of existing applications Hardware and Software Requirements
		Outline system features	Technique: Requirement Analysis Tools: Google Chrome, Microsoft Word & Canva	Functional Requirements & Non-Functional Requirements
		Designing User Interface	Techniques: Storyboard & Wireframe Tools: Canva & Figma	Storyboard & Wireframe
		Designing interaction flow for the app	Techniques: Flowchart Tools: Lucidchart & Draw.io	Flowcharts of the app
			Techniques: Use Case Diagram (UCD) Tools: Lucidchart & Draw.io	Use Case Diagram (UCD)

Table 3.2 – Continued from previous page

Phase	Objectives	Activities	Tools & Techniques	Deliverables
			Techniques: Entity Relationship Diagram (ERD) Tools: Lucidchart & Draw.io	Entity Relationship Diagram (ERD)
			Techniques: Sequence Diagram Tools: Lucidchart & Draw.io	Sequence Diagram

In the Mobile Application Development Lifecycle (MADLC), the design phase is a crucial stage where the initial ideas and plans for the project are transformed into an actual form. In this stage, a detailed plan is developed which includes all the necessary design elements, hardware and software needs, and architectural frameworks for the mobile application. This plan is created to ensure that it aligns with the project's goals and objectives. According to Wambua (2023), the first step in the design process involves determining the functional needs and making important decisions. According to Shanmugam et al. (2019), it is recommended for developers to construct a storyboard outlining the flow of the user interface design for the application. This step is crucial for visually illustrating the design of the program, enabling a thorough description of its flow and interactions.

In the project's context, the design phase begins by conducting an in-depth review of mobile applications that are relevant to the project's domain. This involves reviewing applications from popular app stores like Google Play Store and Apple Store, as well as undertaking thorough research to determine the precise hardware and software requirements that align with the project's objectives. The tools utilized for this project include a laptop, smartphone, Google Chrome, and Microsoft Word. The main outputs consist of a concise review of design characteristics and functionali-

ties derived from current applications, together with a thorough inventory of hardware and software requirements customized to meet the project's specific requirements.

Table 3.3 Hardware Requirements

No	Hardware	Specification	
1	PC or Laptop	Processor	Intel Core i5 or AMD Ryzen 5
		RAM	8GB or higher
		Storage	256GB SSD or HDD
		Operating System	Windows 10 or higher
2	Mobile Phone or Tablet	Model	Any modern smartphone or tablet with decent performance
		CPU	Qualcomm Snapdragon 660 or higher
		RAM	4GB or higher
		Storage	Minimum 64GB internal storage

Table 3.4 Software Requirements

No	Software	Descriptions
1	Figma	To create the user interface for the application
2	Canva	To create user persona for this project
3	Lucidchart	To create a Gantt chart for the project
4	Draw.io	To create the interaction flow for the application
5	Google Play Store	To compare similar applications
6	Apple App Store	To compare similar applications
7	Microsoft Word	To create the documentation and reports of the project
8	Visual Studio Code	To create the documentation and reports of the project
9	Google Chrome	To browse the journal, articles, and books
10	Android Studio	To develop the front-end and back-end of the application
11	Firebase	To develop a database of the application
12	Google Forms	To create SUS Questionnaire for user testing
13	Google Spreadsheet	To calculate SUS score based on user testing
14	GitHub	To control version of the application and report

Within the project's framework, the design phase entails the thorough identification of system features. This is accomplished through an in-depth requirement analysis process, in which both functional and non-functional requirements are discovered and carefully documented. The documentation process is facilitated by employing techniques like requirement analysis and utilizing applications like Google Chrome, Microsoft Word, and Canva. The primary deliverables consist of functional requirements that identify the functionality of the application, and also non-functional requirements that define characteristics such as performance, security, and others.

As part of the project, the design phase progresses by developing the user interface (UI) of the program. This task requires using methods such as storyboard-ing and wireframing to visually represent and strategize user interface components. Canva and Figma are digital tools used for design purposes. The main deliverables consist of storyboard and wireframe representations, which visually outline the interface of the program and ensure that it aligns with the user experience objectives.

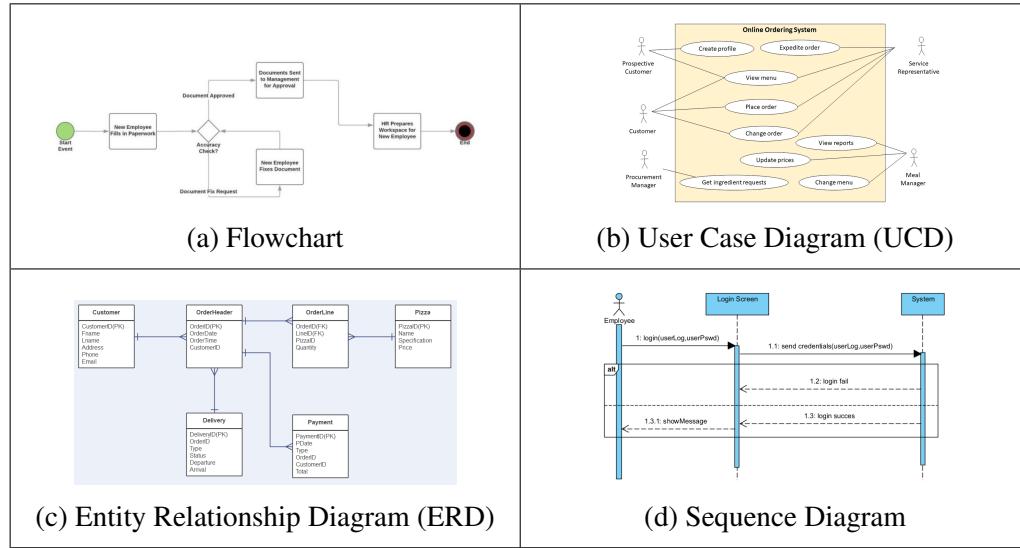


Figure 3.4 Design Phase Deliverables Examples

[SmartDraw, 2023], [Medium, 2022], [EDraw, 2022] & [Stack Overflow, 2022]

As the project progresses, the design phase now focuses on creating the interaction flow for the mobile application. This entails utilizing methodologies such as creating flowcharts and employing Use Case Diagrams (UCD), Entity Relationship Diagrams (ERD), and Sequence Diagrams to illustrate the functionalities and interactions of the application. Lucidchart and Draw.io, are used to assist in the production of these diagrams. The main outputs comprise flowcharts, Use Case Diagrams (UCDs), Entity-Relationship Diagrams (ERDs), and Sequence Diagrams. These outputs offer a full representation of the user's interaction with the application and the flow of data within the system.

3.3.3 Development Phase

Table 3.5 Overview of Development Phase

Phase	Objectives	Activities	Tools & Techniques	Deliverables
Development	To develop the Alunan as a mobile application for local independent musicians' online community and music discovery	Develop user interface and functionalities	Techniques: User Interface Development Tools: Android Studio & Figma	User Interface for Alunan mobile application developed
		Establish database for the mobile application	Technique: Database Development Tools: Android Studio & Firebase	Database for Alunan mobile application created

The development phase in the Mobile Application Development Lifecycle (MADLC) is a crucial step where the project's conceptualization and design are transformed into concrete implementation. In this stage, the interface design, as described by Shanmugam et al. (2019), is combined with the selected programming language. The development process is essentially divided into two distinct components: functional programming, which deals with the application's scope and goal, and programming for the user interface, which includes multimedia elements such as buttons, hyperlinks, and images. According to Wambua (2023), a suitable programming language is deliberately selected to write the code for the mobile application's functional needs and user interface. This programming language acts as the underlying framework for the application's functionality and user interactions, ensuring that the design specifications are accurately converted into executable code.

The development phase involves the initial set of tasks, mostly focused on creating the user interface along with crucial features. The development of the user interface is carried out carefully, employing tools like Android Studio and Figma to design a user-friendly and feature-packed interface that is customized to meet the specific requirements of the application. The main outcome resulting from these efforts is a well-designed user interface that smoothly aligns with the aims of the application.

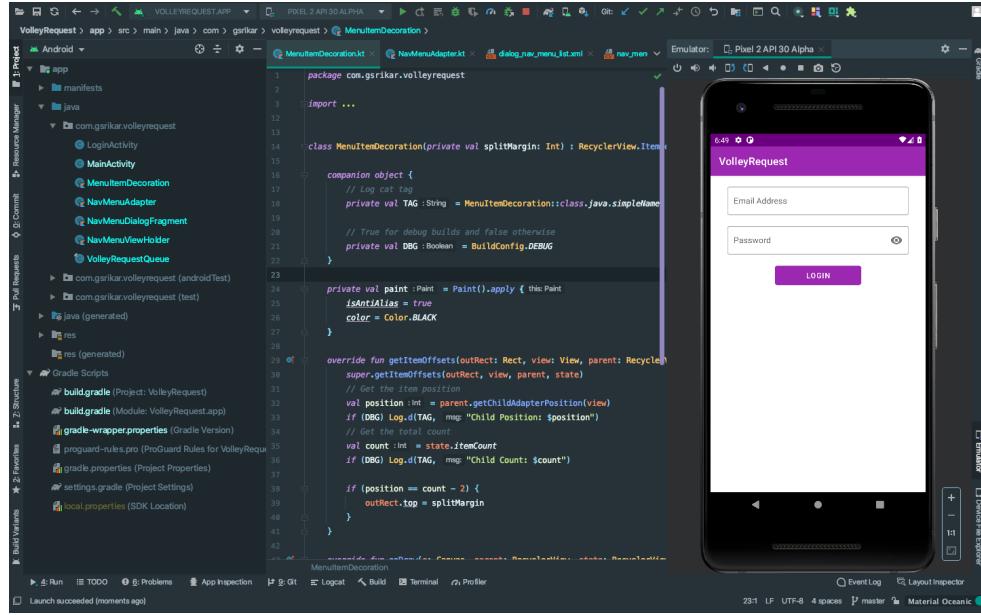


Figure 3.5 Screenshot of Android Studio

Android Studio: Emulators [Cloud2Data, 2023]

<https://cloud2data.com/android-studio-emulators/>

Alongside the construction of the user interface, the development phase also includes the creation of a strong and organized database. This activity entails the utilization of database development techniques, frequently utilizing Android Studio and Firebase as essential tools. The primary objective is to establish a database that can effectively store and retrieve data, serving as a fundamental element essential for the smooth functioning of the mobile application. These development activities serve as the connection between the project's design and its actual implementation, laying the foundation for the future testing stage in the mobile application development process.

3.3.4 Prototyping Phase

Table 3.6 Overview of Prototyping Phase

Phase	Objectives	Activities	Tools & Techniques	Deliverables
Prototyping	To develop the Alunan as a mobile application for local independent musicians' online community and music discovery	System Integration and Frontend-Backend Coding	Techniques: Frontend and Backend coding and System Integration Coding Tools: Android Studio & Firebase	Coding algorithms that integrate the frontend and backend elements
		Construct a high-fidelity Alunan app prototype with key features and interactions	Technique: High-Fidelity Prototyping Tools: Android Studio, Firebase & Tablet	A high-fidelity prototype of the Alunan mobile application that includes key features and interactions

The prototyping phase in the Mobile Application Development Lifecycle (MADLC) is defined by its focus on producing realistic representations of the Alunan mobile application's user interface (UI) and functionality. In this stage, the main goal is to create prototypes or mockups that provide stakeholders with a visual and interactive preview of the application's design and functionalities. This helps them better comprehend how the application will look and work. According to Shanmugam et al. (2019) and Wambua (2023), this phase is critical since it is necessary to ensure that the application is in line with the established standards.

Within the context of the Alunan mobile application project, the prototyping phase consists of a variety of crucial actions. First and foremost, system integration and frontend-backend coding are of primary importance. This requires the careful execution of frontend and backend code pieces, with a focus on integrating these components to guarantee smooth functionality. The activities commonly involve the use of Android Studio and Firebase, which are crucial for developing codes that allow the integration of frontend and backend components. The deliverables of this phase include coding methods that enable the smooth integration of frontend and backend

components, establishing the foundation for the following development stages.

In addition, as part of the Alunan mobile application project, the prototyping phase involves creating a high-fidelity prototype. This significant effort involves developing a realistic and interactive depiction of the Alunan application, including its essential features and functions. High-fidelity prototyping techniques are utilized to ensure that the prototype accurately reflects the intended final product. By utilizing tools such as Android Studio and Firebase with a tablet device, the goal is to create a high-fidelity prototype that accurately represents the key features and interactions of the Alunan mobile application. The outcome of this process is a high-fidelity prototype that acts as a detailed and accurate representation, providing stakeholders with a tangible preview of the application's essential features and user experience.

3.3.5 Testing Phase

Table 3.7 Overview of Testing Phase

Phase	Objectives	Activities	Tools & Techniques	Deliverables
Testing	To develop the Alunan as a mobile application for local independent musicians' online community and music discovery	Perform application testing	Techniques: Android Emulator Tools: Android Studio, Firebase & Tablet	Result of Testing
		Perform usability and user acceptance testing	Technique: System Usability Scale (SUS) Questionnaire Tools: Google Form & Google Spreadsheet	SUS Score and User Feedback

The testing phase in the Mobile Application Development Lifecycle (MADLC) is extremely important, especially because it involves targeted users and real devices for thorough testing. At this step, an in-depth evaluation and testing of the mobile application are carried out to guarantee that its performance and functionality meet the required standards (Shanmugam et al., 2019). During this testing phase, the application's reliability and adaptability for real-world usage scenarios are comprehensively assessed and improved. In addition, as stated by Wambua (2023), the testing step extends beyond virtual testing by integrating both virtual and actual devices to conduct a thorough evaluation. This approach enables a comprehensive assessment of the application's compatibility across various platforms and devices. Conducting tests on actual devices guarantees that the application performs as intended in real-life scenarios, including different device setups and user contexts.

The testing phase comprises a sequence of crucial steps, with the primary focus being on doing application testing. The process of testing is made easier by utilizing tools such as Android Studio, Firebase, and tablets, with the Android Emulator being a particularly useful technique adopted. The main outcome of this testing

activity is the testing result, encompassing an in-depth evaluation of the application's functionality and performance. This phase is crucial for identifying and resolving any faults or flaws that could affect the overall quality and functionality of the application.

In addition, the testing process includes usability and user acceptance testing. An established method employed is the System Usability Scale (SUS) Questionnaire, a widely acknowledged instrument for evaluating the usability of software programs. The SUS Questionnaire, a ten-item Likert scale utilized in system engineering to acquire extensive subjective evaluations of usability, is delivered to users with Google Forms. Subsequently, their responses are gathered and analyzed using Google Spreadsheets. The outcomes of this activity encompass the SUS Score, which measures the usability of the application, and useful user input. The SUS Questionnaire is an effective tool for measuring user happiness and usability, offering practical insights to improve the entire user experience of the mobile application.

Table 3.8 System Usability Scale (SUS) Questionnaire

Source: Brooke (1995)

Number	Questionnaire
1	I think that I would like to use "Alunan" application frequently
2	I found "Alunan" application unnecessarily complex
3	I thought "Alunan" application was easy to use
4	I think that I would need the support of a technical person to be able to use "Alunan" application
5	I found the various functions in "Alunan" application were well integrated
6	I thought there was too much inconsistency in "Alunan" application
7	I would imagine that most people would learn to use "Alunan" application very quickly
8	I found "Alunan" application very cumbersome to use
9	I felt very confident using "Alunan" application
10	I needed to learn a lot of things before I could get going with "Alunan" application

Table 3.9 System Usability Scale (SUS) Score Scale

Source: Brooke (1995)

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

3.4 Documentation

Comprehensive documentation is crucial for this project, as it involves important tasks including authoring, formatting, and publishing. Microsoft Word is primarily utilized for the generation of drafts for this report. LaTeX, a typesetting technology, is subsequently employed in Microsoft Visual Studio to convert the original drafts into refined documents. LaTeX is a scripting language utilized for typesetting various technical papers and facilitating the creation of thesis, general-purpose books, and articles. The use of LaTeX allows for accurate and uniform formatting. In this case, the "uitmthesis" LaTeX class, which follows the "Guidelines on Thesis/Dissertation Format" handbook by IPSis UiTM, is used for producing this final year project report. Additionally, the project's documentation is openly accessible and published on Github, to enable version control. This enhances the project's openness and accessibility.

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APPENDICES

APPENDIX A

GANTT CHART

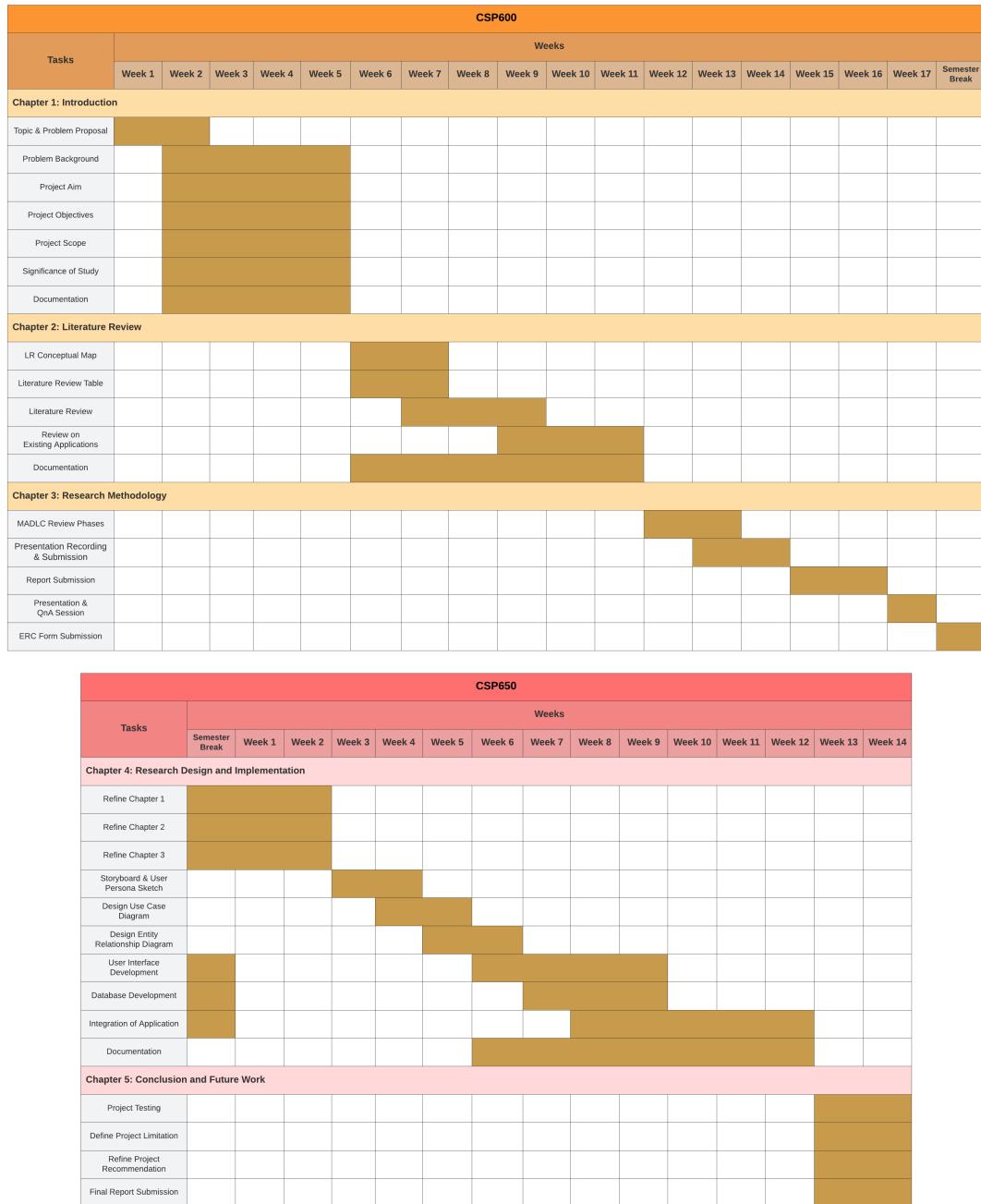


Figure A.1 Gantt Chart for the Project