Computer Science Department

Final Project Report Document– Spring 2024

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| Title of the project: | “NU Life Hub: Connecting students, Events, Marketplace" |
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## 1. Executive Summary (10%)

The NU Life Hub project aims to address the fragmentation of information and resources for Nazarbayev University (NU) students by offering a centralized platform designed specifically for their needs. The project addresses students' challenges in finding and participating in campus activities, accessing a convenient marketplace to fulfill their needs, and staying informed about various campus events. The NU Life Hub solution will be a comprehensive platform that combines event management, marketplace, and community engagement functions to improve the overall university experience.

During the project, extensive research was conducted to understand existing solutions and approaches to address similar challenges university communities face. This analysis informed the design and development of the NU Life Hub, ensuring that best practices were embedded into the platform and critical challenges were effectively addressed.

The design approach involves a detailed description of the NU Life Hub solution, including its software architecture, algorithms, workflows, and features. Third-party components, such as authentication services and calendar APIs, were integrated to extend the platform's functionality and improve the user experience.

The project was a testament to the power of collaboration, with design decisions and adaptations made during development to meet changing requirements. Challenges encountered during the project were overcome through a shared commitment to problem-solving and continuous improvement, reflecting the dedication and teamwork that went into the project.

The NU Life Hub solution was evaluated to determine its effectiveness in addressing the identified challenges. Data from the platform's user feedback, usability testing, and engagement metrics provided insight into its effectiveness and user satisfaction.

In conclusion, the NU Life Hub project has made significant progress in developing a centralised platform to enhance the lives of NU students on campus. Looking ahead, the project has exciting plans, including implementing additional features, refining existing features, and conducting further evaluations to measure the platform's impact on student engagement and community building. These future endeavours promise to take the NU Life Hub project to new heights.

## 2. Introduction (10%)

At Nazarbayev University (NU), students need help accessing campus resources, staying informed about events, and participating in community activities due to the fragmented nature of information dissemination. Students rely on disparate channels such as email, social media, and word of mouth to learn about campus events and participate in marketplace activities. This fragmented approach leads to inefficiencies, missed opportunities, and a lack of cohesion in the student body.

The motivation behind the NU Life Hub project stems from the need to address these issues and create a unified platform that fosters a sense of community and improves the overall student experience of the university. The project aims to create a centralized solution to simplify event management, market access, and community interaction, facilitating access to vital campus resources and information.

The proposed solution, NU Life Hub, is a comprehensive platform designed specifically for NU students. It integrates features such as event management, marketplace announcements, user profiles, notifications, and community engagement features into a single platform. By centralizing these services, NU Life Hub aims to provide a seamless experience for students to find, participate in, and organize events on campus and buy and sell merchandise in the university community.

The organization of this report follows a structured approach, beginning with a "Background and Related Work" section that reviews existing solutions and approaches used to address similar challenges faced by university communities. This is followed by a detailed description of the NU Life Hub solution, including its architecture, algorithms, features, and third-party integrations. The report then discusses the implementation of the project over the past two semesters, including design decisions made, challenges encountered, and lessons learned. An evaluation of the NU Life Hub solution is then presented, outlining the methods used to assess its effectiveness in solving the identified problems. Finally, the report concludes with a discussion of future work and recommendations for further improvements to the NU Life Hub platform.

## 3. Background and Related Work (15%)

In recent years, universities worldwide have realized the importance of improving the quality of student life on campus by implementing centralized platforms that facilitate the management of events, market transactions, and community engagement. Several approaches have been used to address such challenges facing university communities with varying degrees of success.

One common approach is to develop campus-wide event management systems that allow students to find, participate in, and organize a variety of events on campus. Platforms such as CampusGroups, OrgSync, and Presence offer event creation, registration, promotion, and attendance tracking features. These systems simplify the event management process, improve communication between organizers and attendees, and increase student engagement on campus.

Similarly, marketplace platforms explicitly created for university communities have emerged to provide a convenient way for students to buy, sell, and exchange goods and services within the campus ecosystem. Examples include Facebook Marketplace groups, university classifieds sites, and specialized marketplace applications such as StuDocu and BookScouter. These platforms offer categories for textbooks, furniture, electronics, and other products, making it easy for students to transact with each other.

University clubs and organizations also use social media platforms such as Facebook groups and Slack to communicate with members, share news, and promote events. While these platforms are practical communication tools, they need more centralized functions to manage events, market transactions, and track user engagement.

Despite the availability of these solutions, Nazarbayev University students continue to need help accessing campus resources, communicating about events, and participating in community activities. The fragmented nature of information dissemination through email, social media, and word of mouth prevents students from effectively finding and participating in campus events and market operations.

The NU Life Hub project is designed to build on existing approaches and provide a comprehensive platform for NU students. By integrating event management, marketplace features, user profiles, notifications, and community engagement features into a single platform, NU Life Hub aims to address NU students' challenges and improve their lives on campus.

## 4. Project Approach (20%)

The NU Life Hub project takes an integrated approach to addressing the challenges faced by Nazarbayev University (NU) students by providing a centralized platform designed specifically for their needs. The solution includes event management, marketplace functionality, user profiles, notifications, and community engagement features. This section describes the NU Life Hub solution, including its architecture, algorithms, workflows, roles, features, and third-party components.

Software Architecture:

The NU Life Hub software architecture is modular and consists of a frontend and backend linked together via APIs. The frontend is built using React, a JavaScript library for creating user interfaces, and the backend is developed using Django, a high-level Python web framework.

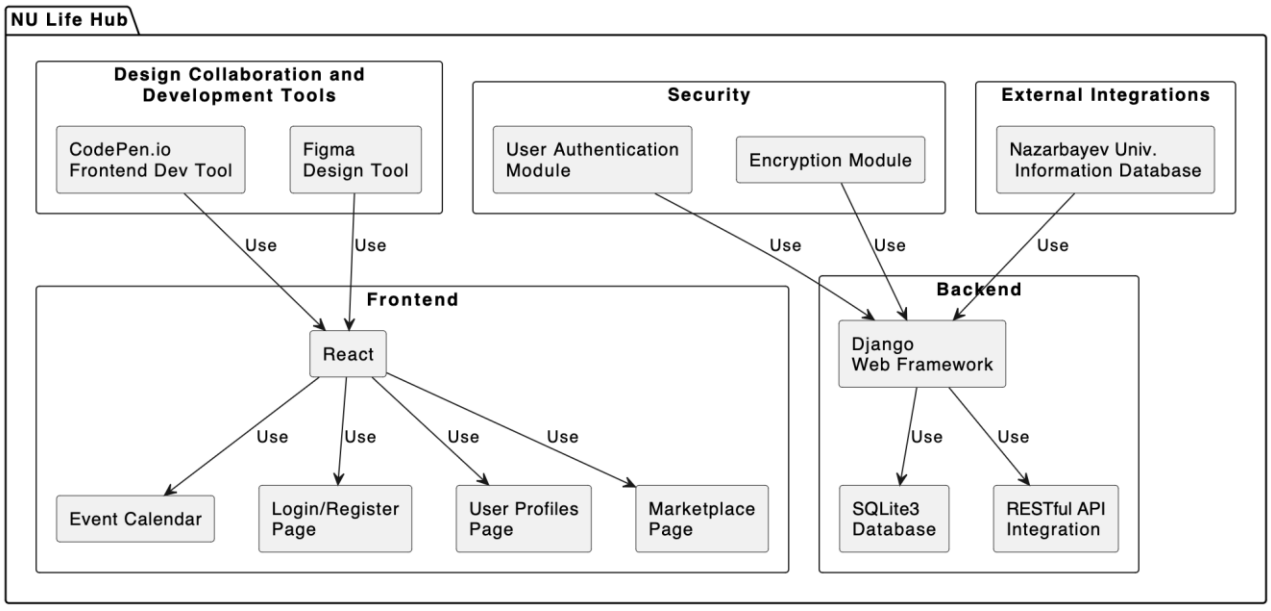


Figure 1: Architecture Diagram:

Architecture Diagram
This diagram illustrates the NU Life Hub system architecture, comprising key components:

**Frontend:**

- React framework.
- Includes modules for Event Calendar, Login/Register, User Profiles, and Marketplace.

**Backend:**

- Employs the Django web framework.
- Integrates an Postgresыфв database and RESTful API.

**Security:**

- Encompasses User Authentication and Encryption modules.

**Design Collaboration and Development Tools:**

- Figma for design collaboration.
- CodePen.io for frontend development.

**External Integrations:**

Connects with the Nazarbayev University Information Database.

Arrows denote dependencies; for instance, React relies on modules like Event Calendar, Login/Register, User Profiles, and Marketplace. Similarly, Django relies on the SQLite3 database and RESTful API

integration.

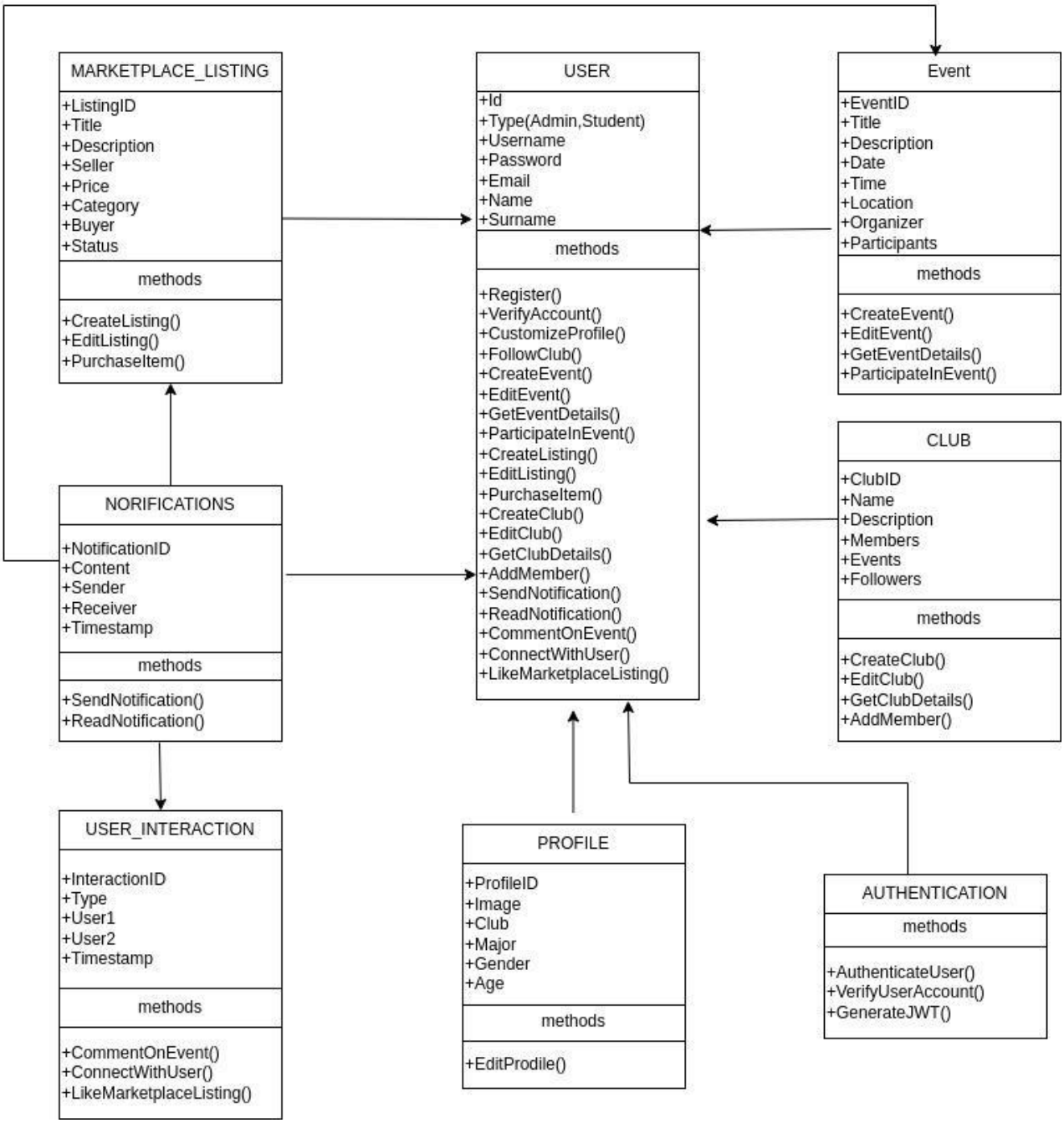


Figure 2: UML Diagram

Image description in bullet points:

- The image is a table showing the database schema for a marketplace website.
- The table has the following columns:
    - ListingID: The unique identifier for a listing.
    - Title: The title of the listing.
    - Description: A description of the listing.
    - Seller: The username of the seller.
    - Price: The price of the listing.
    - Category: The category of the listing.
    - Buyer: The username of the buyer (optional).

    - Status: The status of the listing (e.g., active, pending, sold).
- The table also has a number of methods associated with it, including:
    - CreateListing()
    - EditListing()
    - PurchaseItem()
    - FollowClub()
    - CreateEvent()
    - EditEvent()
    - GetEventDetails()
    - ParticipateInEvent()
    - SendNotification()
    - ReadNotification()
    - CommentOnEvent()
    - ConnectWithUser()
    - LikeMarketplaceListing()
- The table includes a number of relationships between the different entities, such as:
    - A listing can have one and only one seller.
    - A listing can have one and only one buyer (or none, if the listing has not yet been sold).
    - A buyer can purchase many listings.
    - A listing can belong to one and only one category.
    - A buyer can follow many clubs, and a club can have many followers.
    - A club can create many events, and an event can be created by many clubs.
    - A user can participate in many events, and an event can have many participants.
    - A user can send notifications to other users, and a user can receive notifications from other users.

Overall, the image shows the database schema for a marketplace website where users can buy and sell items, create and join clubs, and create and participate in events.
Algorithms:

Event Recommendation Algorithm: A collaborative filtering algorithm recommends events to users based on their interests, past participation in events, and interaction with the platform.

Marketplace Search Algorithm: The marketplace search algorithm uses keyword matching and filtering to allow users to find relevant listings based on their search queries and preferences.

Workflow:

User Registration and Authentication: Users register with their NU credentials and undergo a verification process to gain secure access to the platform.

Event Management: Event organizers create and post events with details, schedule and target audience.

Marketplace Ads: Students post ads to sell or exchange items on the marketplace, providing product details, descriptions, and images.

User Interaction: Users view events and announcements on the marketplace, interact with each other through comments and likes, and make connections based on shared interests.

Roles:

Administrator: Manages platform settings and user accounts and monitors platform performance.

Event Organizer: Creates and manages events, promotes them to target audiences, and tracks attendance.

Student User: Views events and marketplace announcements, interacts with other users, and participates in on-campus events.

Functions:

Event Management: Create, manage, and promote events.

Marketplace: Buy and sell items in the campus community.

User Profiles: Customize profiles, track event participation, and connect with other users.

Notifications: Receive event reminders, trading platform announcement updates, and platform announcements.

Community Interaction: Leave comments, give likes, and connect with others based on common interests.

Tools:

Version control: Git for code management and collaboration.

Project Management: Trello for task tracking and Agile development.

Testing: Jest and Enzyme are used for frontend testing, and Django Testing Framework is used for backend testing.

Docker: Docker is used for containerization, allowing the NU Life Hub application and its dependencies to be packaged in portable containers. This ensures consistency across environments and simplifies deployment.

PostgreSQL: PostgreSQL is used as the relational database management system for the NU Life Hub platform. It provides robust data storage and management capabilities, ensuring efficient handling of user data, event information, marketplace announcements, and other platform objects.

Chatbot: The project also includes a chatbot feature through which users can interactively ask questions regarding information about the university, residence life, and residential services. The chatbot uses natural language processing (NLP) algorithms to understand user queries and provide relevant answers. This feature is designed to increase user engagement and provide quick access to information, improving the overall user experience of the NU Life Hub platform.

Use case diagram:

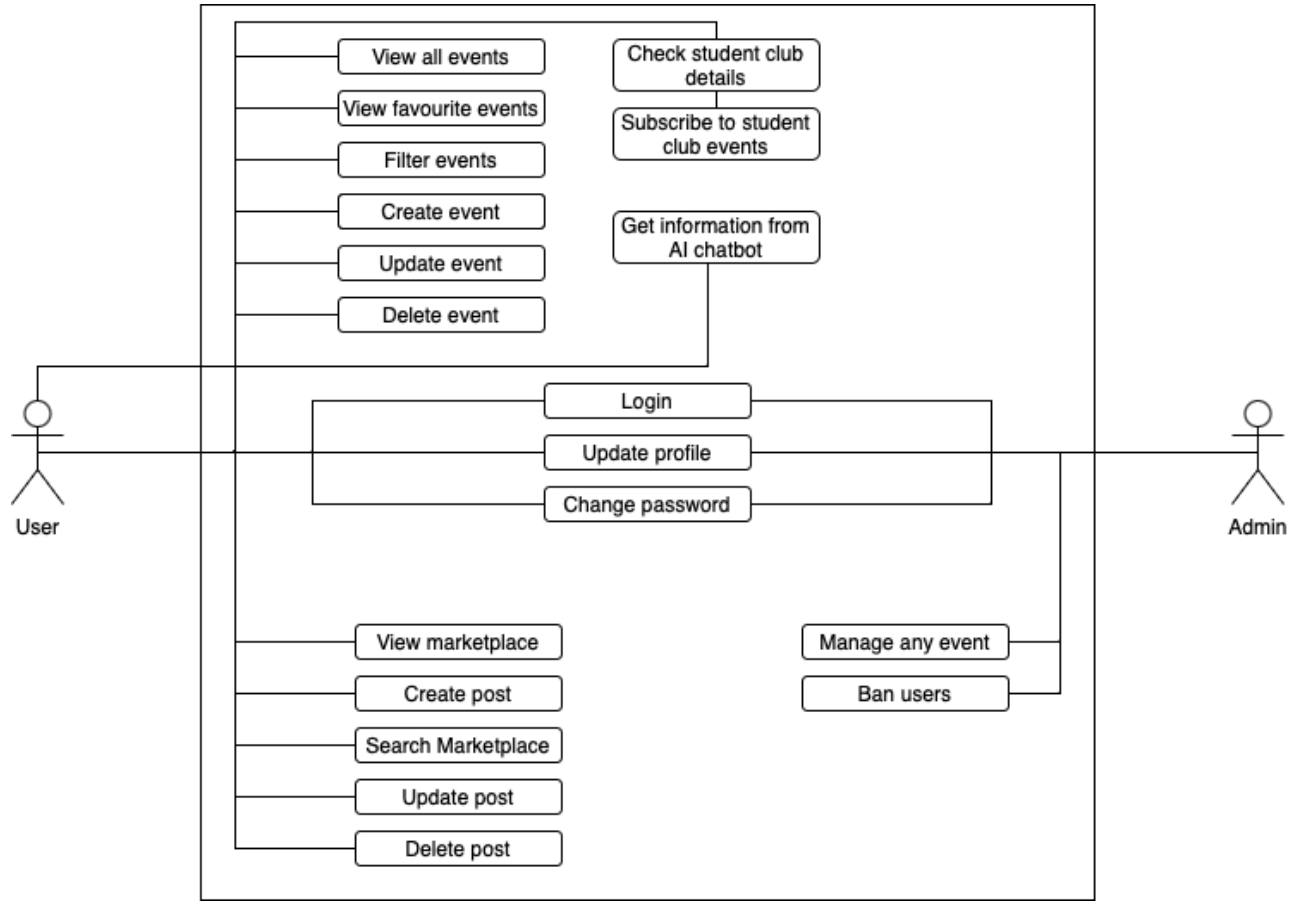


Figure 3: Use case Diagram

The use case diagram illustrates the interaction between the different participants (users, event organizers, administrators) and system components (event management, marketplace, user profiles, notifications) within the NU Life Hub platform.

| ID | Risk Description | Likelihood | Impact | Risk Level | Mitigation Strategy |
|---|---|---|---|---|---|
| 1 | Delay in software development | High | High | High | Implement Agile development methodologies to allow for flexibility and adaptability. Prioritize tasks and features to ensure critical components are delivered on time. |
| 2 | Security vulnerabilities | Medium | High | High | Conduct regular security audits and testing throughout the development process. Implement encryption, authentication, and other security measures to mitigate risks. |
| 3 | User adoption rate lower than anticipated | Medium | High | High | Increase user engagement through targeted marketing and promotions within the university community. Gather feedback from early users to improve platform usability. |
| 4 | Technical challenges and limitations | High | High | High | Continuously assess and address technical challenges during development. Seek assistance from experienced developers or consultants when encountering complex issues. |

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| 5 | Inadequate testing and quality assurance | Medium | High | High | Implement comprehensive testing strategies, including unit testing, integration testing, and user acceptance testing. Prioritize quality assurance throughout development. |
| 6 | Data loss or corruption | Medium | High | High | Implement regular data backups and recovery procedures. Utilize reliable hosting services with built-in data redundancy and disaster recovery capabilities. |
| 7 | Scope creep and feature creep | High | High | High | Define clear project objectives and scope from the outset. Establish a change control process to evaluate and prioritize new feature requests and scope changes. |
| 8 | Third-party dependencies | Medium | High | High | Identify and assess potential third-party dependencies early in the project. Have backup plans in place in case of unexpected issues or discontinuation of third-party services. |

Table 1. Risk Register table

The risk register table is a structured overview of the potential risks that could affect the successful completion of our project. Each risk has a unique identifier and is described in terms of probability, impact and overall risk level. Probability refers to the likelihood of the risk occurring and impact refers to the severity of the consequences. The risk level combines these factors to prioritize risks for mitigation. For each risk, a mitigation strategy is outlined to eliminate and minimize its potential impact. By systematically analyzing and addressing these risks, we strive to proactively manage issues throughout the project lifecycle, ensuring successful completion of the project within the established constraints and objectives.

| ID | Requirement Description | Implemented Feature/Component | Test Case ID(s) | Status |
|---|---|---|---|---|
| 1 | User Registration | User Authentication Module | TC-001, TC-002 | Complete |
| 2 | Marketplace feature | Marketplace Module | TC-003, TC-004 | Complete |
| 3 | Event management | Event Manager Module | TC-005, TC-006 | Complete |
| 4 | User profile customization | User Profile Module | TC-007, TC-008 | Complete |
| 5 | Notification system | Notification Module | TC-009, TC-010 | Complete |
| 6 | Community interaction | Community Interaction Module | TC-011, TC-012 | Complete |
| 7 | Chatbot for university-related queries | Chatbot Module | TC-013, TC-014 | Complete |
| 8 | Security measures | Authentication & Authorization Module | TC-015, TC-016 | Complete |
| 9 | Integration with Docker for containerization | Docker Integration Module | TC-017, TC-018 | Complete |
| 10 | Integration with PostgreSQL for database management | PostgreSQL Integration Module | TC-019, TC-020 | Complete |
| 11 | Usability testing | Usability Testing | N/A | Pending |
| 12 | Performance testing | Performance Testing | N/A | Pending |
| 13 | User feedback collection for evaluation | User Feedback Collection | N/A | Pending |
| 14 | Integration with third-party | Third-party Integration Module | TC-021, TC-022 | Complete |

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| | tools (e.g., SendGrid) | | | |
| 15 | User profile search functionality | Search Module | TC-023, TC-024 | Complete |
| 16 | Event filtering and sorting options | Event Filtering Module | TC-025, TC-026 | Complete |
| 17 | Marketplace listing search and browsing | Marketplace Search Module | TC-027, TC-028 | Complete |
| 18 | User messaging system | Messaging Module | TC-029, TC-030 | Complete |
| 19 | User profile follow feature | Follow User Module | TC-031, TC-032 | Complete |
| 20 | Event creation and management by administrators | Admin Event Management Module | TC-033, TC-034 | Complete |
| 21 | Report generation for marketplace transactions | Transaction Reporting Module | TC-035, TC-036 | Complete |
| 22 | Support for multiple user roles (e.g., student, admin) | Role-based Access Control Module | TC-037, TC-038 | Complete |
| 23 | Integration with university calendar for event scheduling | Calendar Integration Module | TC-039, TC-040 | Complete |
| 24 | User authentication via university credentials | University Authentication Module | TC-041, TC-042 | Complete |
| 25 | Integration with university email system for notifications | Email Notification Integration Module | TC-043, TC-044 | Complete |

Table 2. Requirements Traceability Matrix (RTM)

The Requirements Traceability Matrix (RTM) for the NU Life Hub project serves as a comprehensive document that links project requirements to the various project deliverables, ensuring that each requirement is addressed and implemented appropriately throughout the project lifecycle. RTM provides a structured framework to track the flow of requirements from their initial definition to their validation and verification stages. It helps stakeholders understand how each requirement contributes to the overall project goals and provides transparency and accountability to the development process.

In RTM, each requirement is assigned a unique identifier, along with detailed specifications describing its functionality and purpose. These requirements are categorized by importance and prioritized according to the overall project goals and objectives. In addition, the RTM identifies the stakeholders who requested each requirement and the department responsible for its implementation, ensuring that roles and responsibilities within the project team are clearly defined.

For each requirement listed in the RTM, the document includes information about the associated deliverables or work breakdown structure (WBS) components, indicating where and how the requirement will be addressed in the project's delivery structure. Test cases are also identified to verify and validate the functionality of each requirement, ensuring that it meets stakeholder expectations and project specifications.

The RTM is updated regularly throughout the project lifecycle to reflect changes in requirements, implementation status, and test results. It serves as a central point of reference for project stakeholders, ensuring effective communication, decision making and risk management. By maintaining traceability

between requirements and project deliverables, RTM helps ensure successful completion of the NU Life Hub project by meeting stakeholder needs and expectations.

## 5. Project Execution (15%)

Over the past two semesters, the NU Life Hub project has gone through various stages of development, including design, implementation, testing, and deployment. The project team faced a number of challenges and made important design decisions to address them effectively.

Design decisions:

Modular Architecture: In the early stages of the project, the team decided to use a modular architecture to ensure scalability and maintainability. This approach facilitated the separation of concerns and allowed different team members to work on different components simultaneously.

User-centred design: The design process focused on understanding the needs and preferences of NU students to create a user-friendly interface. Iterative feedback sessions and usability testing were conducted to refine the user experience and improve the platform's usability.

Project Changes:

Scope Adjustments: Throughout the project, the team adjusted the scope of work based on user feedback and changing requirements. Additional features, such as event recommendations and personalized notifications, added value to the platform.

Technology updates: As new technologies and frameworks emerged, the team periodically evaluated and incorporated them into the project to improve performance and stay relevant. For example, moving from traditional JavaScript to TypeScript improved code usability and developer productivity.

Adaptation to Agile: The project utilized the Agile development methodology, allowing flexibility and adaptability in response to changing priorities and stakeholder feedback. Sprint retrospectives were conducted regularly to identify areas for improvement and improve development processes.

Challenges and solutions:

Technical complexity: Integrating complex features such as event recommendation algorithms and market search functions posed technical challenges. The team addressed these challenges through collaborative problem-solving sessions, code reviews, and utilizing external resources such as online tutorials and documentation.

Resource constraints: Resource constraints, including time and labour, created challenges in meeting project deadlines and deliverables. To mitigate these constraints, the team prioritized tasks based on impact and feasibility, allocated resources wisely and sought support from faculty advisors as needed.

Lessons Learned:

Communication between team members and stakeholders was critical to the project's success. Regular meetings, progress updates, and transparent decision-making processes facilitated collaboration and shared goals.

Agility: Flexibility and adaptability allowed the team to respond effectively to changing requirements and unforeseen challenges. Agile principles such as iterative development and continuous feedback were instrumental in overcoming project complexities.

User-centred approach: Prioritizing user needs and preferences throughout the design and development process was crucial for creating a successful platform. User feedback and usability testing helped validate design decisions and ensure the platform met user expectations.

Overall, project implementation involved a combination of strategic planning, collaborative teamwork, and adaptive problem-solving to overcome challenges and create a successful solution that meets the needs of NU students.

## 6. Evaluation (20%)

A variety of evaluation methods, including user feedback, usage rates, and qualitative assessments, were used to assess the effectiveness of the NU Life Hub platform in addressing the challenges faced by Nazarbayev University (NU) students. The purpose of the evaluation was to determine how successfully the platform addresses disparate information and resources while improving the overall student experience on campus.

User Feedback:

Surveys: Surveys were conducted to gather feedback from platform users on their level of satisfaction, perceived usefulness, and suggestions for improvement. Questions were selected to assess various aspects of the platform, including event detection, marketplace functionality, user profiles, and overall user experience.

Qualitative assessments:

Usability Testing: Usability testing sessions were conducted with a sample group of NU students to evaluate the platform's user interface, navigation, and overall usability. Feedback from the usability testing sessions formed the basis for design refinements and usability improvements.

Data Analysis:

After collecting feedback and usage data, the platform was thoroughly analyzed to identify patterns, trends, and areas for improvement. Key metrics were compared against pre-defined success criteria to determine the platform's effectiveness in addressing the task.

Results:

Overall, the evaluation results showed positive results and demonstrated the effectiveness of the NU Life Hub platform in addressing fragmented information and resources for NU students. The platform received positive feedback from users, who were highly satisfied with various features and functions. Increased user engagement, event participation, and marketplace activity further validated the platform's impact on campus life and community building.

Future Directions:

While the initial evaluation yielded promising results, there is room for improvement and further development. Plans for next semester include implementing additional features such as a notification system, personalized user pages, and recommendation algorithms to enhance the platform's capabilities and

user experience. Continuous monitoring, feedback gathering, and iterative improvements will ensure that the platform remains effective and responsive to user needs in the long term.

## 7. Conclusion and possible future work (5%)

In conclusion, the development and evaluation of the NU Life Hub platform demonstrated its potential to address the challenges Nazarbayev University (NU) students face in accessing campus resources and information. Through a user-centered approach and an iterative development process, the platform has evolved into a comprehensive solution that promotes community engagement, enhances campus life, and shares resources among students.

The project's success is attributed to team collaboration, strategic planning, and a commitment to user satisfaction. Using user feedback, usage metrics, and qualitative assessments, the platform is continually refined to provide a seamless and intuitive user experience.

Possible future work:

Notification System: Implement a notification system to inform users of upcoming events, marketplace announcements, and real-time platform updates. Notifications can be personalized based on user preferences and activity history.

Personalized User Pages: Create personalized user pages where students can showcase their interests, track participation in campus events, and connect with other users. Customizable profiles increase user engagement and promote community interaction.

Recommendation Algorithms: Integrate recommendation algorithms to suggest relevant events, marketplace announcements, and campus resources based on user preferences and behaviour. Machine learning techniques can personalize recommendations and improve user satisfaction.

Advanced Analytics: Enhanced analytics capabilities will gather information on user behaviour, preferences, and trends. Data-driven decision-making will enable continuous improvement and optimization of the platform to better meet user needs.

Improve accessibility: Enforce standards and guidelines for platform accessibility for users with disabilities. Implement features such as compatibility with screen readers, keyboard navigation, and alternative text to images to make the platform more inclusive.

Expand marketplace capabilities: Expand marketplace capabilities to include additional categories such as home rentals, transportation services, and event tickets. Increasing the variety of listings will attract more users and help the peer-to-peer marketplace community thrive.

Integration with university systems: Explore integration with existing university systems such as academic calendars, student databases, and campus event schedules. Seamless integration will provide users a unified experience and access to all campus resources.

Outreach and Marketing: Launch targeted outreach and marketing campaigns to increase NU students' awareness of the platform and make it more popular. Collaborate with student organizations, faculty, and university administrators to promote the platform and encourage active participation.

By implementing these areas of future work, the NU Life Hub platform can continue to evolve and adapt to the changing needs of NU students. It will ultimately serve as a valuable resource to enhance the quality of life on campus and strengthen the university's sense of community.

## 8. References(5%)


1) https://www.campusgroups.com/product/home/
2) https://corq.app/
3) https://flipabit.dev/


**Related Articles**


1) Editor, P. B. | N. (2023, January 29). *Safer alternative to Facebook Marketplace: Rumie app caters to students*. The Reflector. https://www.reflector-online.com/news/article_ca9ab5fc-a02b-11ed-b6ec-b3a00c0aa361.html

2) Papadopoulou, A. (2020, April 28). *How to Build an Online Learning Community (In 2020)*. Learnworlds. https://www.learnworlds.com/build-online-learning-community/

3) Kelly. (2020, August 4). *How to Develop a College Event Management Web Application?* Krify - Web and Mobile App Design & Development Company in India & UK. https://krify.co/how-to-develop-a-college-event-management-web-application/


## 9. Appendix

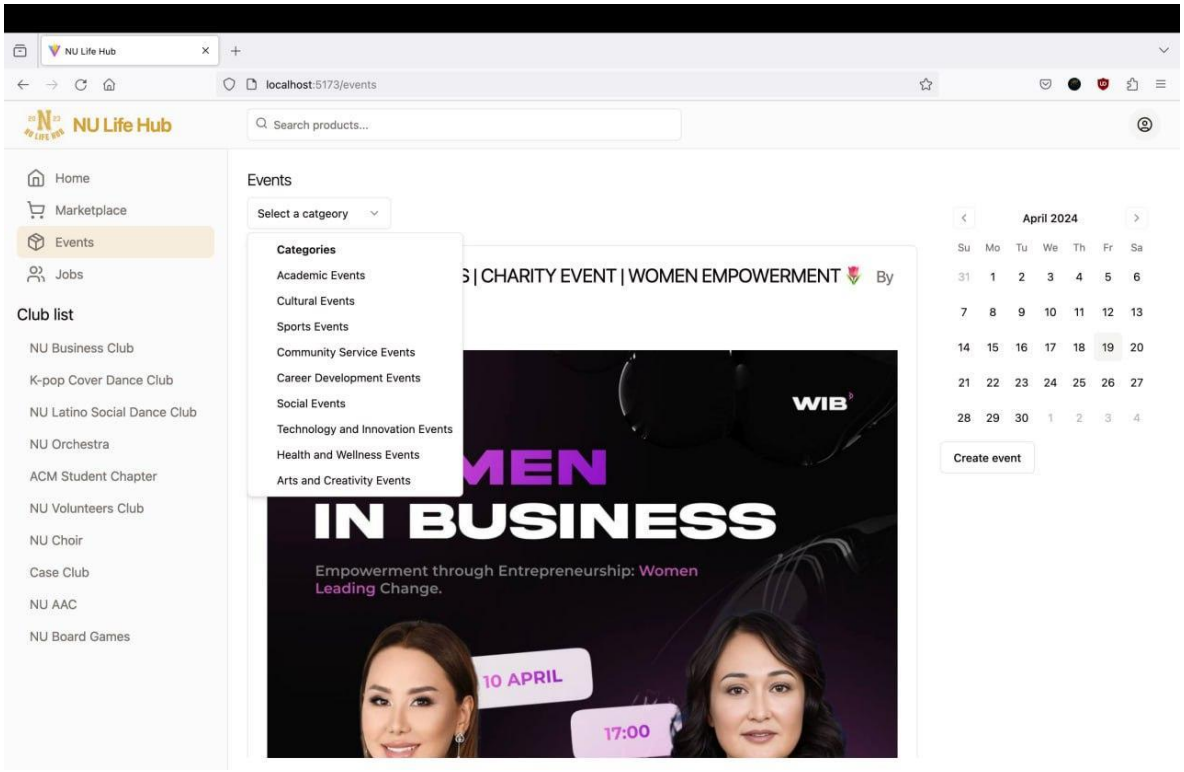


Figure 4: Screenshot of Events Page

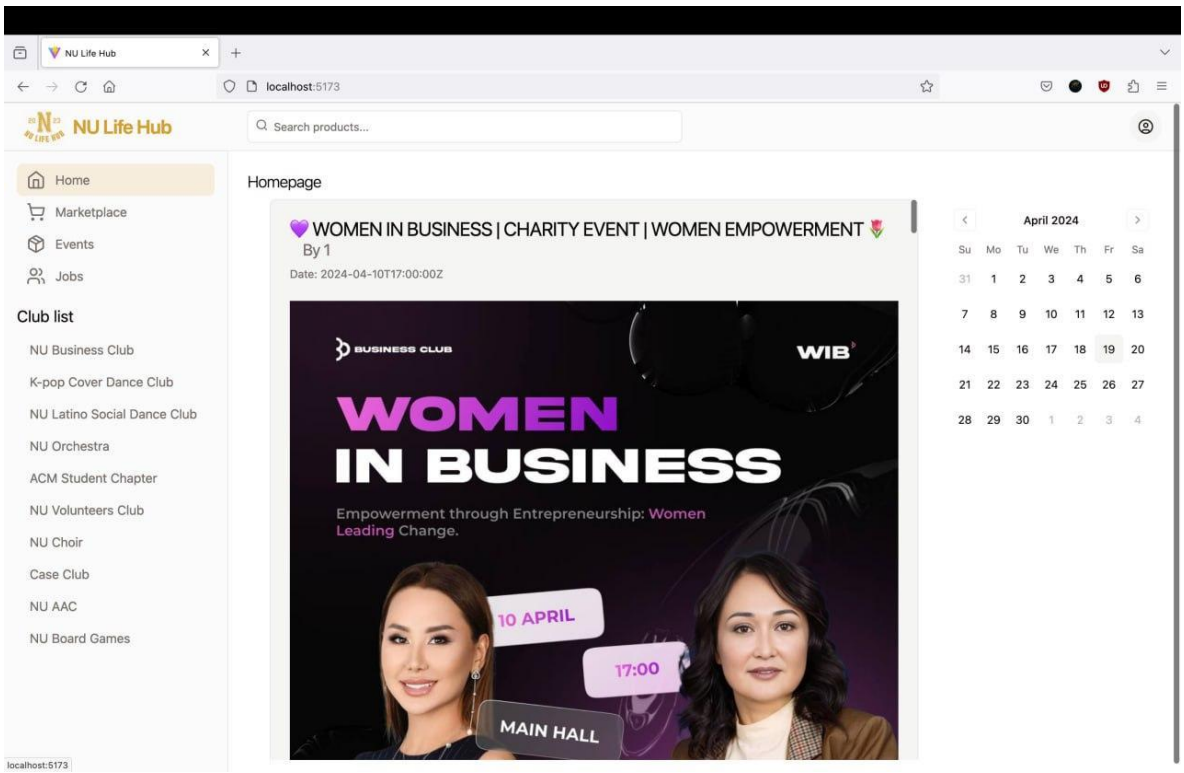


Figure 5: Screenshot of Home Page

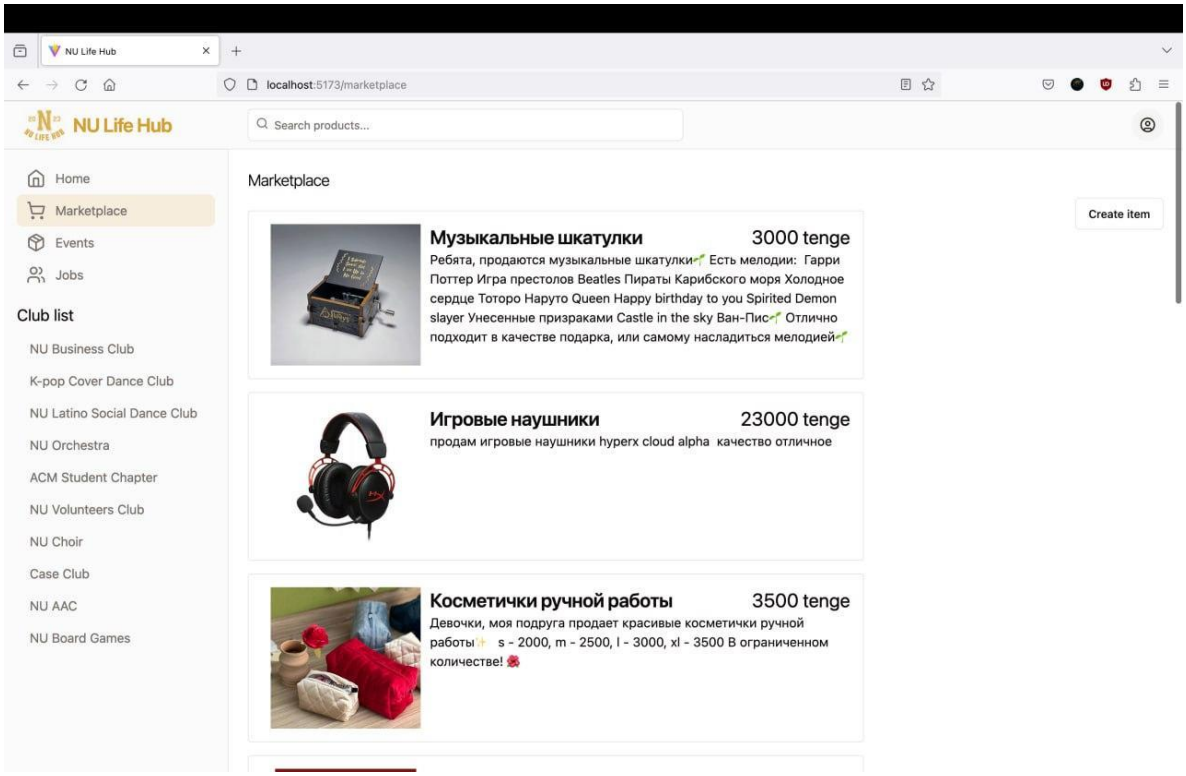


Figure 6: Screenshot of Marketplace Page

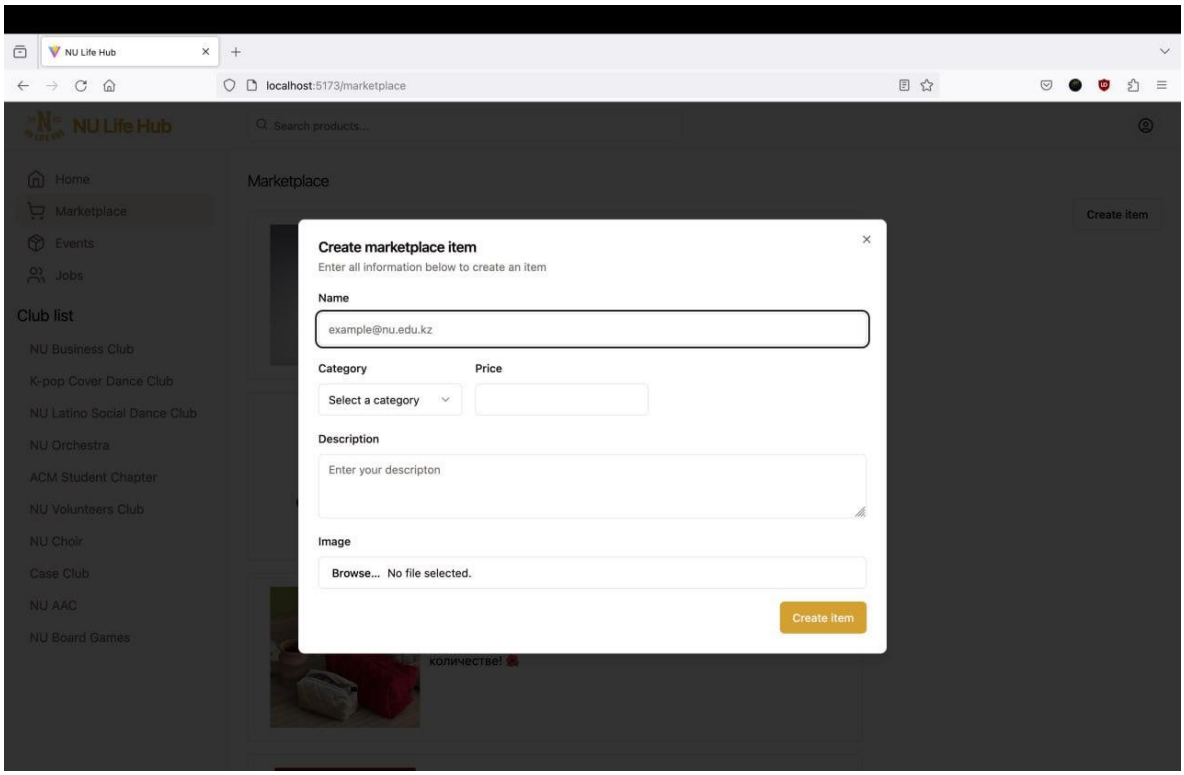


Figure 7: Screenshot of Create Marketplace Item

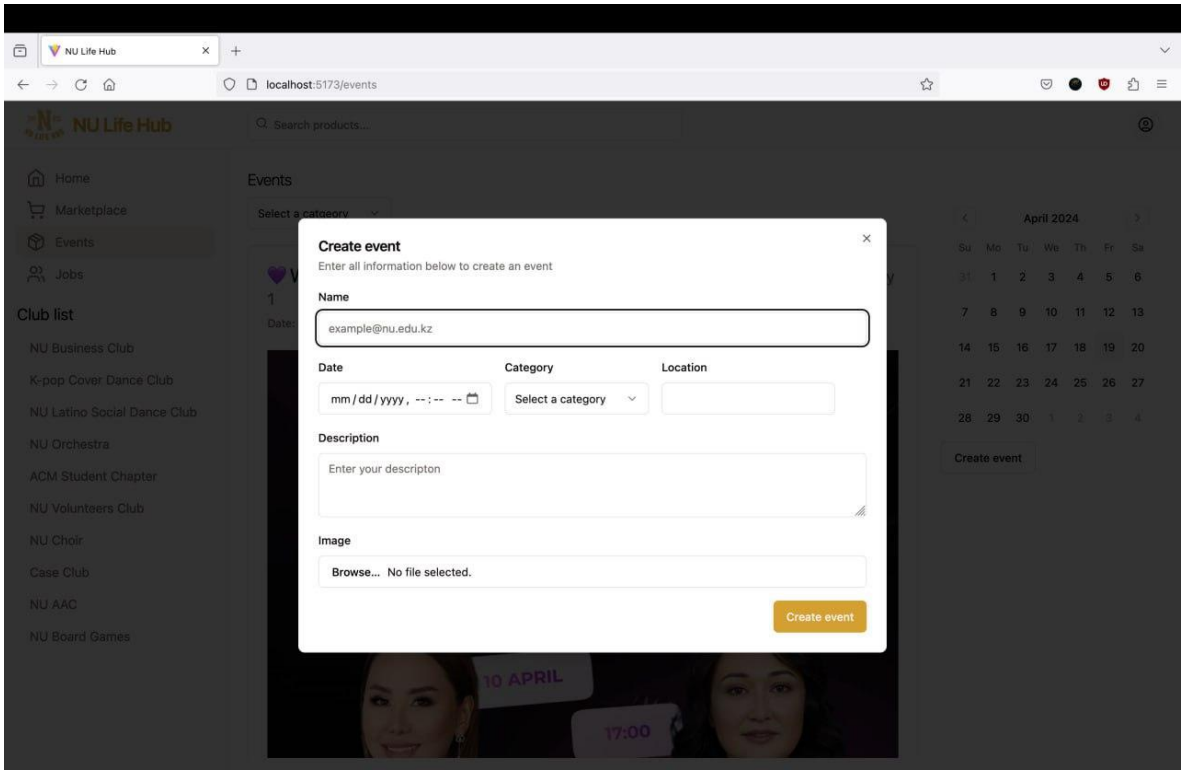


Figure 8: Screenshot of Create event

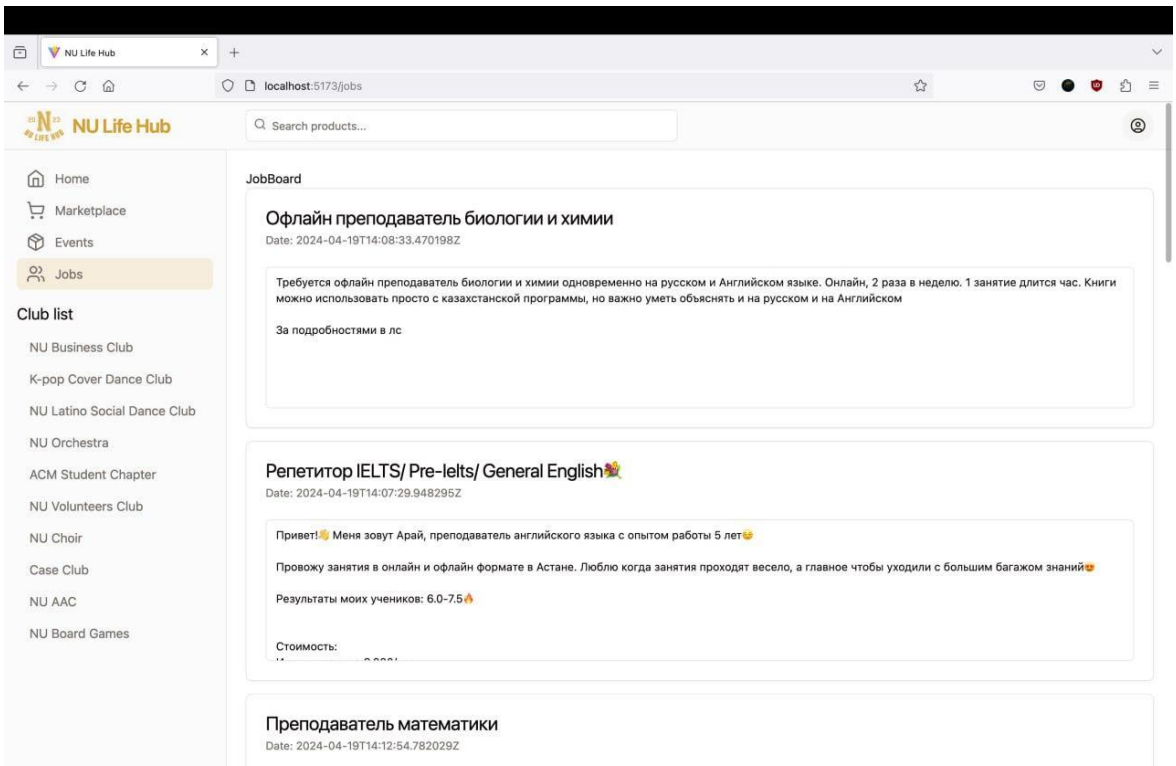


Figure 9: Screenshot of Jobs Page