

CSCI 408 Senior Project

Final Project Report

Project title	“EduConnect”
Group members	<p>Yeressil Taupiyk</p> <p>Ali Kuanov</p> <p>Assadbek Abdumazhitov</p> <p>Yarkinbek Narkulov</p> <p>Beksultan Yestemes</p>
Advisers	Anara Sandygulova, Marat Isteleyev

1. Executive Summary

1.1) Provide a concise summary of the project, highlighting the problem statement, key objectives, methodology, and main results.

The main idea of the project titled **“EduConnect”** is to address the challenges of early childhood education and development through a multidisciplinary, digital platform. Currently, Kazakhstani parents face significant difficulties in finding available kindergartens and extracurricular activities for their children. Moreover, there is no local platform that allows parents to receive real-time updates on their children’s performance, schedules, and daily activities. While platforms such as Google Calendar, WhatsApp, and Google Photos can individually provide some of these services, there is no single application that integrates all these functionalities. This gap makes it difficult for parents, teachers, and organizations to coordinate effectively. Our application aims to bridge this gap by offering an all-in-one solution that simplifies the lives of all relevant stakeholders.

The primary objectives of the project were to:

- Make the enrollment process for kindergartens and extracurricular activities more efficient
- Enable real-time communication between parents and teachers
- Allow parents to control their children’s progress and schedules
- Provide parents with updates on their children’s daily activities with the help of posts
- Create a well-organized environment where organizations and teachers can offer their services and manage operations.

To achieve objectives mentioned above, the team used the Incremental Process Model, where team members worked in parallel while having weekly meetings. By the end of the semester the team has created a working application that has functionalities including user authentication, teacher and organization management, real-time chat, gallery, calendar, and notifications.

1.2) Explain how the project aligns with the design, implementation, and evaluation of a computing-based solution.

The application itself was built using Flutter as a front end platform for mobile devices, Node.js was used for backend while PostgreSQL was used for data storage. During the development process tools including GitHub and Android Studio were used to collaborate and manage the project more efficiently. The design of the application was created in Figma by an experienced team member.

At the end of the project development user testing phase involving parents and tutors was conducted to understand usability of the application. The evaluation was conducted in person to understand whether the initial objectives of the project were met by the team. We received multiple positive feedbacks from both parents and teachers regarding the functionalities of the application; at the same time suggestions for improvements were given to us regarding the design and media upload speed.

2. Introduction

2.1) Clearly describe the problem, motivation, and significance of the project.

In all of the CIS(Commonwealth of Independent States) countries parents face a large number of problems related to managing their children's early education and extracurricular activities from the day their children are born. Problems including availability of kindergartens, bureaucracy, and paperwork are painful processes. The lack of a centralized platform for activity tracking, kindergarten enrollment and real-time updates makes the situation even worse. These days parents have to rely on multiple platforms to get engaged in their children's lives. This leads to missed updates, miscommunication, and added stress.

2.2) Provide a brief overview of the proposed solution and outline the organization of the report.

Problems mentioned above motivated us to come up with a solution that simplifies the entire process of managing a child's early development journey for all interested parties which

includes parents, teachers, and organizations. Our goal is to support all relevant stakeholders by providing a cohesive platform where all their needs are met.

By providing a platform where parents can enroll their children to all types of educational and extracurricular services we addressed most of the issues that they face.

This report is organized into the following sections:

- Section 3 reviews background information and related work
- Section 4 describes how we approached and implemented the project
- Section 5 discusses collaboration of our team and issues that we have faced
- Section 6 presents user feedback and evaluation process
- Section 7 concludes the report and outlines future work
- Section 8 contains references

3. Background and Related Work

3.1) Discuss prior research, existing solutions, and related work.

Numerous research projects have been written about applications that ease kindergarten and extracurricular activities of children for parents, business owners, and teachers. For instance, Tuliao, Duldulao, Pagtaconan, and Galang (2015) developed a mobile learning application for kindergarten highlighting the process and key challenges. Another study conducted by Ke and Wu (2022) depicts that there is a need in the market for an application that enables a user-friendly information management system. There are several applications in the market that have certain similarities and differences when it comes to functionalities. For instance, Brightwheel is a famous “Shark Tank” product that offers features such as parent communication and lesson planning, Illumine is another application used in kindergartens that keeps track of attendance, billing and parent communication. However, these tools are largely fragmented and lack the localization needed to the Kazakhstani and CIS market which are our primary target. Additionally, the application created by our team has more functionalities and will not be as expensive as the above -mentioned products.

3.2) Compare and contrast various approaches to justify your selected methodology.

In terms of methodology we used Incremental Process Model and to be precise the Parallel Development Model which allows each developer to work separately on different functionalities (authentication, chat, profile page, database, calendar) at the same time. Compared to other methods such as waterfall or fully agile methods this approach offers more flexibility to our team making the whole development process efficient timewise.

3.3) Demonstrate an understanding of computing-based solutions by analyzing existing literature.

From a computing-based perspective, our approach draws from a principle of modular architecture, role-based access control where for each role there are different functionalities and information, and real-time client-server communication.

4. Project Approach

4.1) Provide a detailed description of the solution, including software/hardware architecture, algorithms, workflows, roles, features, tools, and use case diagrams.

Software/ hardware architecture

The client application is built using Flutter. Communication with the backend is implemented using http requests. The backend is developed in Node.js using Express.js. It uses endpoints for authentication, events, messaging, payments, and service-related operations. Modular route handlers are defined per domain. Process management is handled via pm2. PostgreSQL serves as the backend database, structured to support complex relationships among users, children, services, and events. Data is accessed securely via the pg Node.js library, with environment variables managed through dotenv file. A Flask application handles image and media storage. It responds to authenticated requests from the frontend and retrieves URLs based on entries stored in the PostgreSQL database. All services run on a unified Linux server accessed via SSH. Node and Flask processes are managed with pm2 or system services. The system transitioned from SSH tunneling to direct local database connections, improving efficiency and reducing complexity.

Algorithms

The system mainly uses CRUD and data-fetch logic, the following algorithms were used:

- Filtering
- Chat
- Notifications
- Sorting

Workflows

We used following workflows:

- Authentication
 1. User fills information
 2. Code is generated and send to email
 3. Generated code is checked and user is verified

- Authorization
 1. Users log in(email, password)
 2. Relative pages/ widgets are opened according to roles

- Apply to organization
 1. Tutor registers
 2. Goes to my classes page
 3. Chooses organization/s
 4. Press the “Apply” button.

Roles

Our application supports multiple user roles (parents, staff, teachers) with dynamic interfaces.

Features

Key features of our application includes:

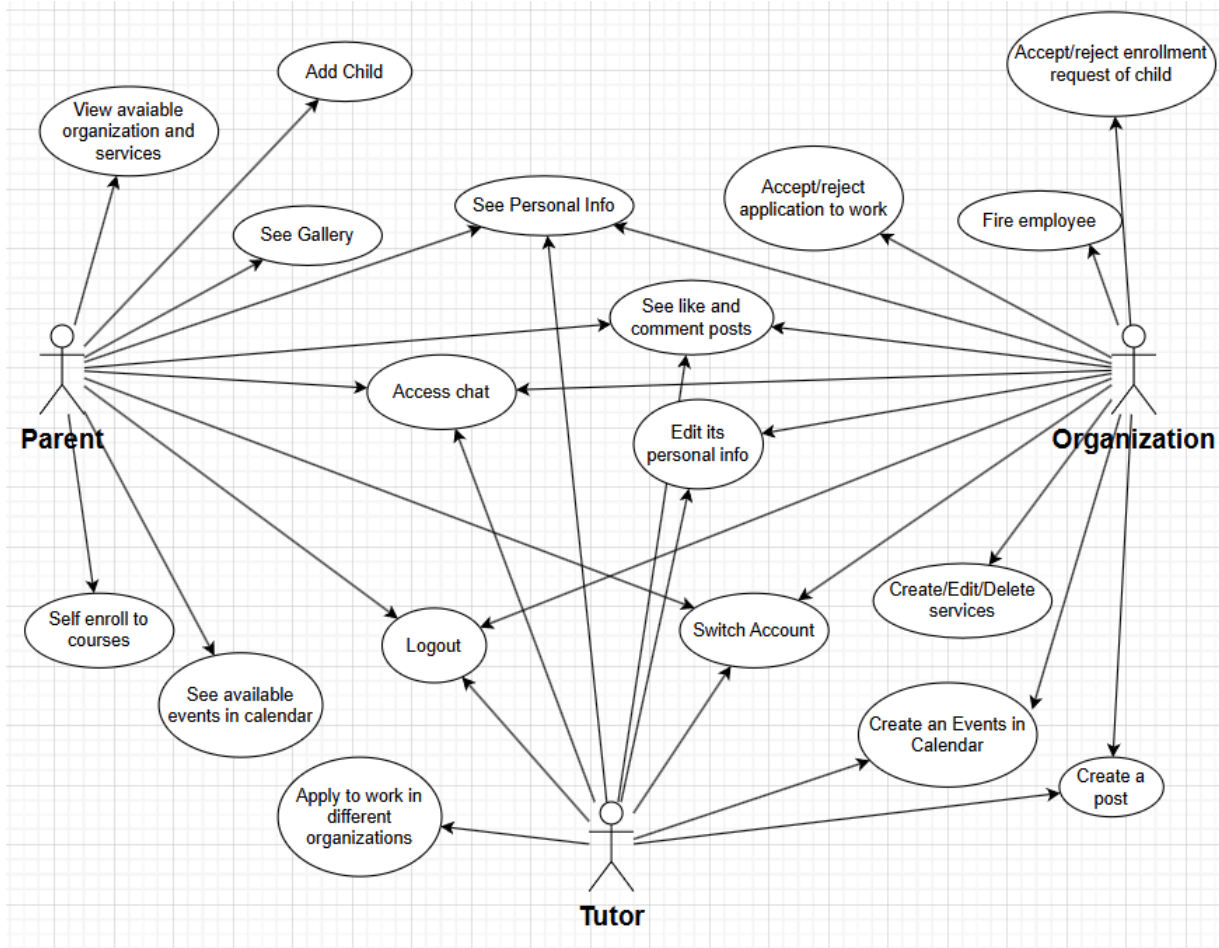
- Child management: parents can send enrollment requests to organizations and view child progress and schedules
- Posts and Gallery: tutors can create and edit posts containing media and tag all children. These posts appear in parent’s and organizations newsfeed
- Calendar: important events are accessible to both parents and teachers. Organizations and teachers can create events while parents can only see.
- Profile Management: users can manage their own profiles edit informations which are send immediately to database
- Chat System: real-time chat including image sending, audio recording

Tools

Tools used:

- Whatsapp/ Telegram: for team communication and advisor coordination
- GitHub: for version control and collaboration
- Android Studio and VS Code: for development and testing across different devices and emulators

Use Case Diagram



4.2) Explain any third-party components that the group did not implement themselves used and their integration.

We used flutter packages as http, cached_network_image, device_info_plus, flutter_secure_storage, google_fonts, image_picker, mailer. Also, we used the sendGrid site to send emails.

4.3) Show how the project team functioned effectively to develop a computing-based

solution.

To ensure effective development of our computer-based solution, our team adopted the famous Parallel Development Model under the broader Incremental Software Process. Each team member was given different functionalities to implement which will be later discussed in part five of the final report. All five members of the team worked on both front end and back end. Our development process went smoothly because of messengers such as Whatsapp and Telegram where we discussed the development process and problems that the members are facing. Additionally, weekly meetings with advisors and everyday advice from them gave us clear vision in our path of development of the project. GitHub was a useful tool where each team member pushed changes through individual branches.

5. Project Execution

5.1) Describe what happened over the course of the last two semesters, including design decisions made, changes in the project, what went wrong/right, how you dealt with the problems you encountered, etc.

In the first semester, after our team was formed, we decided to develop an application that would facilitate smooth interaction between teachers, parents, and organizations involved in kindergartens and extracurricular activities. We began by thoroughly discussing the overall implementation of the project, including the database structure, user interface, and core functionalities. These discussions were held during our weekly meetings, where we used whiteboards to draw architecture diagrams and plan workflows.

Based on those diagrams, we began development and initially focused on the parent side of the application. One of the main challenges we encountered during this phase was setting up the server. However, thanks to Ali's dedicated efforts, we were able to connect to a server hosted at his home, which enabled us to begin backend development. By the end of the first semester, we had a working application for parents, featuring a well-designed user interface created by Assadbek.

Our biggest obstacles at the beginning were setting up the development environment and designing the initial database. By researching online articles and watching tutorial videos, we were able to overcome these challenges and proceed with development.

During the second semester, we shifted our focus to developing the organization and teacher sides of the application. The major challenge this time was integrating the various modules developed by individual team members. Since we followed the Incremental Process Model, there were minor issues when connecting different functionalities into a unified system.

Fortunately, we resolved these issues through collaborative efforts and by learning from online resources such as YouTube tutorials.

By the end of the second semester, we had developed a fully functional application supporting three user roles, with an intuitive design and a robust, well-structured database.

5.2) Highlight teamwork aspects, such as how responsibilities were divided, collaborative problem-solving strategies, and leadership roles taken during the project.

We have decided during the first semester that all members of our team will work together on both backend and frontend. However, there are certain functionalities that were done by individual members of the team. Ali Kuanov did a great job on setting up the database and image storage server. Assadbek created the design of the application in Figma and during the process of development we mainly focused on his job for UI.

Functionalities that were completed by members of the team:

- Yeressil: chat (with audio and images),
- Ali: creation of the database, calendar, notifications, homepage of organization, child profile page
- Assadbek: side bar(report issue, about us, log out, switch account), app bar, dynamic navbar, services, teacher application, authorization page (log in, forgot password, email verification)
- Yarkinbek: creation of the database, authorization page, profile page
- Beksultan: parent home page, tutor home page, create a post by tutor, gallery page, view organizations page by parent, send enrollment request by parent, accept enrollment request by organization, organization profile page, tutor profile page, edit org profile, manage organization page, add new child page, my classes page for tutor, enrolled children page for tutor

All documents that we submitted were done by five members of our team. Beksultan is the leader of our project and role model to the rest of the team. To conclude, team members collaborated on almost all of the functionalities because doing one without another was not possible technically.

6. Evaluation

6.1) How did you evaluate the project solution to determine whether it did or did not solve the problem mentioned in the introduction?

The evaluation was conducted to understand whether the initial objectives of the project were met by the team. We created an apk version of the application and asked parents to register,

create a children's profile page, enroll to available kindergarten in the database, check chat functionality, and view posts. At the same time teachers were asked to register, apply to organizations, chat with parents, and create posts and meetings in the calendar. The testing was done in Android phones and fifteen people (10 parents and 5 teachers)

6.2) Clearly illustrate how the evaluation process validates the computing-based solution.

After using the system, users filled out a structured questionnaire based on the System Usability Scale (SUS) and custom questions targeting specific features.

Sample Metrics Collected:

Ease of navigation (1–5 scale)

Clarity of available actions (1–5)

Performance speed (1–5)

Satisfaction with image viewing and calendar management (1–5)

Open-ended feedback on confusing elements or bugs (1–5)

6.3) Include any data collected for the evaluation and give a brief analysis of it. In some cases, the group may need to have potential users try out the developed system and provide feedback using questionnaires as part of the evaluation. This is NOT about what tests the group ran to help detect bugs in the system as part of the normal

Quantitative Results Summary:

Evaluation Metric	Average Score (1-5)
Ease of Navigation	4.3
Clarity of available actions	4.4
Performance speed	4.6
Open-ended feedback on confusing elements or bugs	4.5

Overall satisfaction	4.4
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The collected data and user feedback validate that the solution successfully meets its intended goals:

- Users were able to complete core tasks.
- The system interface was rated highly usable and responsive.
- Role-based content delivery and secure media retrieval performed as expected.

The evaluation process confirms that the computing-based solution solves the real-world organizational and communication problems identified at the outset.

7. Conclusion and possible future work

7.1) Summarize key findings and contributions.

This project shows good integration of a modular system mixing Flutter frontend, Node.js and Flask-based backend, both of which are connected through a PostgreSQL database. In conclusion, our Kindergarten management app has met most of the requirements. We finished clear and distinct user roles such as Parent, Tutor, and Organization, each with specific access and operations. Parents have access to functionalities such as viewing available organizations and services, registering kids, seeing galleries, enrolling kids to courses, and seeing available events in the calendar. Tutors and organization owners create an events in calendar, create posts. Organization owners can accept/reject enrollment requests of children, edit its personal info, accept/reject applications to work, fire employees, create,edit, and delete services. And all of them can see personal info, access chat, see like and comment posts, switch accounts. Key requirements such as real-time chat, profile management, and structured server storage were created and extensively tested. The system's architecture guarantees some scalability and flexibility for future updates, which is by a prototype that shows core interaction flows.

During the course of the semester, we gained many valuable insights into project development and management. We learned the ins and out of Incremental Process Methodology such as its advantages and disadvantages. We gained good experience on how incremental

planning and immediate feedback can improve the project's quality and team coordination. However, we also came upon challenges such as time constraints and increasing requirements, which showed how important balancing flexibility and clear boundaries are.

7.2) Discuss potential future enhancements and areas for improvement.

Even though the prototype can definitively be called a mostly successful product, during the development, our gained experience gave us even more ideas on improvements that could have been implemented if we had more time on our hands.

One major enhancement we would like to do is build the database including even more information and connect and merge some of them for better usage experience. Due to constraints the UI/UX came out with barebones, how it was developed so it came out. Some styling and designing would be definitely good areas to focus on. Another area of focus can be “child development” tracker which will rely on machine learning by using assessment results and user feedback, which will allow the project to develop a tailored insight into each child the more the app is used.

In addition deploying the app in Google Play and other platforms like IOS can improve accessibility substantially and in the mean-time security, data privacy, and performance optimization can be prioritized for a more stable and secure experience for the users. All of these planned updates can bring the project to the next stage of its evolution, improving all the areas and making this a more fully developed, user-centered application.

8. References

1. Tuliao, D. P., Duldulao, T. J., Pagtaconan, W. C., & Galang, A. A. (2015). *Development of a mobile learning application for kindergarten: Process, issues, and challenges*. International Journal on Open and Distance e-Learning, **1**(1&2).
2. Ke, Y., & Wu, Y. (2022). *Design and implementation of kindergarten information management system under the background of Internet*. In Proceedings of the 2022 International Conference on Computer Science and Educational Informatization (pp. 312–316). IEEE.
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