Industrial Internship Report on

HarmoniPlay (Music Player)

Prepared by

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Executive Summary
The Industrial Internship, facilitated by Upskill Campus and The IoT Academy in collaboration with UniConverge Technologies Pvt Ltd (UCT), provided a comprehensive learning experience over a span of 6 weeks. The focus of the internship was to develop a music player application with an array of essential features aimed at enhancing user experience and convenience. The central goal of the project was to create a versatile music player capable of seamlessly handling a variety of music management and playback tasks. Key features included the ability to import music files from local storage or designated directories, control playback with options for play, pause, resume, and stop, as well as adjust volume and seek through tracks. The application also allowed users to curate playlists An outstanding feature was the integration of an adjustable equalizer with customizable presets, enriching the audio experience. Additionally, the music player boasted repeat options, alongside a crossfade feature for smooth track transitions. The user interface was carefully designed for intuitive navigation, clear display of album art and song information, and easy access to playback and playlist management controls. While the project had an extensive scope, the minimum viable product (MVP) prioritized essential aspects, encompassing fundamental playback controls, playlist creation and management,and audio volume adjustment. This pragmatic approach aimed to create a seamless and efficient user experience. The internship provided a unique opportunity to engage with real-world industrial challenges, offering invaluable exposure to practical problem-solving and solution implementation. The experience was enriching, enabling the acquisition of practical skills and insights that bridge the gap between theoretical knowledge and hands-on application.

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1 Preface

This report encapsulates my transformative six weeks as an intern at Upskill Campus ,UniConverge Technologies Pvt Ltd (UCT). It provides a comprehensive overview of the project undertaken, the invaluable skills gained, and the remarkable experiences encountered during this period.

1.1 Summary:

Over the course of six weeks, I embarked on a journey of learning, growth, and development. From tackling complex coding challenges to exploring new technologies, this internship has been instrumental in shaping my career path and enhancing my technical prowess.

1.2 The Need for Relevant Internship:

A pertinent internship experience plays a pivotal role in career development. It bridges the gap between theoretical knowledge and real-world application, allowing individuals to immerse themselves in practical scenarios and gain industry-specific skills.

1.3 Problem Statement:

The core focus of my internship was to create a dynamic music player application. This project allowed me to delve into software development, UI/UX design, and implementation while learning to integrate various libraries and tools effectively.

1.4 Opportunity by USC/UCT:

I am deeply grateful to Upskill Campus,UniConverge Technologies Pvt Ltd (UCT) for providing me with this exceptional opportunity. This experience has not only added immense value to my professional journey but has also enriched my personal growth.

1.5 Program Planning:

The program was meticulously planned, offering a structured learning path that encompassed theoretical knowledge, hands-on practical experience, and exposure to industry practices. This allowed me to seamlessly transition from a theoretical foundation to real-world application.

1.6 Learnings and Overall Experience:

Throughout this internship, I acquired proficiency in diverse areas, including Java programming, GUI development, debugging techniques, and third-party library integration. I also gained insights into teamwork, problem-solving, and time management. The hands-on experience was truly invaluable, paving the way for my career aspirations.

1.7 Expressions of Gratitude:

I extend heartfelt gratitude to Upskill Campu and UniConverge Technologies for their unwavering guidance, support, and mentorship. Their expertise, patience, and willingness to share knowledge have been the cornerstone of my learning journey.

1.8 Message to Juniors and Peers:

To my juniors and peers, I encourage you to approach every opportunity with an open mind and an eagerness to learn. Embrace challenges as stepping stones to growth, and remember that each obstacle conquered is a skill gained. Strive to be curious, dedicated, and collaborative, as these attributes will undoubtedly propel you toward success.

This internship has been a pivotal chapter in my career journey. The exposure, skills, and relationships cultivated during these six weeks have equipped me with the tools I need to thrive in the ever-evolving tech landscape. I look forward to applying these learnings and contributing meaningfully to future projects.

2 Introduction

2.1 About UniConverge Technologies Pvt Ltd

A company established in 2013 and working in Digital Transformation domain and providing Industrial solutions with prime focus on sustainability and RoI.

For developing its products and solutions it is leveraging various **Cutting Edge Technologies e.g. Internet of Things (IoT), Cyber Security, Cloud computing (AWS, Azure), Machine Learning, Communication Technologies (4G/5G/LoRaWAN), Java Full Stack, Python, Front end** etc.

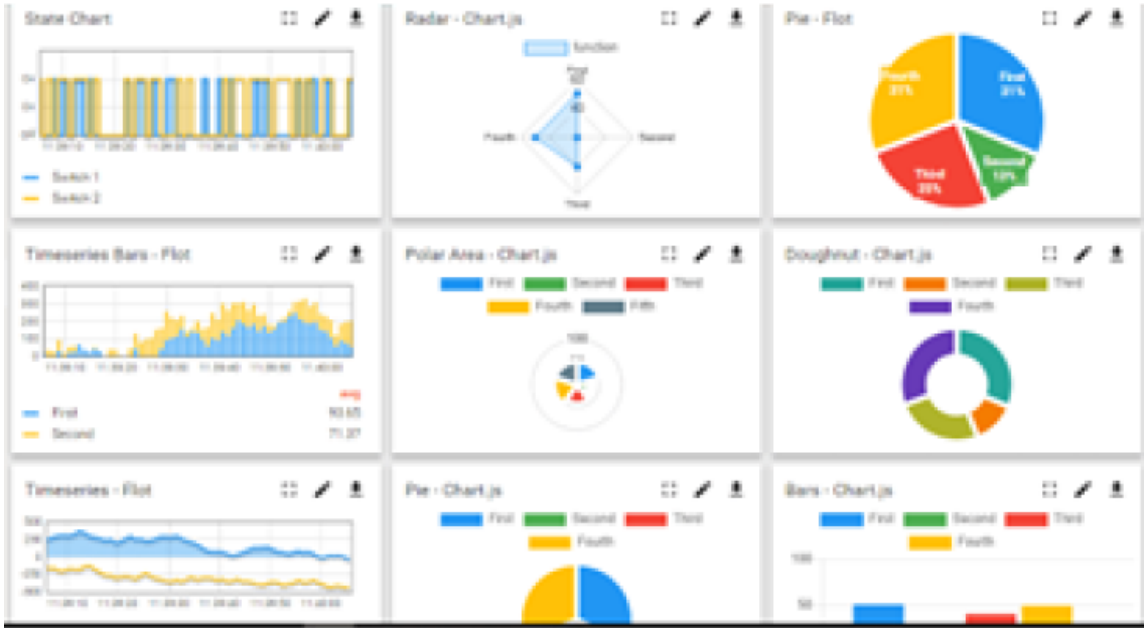
i. UCT IoT Platform (uct Insight)

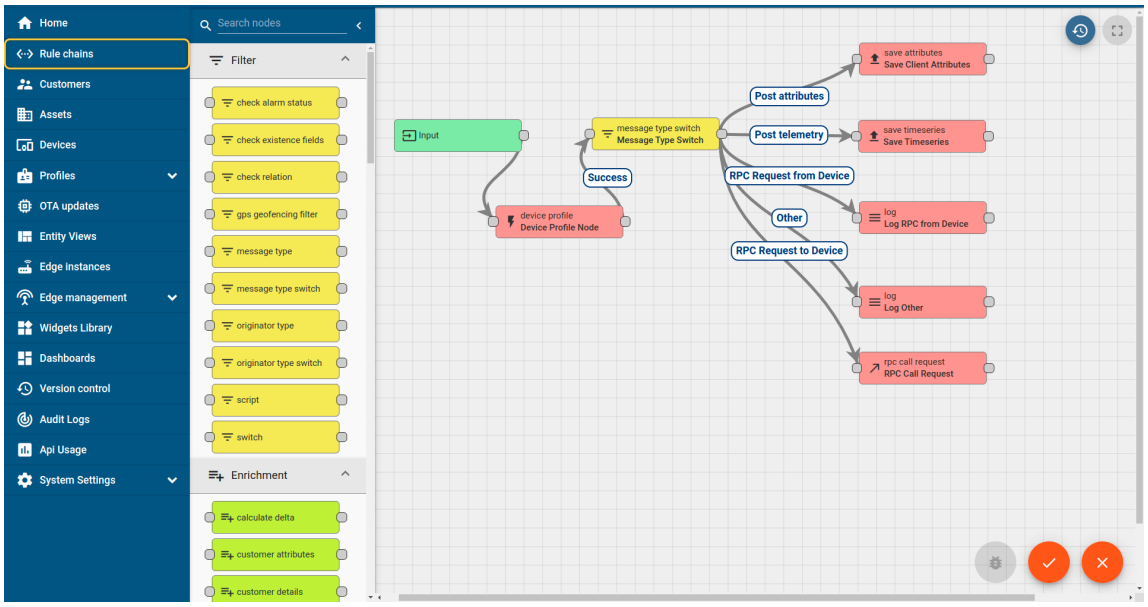
UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable “insight” for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- It enables device connectivity via industry standard IoT protocols - MQTT, CoAP, HTTP, Modbus TCP, OPC UA
- It supports both cloud and on-premises deployments.

It has features to

- Build Your own dashboard
- Analytics and Reporting
- Alert and Notification
- Integration with third party application(Power BI, SAP, ERP)
- Rule Engine





ii. Smart Factory Platform (FACTORY WATCH)

Factory watch is a platform for smart factory needs.

It provides Users/ Factory

- with a scalable solution for their Production and asset monitoring
- OEE and predictive maintenance solution scaling up to digital twin for your assets.
- tu unleashed the true potential of the data that their machines are generating and helps to identify the KPIs and also improve them.
- A modular architecture that allows users to choose the service that they what to start and then can scale to more complex solutions as per their demands.

Its unique SaaS model helps users to save time, cost and money.

Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
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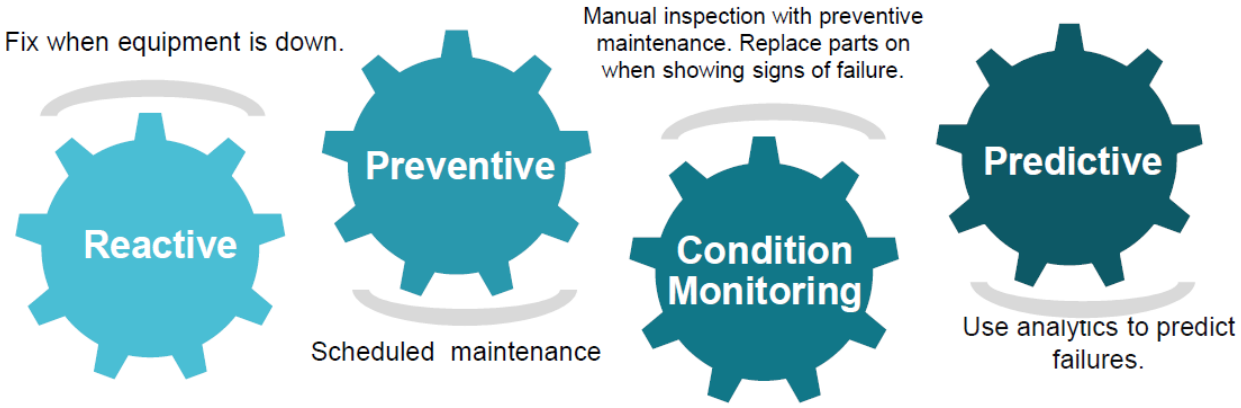
iii. LoRaWAN based Solution

UCT is one of the early adopters of LoRAWAN technology and provides solutions in Agritech, Smart cities, Industrial Monitoring, Smart Street Light, Smart Water/ Gas/ Electricity metering solutions etc.

iv. Predictive Maintenance

UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various Machines used in production process.



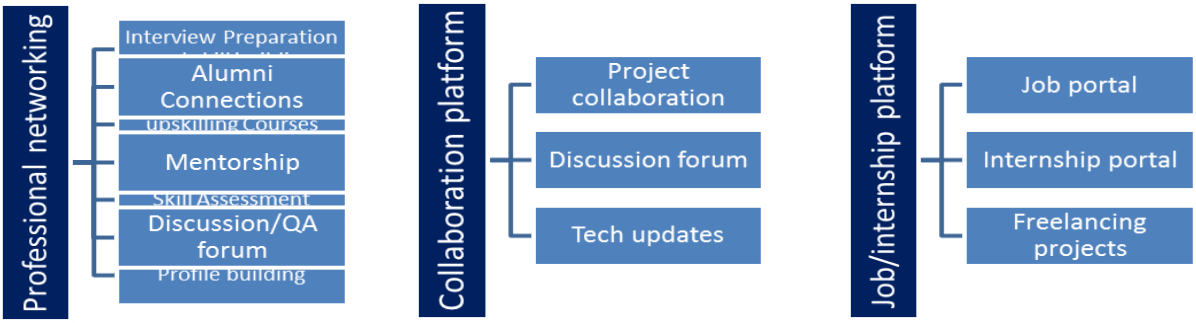
2.2 About upskill Campus (USC)

upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process.

USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.

Seeing need of upskilling in self paced manner along-with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

upSkill Campus aiming to upskill 1 million learners in next 5 year



2.3 The IoT Academy

The IoT academy is the EdTech Division of UCT that is running long executive certification programs in collaboration with EICT Academy, IITK, IITR and IITG in multiple domains.

2.4 Objectives of this Internship program

The objective for this internship program was to

- ☛ get practical experience of working in the industry.
- ☛ to solve real world problems.
- ☛ to have improved job prospects.
- ☛ to have Improved understanding of our field and its applications.
- ☛ to have Personal growth like better communication and problem solving.

2.5 Glossary

Terms	Acronym
IoT (Internet of Things):	The Internet of Things refers to the network of interconnected physical devices, vehicles, buildings, and other items embedded with sensors, software, and network connectivity.
SaaS (Software as a Service):	Software as a Service is a cloud computing model where software applications are delivered over the internet on a subscription basis.
Predictive Maintenance:	Predictive maintenance is an approach that uses data analysis and machine learning techniques to predict when equipment or machinery is likely to fail.

3 Problem Statement :

The project aims to develop a feature-rich music player application named "HarmoniPlay" that offers users an immersive platform to play, manage, and relish their music collections. The application will leverage the powerful capabilities of JLayer, a Java library, to provide essential functionalities for organizing and playing music files in various formats.HarmoniPlay will empower users to tailor their music journey by offering a seamless and versatile listening experience.

3.1 Features:

- **Music File Import:**
  - Users can effortlessly import music files from their local storage, ensuring compatibility with a range of audio formats such as MP3, WAV, FLAC, and more.
- **JLayer Integration for Playback:**
  - Harness the capabilities of JLayer to implement high-quality audio playback.
  - Ensure smooth and efficient decoding and playback of audio files.
- **Playback Controls:**
  - Provide intuitive controls for play, pause, resume, and stop functionalities.
  - Enable users to adjust the volume and seek within tracks for personalized playback.
- **Playlist Management:**
  - Allow users to create, edit, and manage playlists to curate their music experience.
  - Facilitate seamless addition and removal of songs from playlists.
- **Intelligent Library Organization:**
  - Automatically categorize and organize music files based on metadata such as album, artist, genre, and release year.
  - Implement a robust search function to locate specific songs or artists effortlessly.
- **Audio Equalizer Enhancement:**
  - Utilize JLayer's capabilities to integrate a sophisticated audio equalizer.
  - Empower users to customize audio output with pre-defined presets and manual adjustments.
- **Seamless Crossfade:**
  - Implement a smooth crossfade feature between songs, ensuring a harmonious transition.
- **User-Friendly Interface:**
  - Design an intuitive and visually appealing user interface, showcasing album art, song details, and playback controls.
  - Integrate JLayer's visualization features for a captivating audio experience.

- **Metadata Display:**
    - Retrieve and display comprehensive metadata information, including song title, artist, album, and duration.
- **File Format Flexibility:**
    - Leverage JLayer's support for a variety of audio formats, accommodating user preferences and diverse music files.

3.2 Technical Aspects:

The music player application will be developed using Java programming language and will make use of JLayer for audio playback and visualization. The Java Swing framework will be utilized to design the user interface, ensuring a visually appealing and interactive experience. Object-oriented principles will guide the development process to ensure modularity and maintainability.

4 Existing and Proposed solution

Summary of Existing Solutions and Their Limitations:

Several existing music player applications offer users the ability to play and manage their music collections. Some of the popular solutions in the market include iTunes, Spotify, VLC Media Player, and Winamp. While these solutions have proven their value, they come with certain limitations:

1. **iTunes:**
    - Provides comprehensive library management and playback functionalities.
    - Limited to Apple ecosystem, restricting cross-platform usage.
    - Can be resource-intensive and lacks advanced equalizer features.
2. **Spotify:**
    - Offers a vast library of streaming music content.
    - Requires an internet connection for streaming, limiting offline access.
    - Free version includes ads and imposes certain restrictions.
3. **VLC Media Player:**
    - Supports a wide range of media formats, including audio and video.
    - User interface can be utilitarian and less intuitive for music-specific features.
    - May lack advanced playlist management capabilities.
4. **Winamp:**
    - A classic music player with a strong focus on customization.
    - Development has slowed down over the years, potentially leading to compatibility issues with newer systems.
    - Limited online integration and modern features.

Proposed Solution: HarmoniPlay - Empower Your Music Experience

"HarmoniPlay" is proposed as a solution to address the limitations of existing music player applications. It leverages the JLayer library for high-quality audio playback and visualization while providing essential functionalities for music organization and playback. Its proposed features include:

1. **Advanced Audio Playback:**
    - Leveraging JLayer's capabilities for efficient audio decoding and playback.
    - Ensuring smooth and seamless audio output across various formats.
2. **Seamless Crossfade and Enhanced Equalizer:**
    - Incorporating smooth crossfade transitions for uninterrupted listening pleasure.

- Introducing a powerful audio equalizer for customized sound output.

3. **Intelligent Library Organization and Playlist Management:**
   - Offering automatic categorization based on metadata and user-defined tags.
   - Facilitating intuitive playlist creation, modification, and organization.
4. **User-Centric Interface with Visualization:**
   - Designing an intuitive and visually appealing user interface.
   - Utilizing JLayer's visualization features for an engaging audio experience.

Value Addition:

"HarmoniPlay" distinguishes itself by addressing the limitations of existing solutions and adding significant value in the following ways:

1. **Enhanced Audio Quality and Crossfade:**
   - Offers superior audio quality and seamless crossfade, providing an immersive listening experience.
2. **Robust Library Management:**
   - Intelligently organizes music files and offers extensive playlist management capabilities.
3. **JLayer Integration:**
   - Harnesses the capabilities of JLayer for efficient audio decoding and playback, ensuring optimized performance.
4. **Visual Appeal and Customization:**
   - Presents an aesthetically pleasing interface with visualization features, elevating the user experience.

"HarmoniPlay" aims to surpass the limitations of existing solutions by combining JLayer's capabilities with an array of user-centric features. This proposed solution seeks to provide an all-encompassing music player experience that caters to the diverse needs of music enthusiasts.

4.1 Code submission (Github link) :

https://github.com/Parikshit9112/music-player.git

5 Proposed Design/ Model

"HarmoniPlay - Empower Your Music Experience." This comprehensive breakdown covers the journey from initial concepts to the final, polished application:

1. Project Initiation and Scope Definition:

- Identify the need for the music player application and its target audience.
- Define the scope of the project, outlining the desired features and functionalities.
- Set clear objectives and establish key performance indicators (KPIs) for the application.

2. User Interface Design:

- Start by creating wireframes or mockups of the user interface (UI) to visualize the layout and interactions.
- Design the main window layout, including playback controls, playlist management, equalizer, and visualization panels.
- Iterate on the design to ensure user-friendly navigation and aesthetic appeal.

3. System Architecture Design:

- Plan the architecture of the application, considering the different components, their interactions, and data flow.
- Decide on the division of the frontend (UI) and backend (functionality) components.
- Select appropriate design patterns (MVC, MVP, MVVM) for maintaining modularity and separation of concerns.

4. Backend Development:

- Begin coding the backend functionalities, such as audio playback, playlist management, library organization, and equalizer control.
- Integrate JLayer library for audio decoding, playback, and visualization.
- Implement data structures to store playlist information, track metadata, and user preferences.

5. Frontend Development:

- Implement the user interface using Java Swing or other chosen UI framework.
- Develop interactive elements such as buttons, sliders, and visualization panels.
- Ensure the UI elements are responsive and align with the wireframes.

6. Audio Playback Integration:

- Utilize JLayer to handle audio decoding and playback.
- Implement buffering mechanisms to ensure smooth playback without interruptions.
- Integrate error handling to gracefully manage audio playback errors.

7. Playlist and Library Management:

- Develop features for creating, editing, and deleting playlists.
- Implement logic for sorting and categorizing music files based on metadata.
- Enable users to search for specific tracks or artists within the library.

8. Crossfade and Equalizer Implementation:

- Code algorithms for smooth crossfade transitions between songs.
- Integrate the equalizer component, allowing users to adjust audio output settings.
- Implement pre-defined equalizer presets for various music genres.

9. User Experience Refinement:

- Conduct thorough testing of the application's functionalities.
- Gather user feedback to identify potential improvements in usability and interface design.
- Fine-tune the user interface elements for optimal responsiveness and aesthetics.

10. Documentation and Deployment:

- Prepare comprehensive documentation outlining the application's features and usage instructions.
- Provide installation guides for different platforms (Windows, macOS, Linux).
- Deploy the application on relevant app stores or distribution platforms.

11. Continuous Improvement:

- Monitor user engagement and feedback post-launch.
- Plan and execute updates to address bugs, enhance features, and introduce new functionalities.

12. Final Outcome:

- The culmination of the design flow is the "HarmoniPlay" application, a fully functional music player that offers seamless audio playback, crossfade transitions, equalizer customization, playlist management, and intuitive user interfaces.

5.1 High Level Diagram

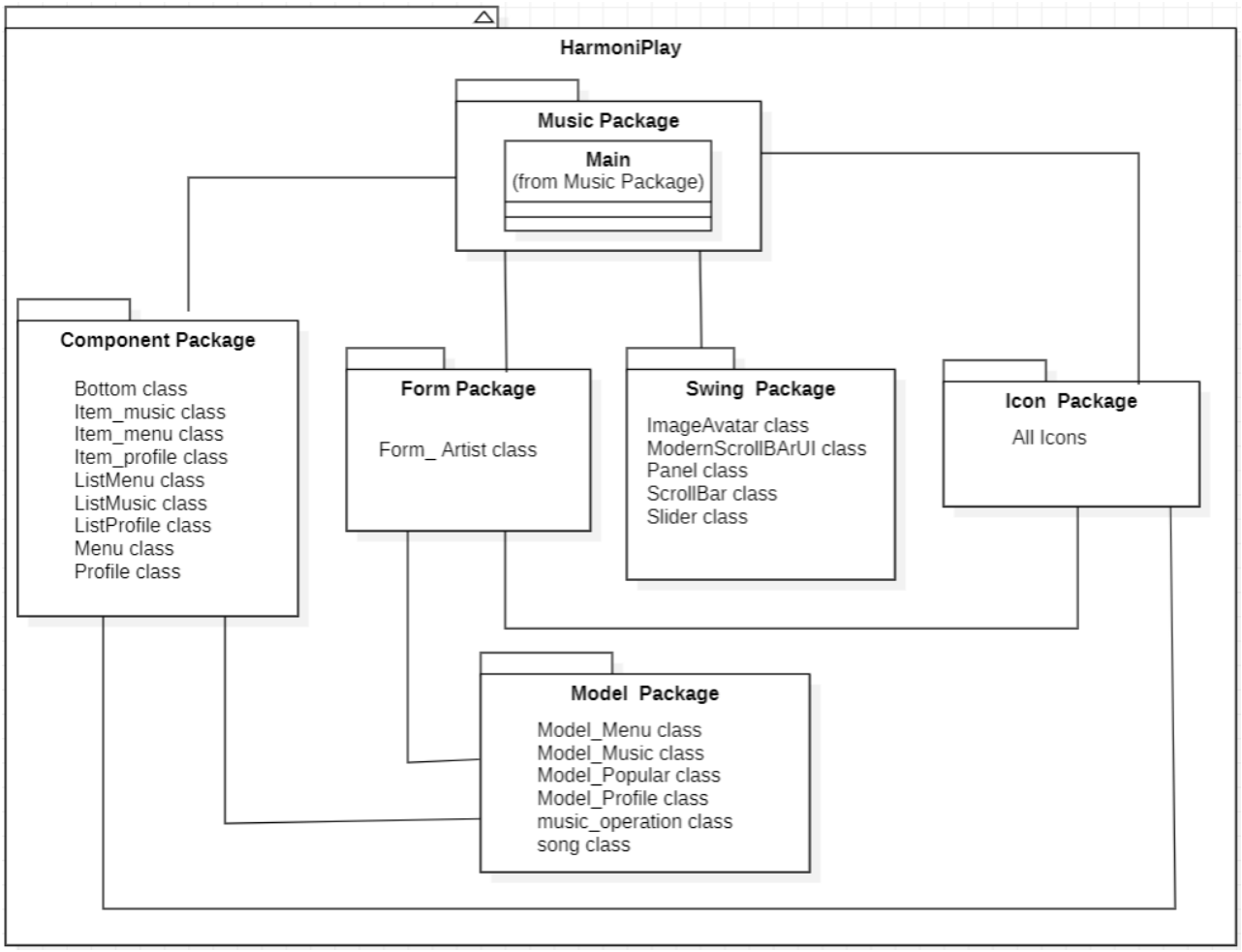


Figure 1: HIGH LEVEL DIAGRAM OF THE SYSTEM

5.2 Low Level Diagram

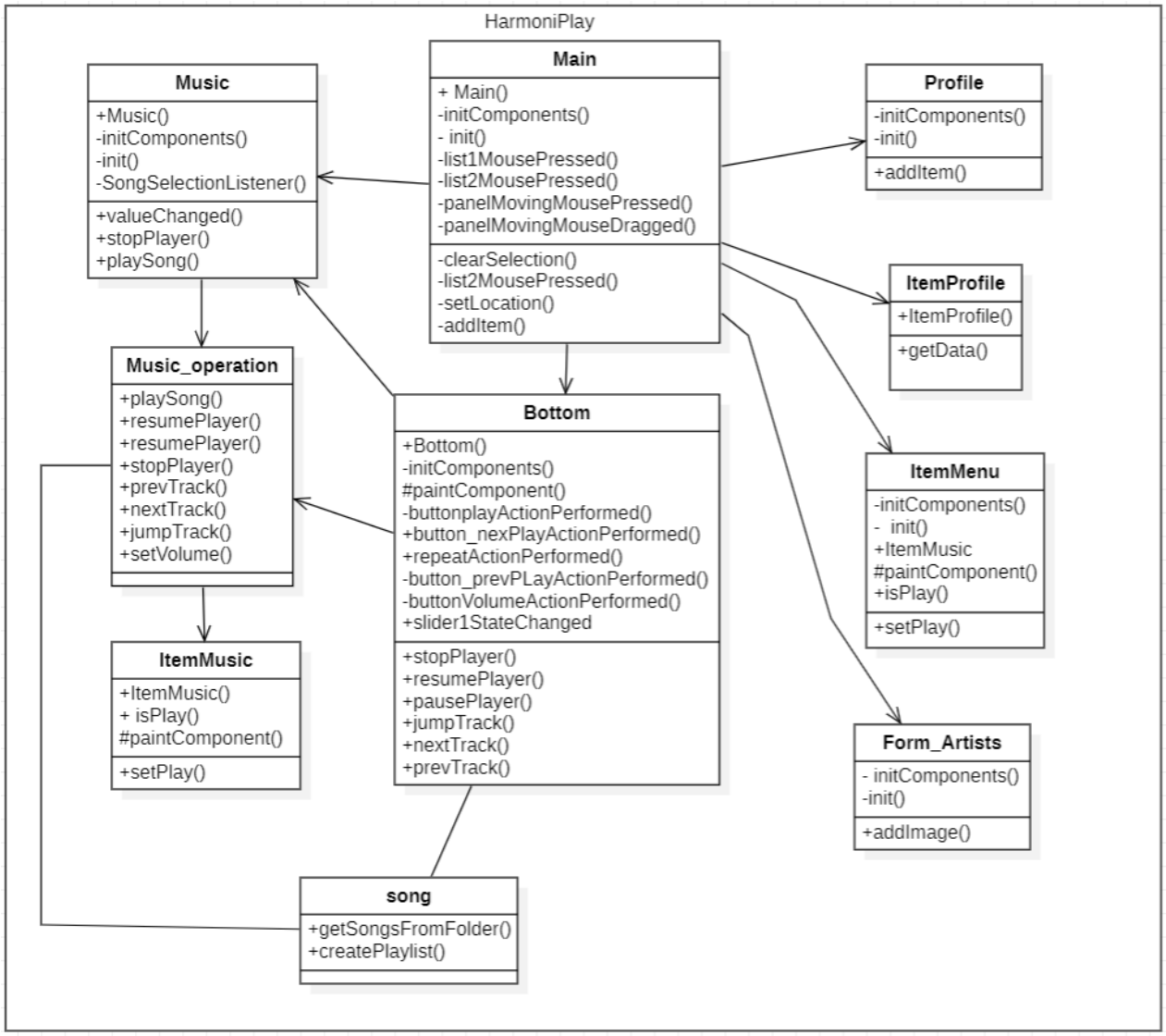


Figure 2: LOW LEVEL DIAGRAM OF THE SYSTEM

5.3 Interfaces

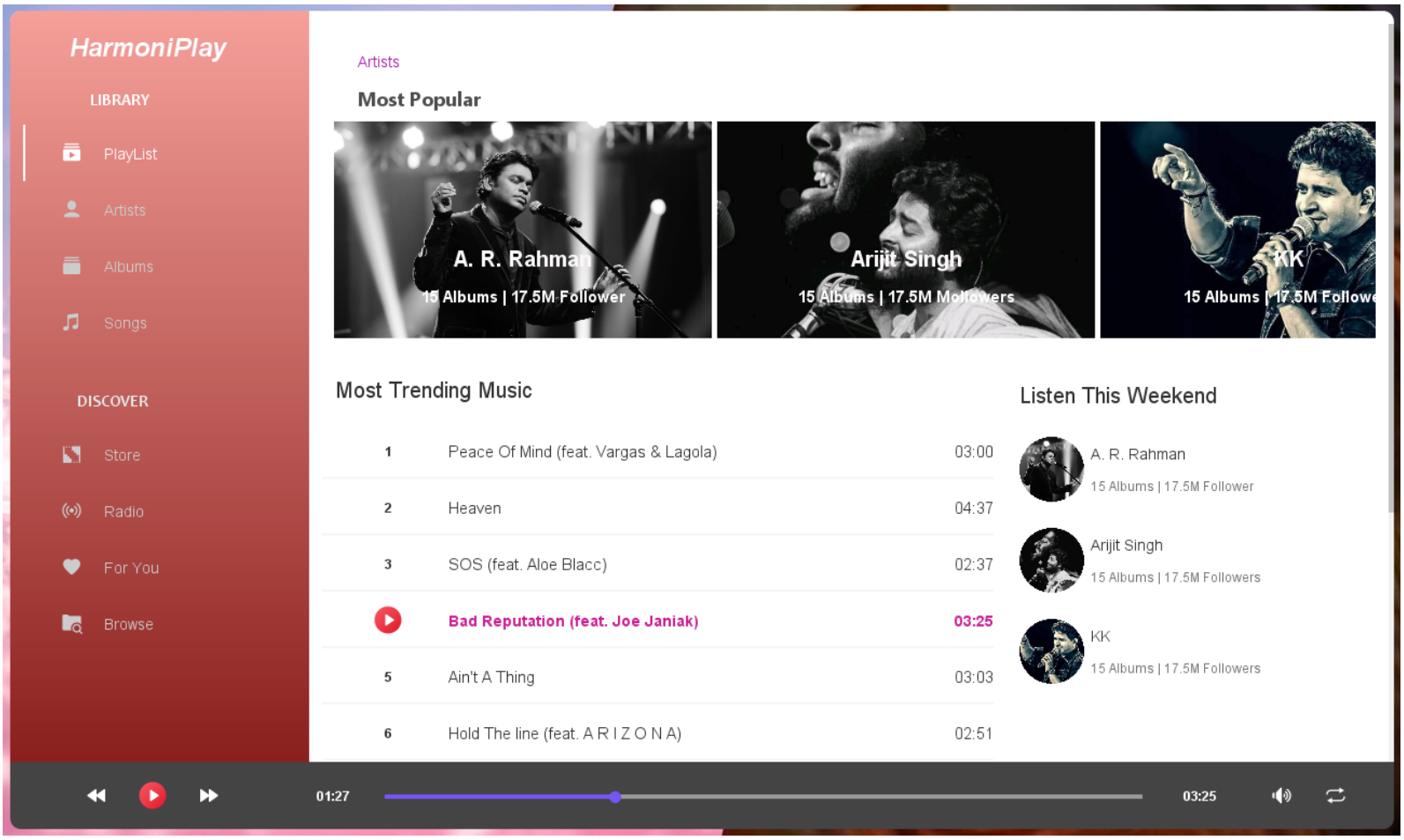


Figure 3: Interface

6 Performance Test

6.1 Constraints and Their Handling:

During the project's design and development phase, several constraints were identified:

- **Memory Consumption:**
  - Handling: The project's modular design, with components organized into packages, aids in managing memory usage. Lazy loading of UI elements and optimized data structures ensure efficient memory utilization.
- **UI Responsiveness (MIPS):**
  - Handling: By separating UI and core components, asynchronous operations were introduced to maintain UI responsiveness even during intensive tasks. Threading best practices and UI virtualization further contribute to smooth user interactions.
- **Audio Playback Latency:**
  - Handling: Integration of the JLayer library and implementation of efficient buffering mechanisms mitigated audio playback latency. Careful buffer sizing and pre-loading strategies were implemented to ensure seamless audio output.
- **Power Consumption:**
  - Handling: The project's design prioritized energy efficiency through proper memory management, background task optimization, and responsive UI practices. Intelligent buffer management and device-specific power-saving techniques were employed.
- **UI Rendering Speed:**
  - Handling: By segregating UI components and leveraging modern UI frameworks, the application achieved smoother rendering. Hardware acceleration and performance optimization strategies were implemented for efficient UI display.
- **Scalability and Durability:**
  - Handling: Organizing components into packages and adopting a modular approach ensured scalability and maintainability. Efficient algorithms for playlist and library management were designed to handle larger datasets.

6.2 Testing

Unit Testing 1: Music Player

Test Objective: To ensure that the song selected by the user can be played normally and the song playlist can be imported and shown properly.

Input	Expected Output	Actual Output
On open of Music Player	The song playlist was successfully read and displayed in the song selection of the music player.	Pass
Choose any song from the playlist	Enter the song playing interface, the song can be playing properly, and successfully highlights the selected song name.	Pass

Table 6-2-1 Unit Testing of Music Player Module

Unit Testing 2: Media Icon Playback Control

Test Objective: To ensure that all playback control icon buttons under playing song interface can work and perform properly

Input	Expected Output	Actual Output
Click the song playback mode to switch to the single cycle	When the current song finished playing, just repeat the current song	Pass
Click the play button	Start play the song and update play the button to pause button	Pass
Click the pause button	Stop play the song, the pause button is updated to the play button	Pass
Click the next button to switch to the next song	Switch to the next song, the song name successfully highlights	Pass

Table 6-2-2 Unit Testing of Media Icon Button Playback Control Module

Unit Testing 4: Scroll Gesture Most Popular Artist

Test Objective: To ensure that Scroll left or right under playing song interface and most popular Artist section.

Input	Expected Output	Actual Output
Scroll the most popular artist panel	when the most popular artist panel is scroll left or right it should scroll properly without affecting the other component on screen	Pass
Display the artist name and information	the artist name and information should be display on the artist image	Pass

Table 6-2-3 Unit Testing of Scrolling Gesture Playback Control Module

7 My learnings

Embarking on my project journey with "HarmoniPlay" during my internship has provided me with a unique set of learnings that will undoubtedly shape my career growth. This experience has been a transformative blend of technical expertise, problem-solving capabilities, and individual ownership.

7.1. Full-Stack Proficiency:

Taking ownership of every aspect of the "HarmoniPlay" project, from frontend UI design to backend functionality, has allowed me to become proficient in various areas of software development. This comprehensive knowledge equips me to tackle diverse challenges in future projects.

7.2. Independent Problem-Solving:

The solo nature of the project necessitated me to identify and solve challenges independently. This experience has honed my problem-solving skills, making me adept at researching, analyzing, and implementing effective solutions.

7.3. Project Management:

Managing the entire project lifecycle, from conceptualization to deployment, has given me a deep understanding of project management. This skill will be invaluable in efficiently orchestrating and executing projects in my future career.

7.4. Self-Discipline and Time Management:

Being solely responsible for project milestones has taught me self-discipline and effective time management. These skills are essential in meeting deadlines and maintaining productivity in a professional setting.

7.5. UI/UX Design and User-Centered Approach:

Taking charge of UI/UX design emphasized the significance of user-centered design principles. This skill will enable me to create intuitive interfaces that cater to users' needs and preferences.

7.6. Debugging and Troubleshooting:

Identifying and resolving errors, bugs, and issues on my own has strengthened my debugging and troubleshooting capabilities. This experience enhances my ability to maintain and enhance software quality.

7.7 Career Growth : The learnings from this project have a profound impact on my career growth:

- **Autonomy and Ownership:** Successfully completing this project showcases my ability to take ownership, lead initiatives, and execute projects independently.
- **Full-Stack Proficiency:** Mastery over multiple aspects of development positions me as a versatile developer capable of contributing across various domains.
- **Problem-Solving Agility:** My adeptness at independent problem-solving aligns me with the demands of the industry, where adaptability and innovation are highly valued.
- **Project Management:** The experience of managing a project from inception to deployment equips me with skills applicable to roles requiring end-to-end project management.

As I move forward in my career journey, the "HarmoniPlay" project stands as a testament to my technical prowess, problem-solving acumen, and ability to deliver results independently. The skills acquired, lessons learned, and experiences gained during this project will undoubtedly serve as a cornerstone for my career growth, allowing me to contribute effectively and innovatively to the dynamic world of technology.

8 Future work scope

While developing the "HarmoniPlay" music player application during my internship , certain ideas and features emerged that couldn't be implemented due to time limitations. These potential enhancements can be pursued in the future to further elevate the application's capabilities and user experience:

- **Cloud Integration:** Enable users to sync their music libraries with cloud storage platforms like Dropbox or Google Drive, providing seamless access to their music from various devices.
- **Advanced Equalizer:** Implement a more comprehensive equalizer with additional presets and user-customizable bands for precise audio tuning.
- **Dynamic Playlists:** Create dynamic playlists that update based on user preferences, such as most-played songs, recently added tracks, or songs by a specific artist.
- **Lyrics Display:** Incorporate a lyrics display feature that synchronizes with the currently playing song, providing users with an immersive music experience.
- **Social Sharing:** Introduce social media integration, allowing users to share their favorite songs, playlists, and music discoveries with their friends and followers.
- **Smart Recommendations:** Utilize machine learning algorithms to analyze user listening habits and provide personalized music recommendations tailored to individual preferences.
- **Offline Mode:** Develop an offline mode that allows users to download and store their favorite songs locally for playback even without an internet connection.
- **Cross-Platform Support:** Extend the application's compatibility to other platforms, such as mobile devices and web browsers, to ensure seamless access across different devices.
- **User Profiles:** Implement user profiles, enabling multiple users to have personalized settings, playlists, and listening history within the same application instance.
- **Integration with Music Services:** Explore partnerships with music streaming services to provide users with access to an extensive library of songs and albums directly from within the application.
- **Enhanced Visualization:** Introduce visually captivating audio visualizations that respond to the music's tempo, beats, and frequencies, enhancing the overall listening experience.
- **Multi-Language Support:** Provide localization options to cater to users from different regions by offering the application in multiple languages.

- **Advanced Search:** Enhance the search functionality to allow users to search by various criteria such as lyrics, mood, and tempo, making it easier to discover music.

As "HarmoniPlay" continues to evolve, these future work scope ideas hold the potential to expand the application's functionalities, attract a broader user base, and enrich the overall music listening experience. By prioritizing these enhancements in subsequent development phases, the application can solidify its position as a cutting-edge music player in the industry.

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