Computer Science Department

Software Engineering & Business Analysis

Bachelor's Thesis

Capstone Project

BeatRate Web Application Paper

Yaroslav Khomych & Maksym Pozdnyakov

Supervisor
KSE, Isaac Newton, PhD, inewton@kse.org.ua

Expert
Company, Expert Name, expert@domain.ua

Submission date
14 August 2025

TODOS

Academic Integrity Statement

I, undersigned, hereby declare that this capstone project is the result of my own work.

- All ideas, data, figures and text from other authors have been clearly cited and listed in the bibliography.
- No part of this project has been submitted previously for academic credit in this or any other institution.
- All code, diagrams, and third-party materials are either my original work or are used with permission and properly referenced.
- I have not engaged in plagiarism or any form of academic dishonesty.
- Any assistance received (e.g. from peers, tutors, or online forums) is acknowledged in the acknowledgements section.

I understand that failure to comply with these declarations constitutes academic misconduct and may lead to disciplinary action.

Place, date   Kyiv, 23.05.2025

Signature   _____

Contents

Abstract

The abstract serves as a concise summary of your entire thesis, encapsulating key elements on a single page such as:
- *General background information*
- *Objective(s)*
- *Approach and method*
- *Conclusions*

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

Keywords:

KSE, Software Engineering, Thesis, BeatRate, Web Application

1 | Introduction

In the rapidly evolving landscape of digital music consumption, where streaming platforms have revolutionized how we discover and consume music, a critical gap exists in the space dedicated to music evaluation, critique, and meaningful social interaction around musical content. This capstone project documents the complete development of **BeatRate** - a Music Evaluation Platform designed to serve as a dedicated social space for music enthusiasts, critics, and artists to rate, review, and discover music while fostering an active community of like-minded individuals.

Unlike existing streaming platforms that prioritize consumption, BeatRate addresses the absence of a comprehensive platform that combines in-depth music evaluation with robust social features. Drawing inspiration from successful platforms like Letterboxd for films and IMDb for movies, this project represents the creation of a similar ecosystem specifically tailored for the music domain. The platform merges the elements of a social network with the depth of a sophisticated discovery and evaluation tool, enabling users to rate and review music using both traditional and innovative custom grading methods, curate personalized music lists, and engage in meaningful discussions within a diverse community.

This paper chronicles the journey of two software engineering students who, over an intensive three-month development period, transformed a conceptual solution into a fully functional web application comprising over 55,000 lines of code across multiple technologies and architectural layers. The development process encompassed detailed market research, competitor analysis, solution architecture design, and implementation of a scalable cloud-based system using modern software engineering practices.

1.1 Project Objectives

The primary objectives of this capstone project are:

1. To develop a fully functional web application that facilitates music rating, reviewing, and discovery
2. To implement a dual rating system allowing both simple and comprehensive evaluations
3. To create robust social features enabling community interaction around musical content
4. To integrate with established music services (specifically Spotify) to access comprehensive music metadata
5. To build a scalable architecture capable of supporting growth in both users and features
6. To deploy the application using modern cloud infrastructure and DevOps practices

These objectives guided our development process throughout the project lifecycle, from initial research through implementation and deployment.

1.2 Relevance and Significance

This project holds significance in several dimensions:

Technical Relevance: The development of BeatRate demonstrates the application of modern software engineering practices in creating a complex, feature-rich web application. The project showcases the implementation of microservices architecture, cloud deployment strategies, and integration with third-party APIs within a constrained timeframe.

Market Relevance: Our market research indicates significant growth potential in the music evaluation space, with global music streaming projected to reach US35.45 billion dollars by 2025 (Statista, 2024). The growing emphasis on personalization and community engagement in music consumption supports the need for platforms that facilitate deeper connections between listeners, critics, and artists.

Academic Relevance: This capstone project integrates knowledge from various courses in the Software Engineering and Business Analysis curriculum, including software architecture, database design, web development, user experience, market research, and DevOps. It demonstrates our ability to apply theoretical concepts to practical, real-world problems.

1.3 Methodology

Our approach to developing BeatRate followed a structured methodology combining thorough research with agile development practices:

1. **Discovery Phase**: We conducted extensive research into the domain, analyzing competitor platforms, identifying market opportunities, and defining core requirements.

2. **Iterative Development**: The implementation followed three month-long development sprints, each with specific goals and deliverables:
   - Sprint 1: Core architecture and basic functionality
   - Sprint 2: Advanced features and social components
   - Sprint 3: Refinement, optimization, and deployment

3. **Technology Selection**: We carefully selected our technology stack based on project requirements, team expertise, and industry best practices. The backend uses `C#` with .NET, while the frontend employs React. AWS provides our cloud infrastructure, with specific services chosen to optimize performance, scalability, and cost.

1.4 Structure of this paper

This thesis is structured to provide both a comprehensive technical reference and an engaging narrative of the development process:

Domain Research and Analysis (Chapter 3) presents our investigation into the music evaluation platform landscape, including detailed competitor analysis and market opportunity identification.

System Design and Architecture (Chapter 4) details our architectural decisions, technology stack selection, and system design rationale, including economic analysis and business process research.

Implementation Journey (Chapter 5) chronicles the three-month development process, documenting each sprint's objectives, challenges, achievements, and retrospective insights.

Validation and Testing (Chapter 6) demonstrates how we verified that our implementation meets initial requirements through comprehensive testing methodologies and user validation.

Conclusions and Future Perspectives (Chapter 7) reflects on the project's achievements, lessons learned, and potential directions for future development.

Throughout this paper, we aim to demonstrate not only the technical implementation of BeatRate but also the thought process behind our decisions and the evolution of the project from concept to deployment. With over 55,000 lines of code and a robust feature set, BeatRate represents the culmination of our software engineering education and our passion for creating meaningful digital experiences.

2 | Research

In this section, you perform a State of the Art investigation of your domain to understand what's been built, how it works, and where it falls short. You'll survey existing solutions—tools, frameworks and approaches—then compare them against your project's requirements to justify why a new tool (and its specific feature set) is needed.

A focused Domain Area Research unfolds in these steps:

1. *Clarify your research questions and functional requirements*
2. *Collect and review candidate solutions*
3. *Evaluate each alternative's strengths, weaknesses, maturity and architectural style*
4. *Group similar approaches into meaningful categories (for example, monolithic vs. microservice, commercial vs. open-source)*
5. *Pinpoint gaps or missing features that motivate your own design*

This process carries your initial concept through systematic research all the way to a clear, actionable set of requirements for your proposed tool.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

Contents

2.1 Section 1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

2.2 Section 2

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

2.3 Conclusion

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

3 | Design

In this section you turn your requirements into a concrete engineering blueprint. You'll justify every major architectural choice, visualize structure with C4 diagrams for the first three layers, and map out your runtime topology so that peers can understand—and you can defend—every aspect of your system.

1. *Clarify how functional and non-functional requirements drive your high-level architecture*
2. *List each architectural decision (for example, "We chose microservices to enable independent scaling and deployment") and explain why it best meets your goals*
3. *Include a C4 Context diagram showing your system in its environment (users, external systems, data sources)*
4. *Include a C4 Container diagram breaking the system into deployable units (APIs, web front end, background workers, databases) and annotate communication styles and protocols*
5. *Include a C4 Component diagram for your core container(s), illustrating key modules, services or libraries and their interactions*
6. *Describe your deployment topology: physical or cloud hosts, network zones, load-balancing, failover and backup strategies*
7. *Summarize your technology stack, mapping each tool or framework back to a specific container or component and noting any trade-offs (performance, community support, learning curve)*
8. *Outline how data flows through the system—including storage models, messaging patterns or API contracts—and note any schema or interface versioning plans*
9. *Address cross-cutting concerns (Security, Logging, Monitoring, Scalability) and show where they sit in your topology*

By walking through Requirements → Decisions → Diagrams → Topology, your Design section becomes a rigorous, evidence-backed foundation for the implementation that follows.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

Contents

3.1 Section 1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

3.2 Section 2

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

3.3 Conclusion

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

4 | Implementation

In this section you translate your component-level designs into working code and systems. Focus on the C4 Component layer and on the details needed to show how your design was realized. Include only the most important code snippets that illustrate key patterns or algorithms, rather than full listings.

1. *Describe the development methodology (for example, Agile or test-driven development) used to guide your implementation*
2. *Explain any prototyping or iterative strategies you applied to refine components before full-scale coding*
3. *Summarize coding standards, naming conventions and architectural patterns followed in your codebase*
4. *Present critical code snippets or configuration templates that highlight how core components were implemented (for example, key classes, interfaces or algorithms)*
5. *Detail your testing approach and quality assurance measures (unit tests, integration tests, coverage metrics)*
6. *Note any performance optimizations or profiling results for components that were bottlenecks*
7. *Outline your deployment and configuration management process for component artifacts (containerization, CI/CD pipelines)*
8. *Highlight documentation deliverables (API references, inline comments, architecture decision records) that support future maintenance*

This section demonstrates how each component specification becomes actual, maintainable code—closing the loop from design to implementation.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

Contents

4.1 Section 1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

4.2 Section 2

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

4.3 Conclusion

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

5 | Validation

Validation (Requirements Verification and Testing)

In this section you demonstrate how your implementation satisfies the initial requirements through clear testing methods and concise examples—suitable for a bachelor-level project:

1. *Restate each key functional and non-functional requirement from your Analysis and Design sections*
2. *Describe the testing approach for each requirement (for example, unit tests, manual acceptance checks or scenario walkthroughs)*
3. *Provide concrete test cases or usage examples that show how you verify each requirement in practice*
4. *Summarize actual versus expected outcomes, indicating pass/fail status for each test*
5. *Include brief snippets of test code or sample console outputs to illustrate your procedures*
6. *Note any gaps or deviations and suggest simple fixes or areas for future improvement*
7. *If a feature wasn't intended for specific scenarios (e.g. high-load), omit unrealistic stress tests and clearly document its current limitations*

This focused structure ties every requirement directly to validation results, using examples and methods you can realistically carry out at the bachelor level.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

Contents

5.1 Section 1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

5.2 Section 2

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

5.3 Conclusion

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

6 | Conclusion

6.1 Project summary

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

6.2 Comparison with the initial objectives

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

6.3 Encountered difficulties

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

6.4 Future perspectives

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

Glossary

Bibliography