Software Engineering Prototype

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1 Summary

Our team implemented the group order feature proposed in Dayn's Engineering Design Review (EDR) for the Student Smart Homes (SSH) application. This feature aims to streamline the process of consolidating and splitting grocery orders among students in shared accommodations. The prototype focused on three core functionalities: group order creation and participation, automated cost-sharing calculations, and enhanced UI for group order tracking and management.

Key EDR changes include minor database schema adjustments for better compatibility with existing systems and simplifying the UI for faster prototyping. The prototype demonstrates the viability of the proposed design through functional backend endpoints, an updated UI aligned with existing SSH design principles, and basic integration with simulated dependencies. We employed modern software engineering techniques (Next.js), including version control (GitHub with Pull-Requests), and continuous integration to ensure a robust implementation.

The prototype validates that the group order feature is technically feasible and addresses the pain points of manual calculations and communication errors identified in the EDR. Further development could include additional optional features, such as customizable delivery fee calculations and user notifications.

2 Detailed Report

2.1 Implementation overview

Our project integrates a modern tech stack to provide a seamless and efficient user experience. For the frontend, we utilized Next.js for its powerful server-side rendering capabilities and flexibility, paired with TailwindCSS to create responsive and visually appealing designs. To streamline development and maintain a consistent UI, we incorporated shadcn as our component library, enabling quick prototyping and high-quality components.

For our database, we chose Supabase as our PostgreSQL database provider. Supabase offered an intuitive interface, robust real-time capabilities, and easy integration with our frontend and backend. To manage database interactions, we used Prisma, a modern Object-Relational Mapper (ORM). Prisma simplified schema definition, query construction, and database migrations, ensuring our development was both scalable and maintainable. The combination of these tools allowed us to focus on building a robust prototype while leveraging cutting-edge technologies.

2.2 Database Update/Creation

The database schema was designed to meet the requirements of group ordering functionalities. We structured the database to include tables for users, orders, group orders, and related entities. Using Prisma, we defined and migrated the schema with ease, benefiting from its intuitive syntax and type safety. Prisma's ability to auto-generate TypeScript types for database models ensured consistency across the application and reduced potential runtime errors.

Supabase served as our database hosting platform, providing us with a managed PostgreSQL database that included authentication and real-time features out of the box. The integration between Prisma and Supabase allowed us to perform complex queries efficiently while maintaining high performance.

2.3 Backend Development

The backend was designed to handle core functionalities such as user authentication, order management, and participant tracking. Using Prisma, we created modular and reusable functions for database interactions, ensuring maintainability and scalability. The backend was implemented as API routes within Next.js's app router, taking advantage of its built-in server-less architecture.

Key features included:

- Order Management Endpoints: Endpoints for creating, fetching, updating and deleting group orders and individual entries.

- Cost Sharing Logic: Backend logic for dividing delivery fees and order costs among participants.

- Integration with Supabase: For user authentication and real-time updates to the frontend.

2.4 Frontend Development

The frontend interface was extended from an individual order page to include group ordering functionalities. Built with Next.js and styled using TailwindCSS, the frontend achieved responsiveness and performance while maintaining an intuitive user experience.

We implemented the following pages:

- **Home page**: A home page displaying all group orders in cards associated with the logged-in user.

- **Order Details Page**: Detailed views of each group order, including participants, items, and cost breakdowns, with buttons to edit the order.

- **Create Group Order Form**: A page for creating new group orders, featuring validation and seamless interaction with back-end APIs.

The use of shadcn streamlined UI component development, enabling rapid iteration and consistent design.

By leveraging these technologies, we delivered a robust, user-friendly interface that met the project requirements and provided a scalable foundation for future enhancements.

2.5 Software Engineering Techniques

2.5.1 Version Control

Tool: Git and GitHub
Version control was managed using GitHub with a branching strategy (e.g., feature branches, main for production). Pull requests required code reviews by at least one other group member to ensure code quality and adherence to standards.

2.5.2 Continuous Integration

Tool: GitHub Actions
CI pipelines included steps for dependency testing and installation, unit testing with Jest and application build steps to verify readiness for deployment.

2.5.3 Dependency Management

Tool: npm
Dependencies were defined in package.json and regularly updated to ensure security and compatibility.

2.5.4 Testing

Tool: Jest for unit testing
Unit testing was implemented for critical functionalities like user authentication, database operations, and middleware logic.

2.5.5 Continuous Deployment (CD)

Tool: Vercel
The CI pipeline was integrated with Vercel to automate deployments for the main branch. This enabled rapid delivery of updates and streamlined feedback loops.

2.6 Planning

For our group order feature prototype, the planning phase was designed to systematically break down the project into manageable milestones, ensuring clarity and focus at every stage. Each milestone targets a specific area of development, from foundational setup to feature implementation, integration, testing, and documentation. This structured approach not only facilitates progress tracking but also ensures that essential functionalities are delivered before delving into enhancements and quality improvements. Below, we outline the key milestones and tasks associated with each phase.

- Milestone 0
    - Create the team and decide which EDR to implement.
    - Decide on which tech stack.
    - Setup the necessary tech stack
- Milestone 1a: Core CRUD functionality
    - Implement basic authentication for users to log in/register.
    - Implement "Read all group orders" functionality for / (home) page.
    - Implement the "Create new group order" functionality on the / (home) page.
    - Implement "Edit entry in group order" functionality in the [id]/order page
    - Implement "Delete entry in group order" functionality in the [id]/order page.
    - Implement "Invite participants to group order" functionality in the [id]/order page.

- Milestone 1b: Core Frontend Development
  - Create Homepage to display group orders
  - Create New Group Order form page frontend.
  - Create Group Order Details page frontend.
  - Create Login/Register Page.

- Milestone 2: Extra Features and Integration and Testing
  - Ensure functions of web services and proper integration between back-end and frontend services.
  - Write unit tests for back-end endpoints and frontend components.
  - Add quality-of-life features if given time.

- Milestone 3: Documentation
  - Write documentation for how to use the app in README.md
  - Write documentation for database schema.
  - Write the final project report summarizing progress and challenges.

3 Reflections

3.1 Ang Z.

3.1.1 Chiu K.

Kinson was very easy to work with throughout the project. Although we did not have the chance to collaborate directly on many tasks, he consistently came across as calm, approachable, and communicative. He was always easy to talk to, which made any interaction positive. When assigned tasks, he completed them reliably and on time, demonstrating a strong sense of responsibility. Despite not being familiar with the web development tools we used for the final project, Kinson showed admirable effort by stepping outside his comfort zone and giving them a try. His willingness to learn and adapt, even when faced with new challenges, was respectable. However, I believe that there were opportunities for Kinson to be a bit more proactive in the project. While it's understandable that he may have had other commitments or lacked experience with the tools being used, there were areas where he could have contributed more, either by taking initiative or offering help where needed. Still, Kinson's reliability and positive attitude were assets to the team. I think that with a bit more engagement, he could have been a stronger team player.

3.1.2 Goddefroy K.

Koenraad was an extremely reliable group member and very easy to work with. He was the most communicative in the team and checked in regularly with the status of the team. He had a great eye for the big picture and foresight for what needed to be done. Coupled with his proactive attitude, he motivated our group and ensured that our tasks were completed in a timely manner. On one occasion, the group chat was silent despite the growing list of things to be done. Koenraad took the initiative in devising how our roles could be split to cover the multitude of things that needed to be done. He ensured that these roles were clearly defined and together, covered the task requirements. This was a testament to his leadership qualities, proactiveness and very good planning abilities. His good communication skills inspired others to do the same. Despite being unfamiliar with the web technologies for the group project, Koenraad took on a "can-do" attitude. He was determined to learn new technologies and did not shy away from the challenges. When faced with doubts, he clarified them promptly and ensured that his work streams were well communicated. His high expectations for work quality allowed him to deliver amazing front-end work. The only suggestion I have for Koenraad is probably for him to continue to work hard to improve his technical skills. He has a great set of soft skills, and an equally competitive set of technical skills will allow him to go far.

3.1.3 Lee Z.

Zheng Jing was an extremely productive group member and great to work with. He had a good foundation of technical skills that allowed him to contribute extensively to group discussions. He made very good suggestions for different approaches we could take, which was well appreciated. He was also very efficient in his tasks, implementing many different functions of the program expediently. This makes him a dependable group member. Most notably, Zheng Jing is very communicative which proved to be very important for the group. In working closely with him, he actively reached out to ensure that we were well synchronised. When he had any doubts or concerns, he expressed them promptly and ensured that these issues were ironed out. He had an inquisitive approach to software engineering and often took time to examine the effectiveness of the things being done. This allowed us to engage in meaningful discussions about the project. On one occasion, Zheng Jing took the initiative to help me with debugging the issues I was facing with implementing the API. Despite having a large workload, he spent some time assisting me and suggesting methods I could try. This was a testament to his collaborative attitude which was inspiring to me. The only suggestion I have for Zheng Jing is perhaps for him to manage the amount of work he takes on. Given his experience, he tends to commit to more tasks. However, there is room for a more balanced distribution of tasks in the academic setting.

3.2 Chiu K.

3.2.1 Ang Z.

Dayn had a significant impact on our project's success. First of all, you demonstrated a deep understanding of our tech stack, which enabled us to implement robust solutions efficiently. This was particularly evident in your comprehensive work on the backend development, API implementation, and system integration of our project. Even though you faced multiple challenges while working on the project, you were dedicated to overcoming them. I remember that there were a few nights when you tried to stay up very late to fix the issues and bugs with the integration of all our repositories. However, I believe that if you had more frequent and proactive communication with the rest of us, it would benefit the team even more. There were times when we were not fully aware of your progress or the reasoning behind certain technical decisions. For example, simple updates about your work could help keep everyone aligned and engaged. Sometimes when you modified the code, we had trouble learning all the changes you made. Also, you could consider breaking down large tasks into smaller, more manageable pull requests to facilitate easier code reviews and faster feedback cycles. This would not only improve our workflow but also create more opportunities for knowledge sharing and collaboration. Overall, your combination of technical expertise and strong work ethic makes you an important team member. You could further amplify your impact on the team by focusing on improving communication with other members. I look forward to working with you on future projects.

3.2.2 Goddefroy K.

Koenraad has been very helpful in the leadership and organization of our project. You took the initiative to coordinate tasks for each team member, and you clearly defined role distributions that ensured all the requirements of our project were covered. You were also always proactive in ensuring that our targets and goals were on track since you regularly checked in to see our progress and paid attention to the project's bigger picture, which kept us all aligned and moving forward effectively. However, what I think stood out most was your determination to learn and grow during the project. As you were working with the front-end development, I saw that you were less familiar with the technology stack. Despite that, you still actively tried your best to learn and contribute, with the help of Zheng Jing. You were also trying to maintain high standards or even excel for the quality of the project. An example of this is that when we already achieved having a basic UI for the web app, you still insisted on improving it. Having this passion and dedication for the project are invaluable, and I think they are more important than the technical aspects. In the future, I hope you can continue developing your technical expertise, which will complement your already strong soft skills. Your combination of leadership skills, proactive communication, and commitment to learning makes you an invaluable team member. I am glad to have worked with you and I look forward to working together to achieve more.

3.2.3 Lee Z.

Zheng Jing was an exceptional team member, as you were the one who had the most technical expertise. You contributed significantly to the web app of our project, and you consistently made valuable technical suggestions that enhanced our approach. What particularly impressed me was that you regularly reached out to us to ensure team synchronization, and you also made many pull requests to raise concerns early, which helped prevent potential issues from escalating. I would also like to add that you had a strong commitment to delivering high-quality work even under pressure. Moreover, you demonstrated a willingness to help others, even while managing your own substantial workload. I recall when you took time to assist with the implementation of the front-end of the project, and enhanced the UI and functionality of the web page. Also, I am impressed with your ability to maintain team morale during challenging periods. As we were approaching the deadline, you kept us engaged and focused to continue working on the project, which significantly enhanced our collective effectiveness. Looking ahead, I would suggest focusing on workload management. While your experience and capability enabled you to handle tasks effectively, there is value in maintaining a more balanced task distribution for all team members. This would create more opportunities for other members to contribute to the project and develop their skills. Nonetheless, I really enjoyed working with you and I look forward to collaborating on future projects together.

3.3 Goddefroy K.

3.3.1 Ang Z.

Working with Dayn on this project has been a positive experience in many ways. Your profound knowledge of the tech stack we used was invaluable to the project's success. It was clear that you had a deep understanding of the tools and technologies involved, which allowed us to navigate challenges efficiently and implement solutions effectively. Your technical contributions were both substantial and high-quality, and the project greatly benefited from your expertise and dedication. That said, I think there's room to enhance communication within the team. While you completed a significant amount of work independently, at times it was difficult to fully understand your progress or reasoning without more proactive updates or collaboration. This occasionally created some disconnects and left the rest of the team feeling a little out of the loop. For future projects, I'd suggest focusing on more frequent communication with your colleagues. Even a quick update during team meetings or through messaging platforms can make a big difference in ensuring everyone is aligned and feels included. Sharing your thought processes or seeking input from others could also foster a more collaborative environment and may even spark ideas that improve the final output. Your technical skills are impressive, and with improved communication, I think you'd be an even stronger team player.

3.3.2 Chiu K.

Kinson was a team member who brought a positive attitude and a willingness to help, which made him approachable and easy to work with. His calm demeanour and constructive approach to tasks ensured a positive working environment. He consistently completed assigned tasks on time and with care, demonstrating a strong sense of responsibility and reliability. Despite limited prior experience with the web development tools we used, Kinson showed admirable effort by stepping outside his comfort zone to learn and adapt. His openness to tackling new challenges highlighted his potential for growth and his dedication to contributing meaningfully to the team. That said, there were opportunities for Kinson to be more proactive. While he was approachable and pleasant during direct interactions, he could have been more responsive in the group chat. More engagement could have strengthened collaboration and enhanced his overall impact on the project. Additionally, volunteering for more challenging tasks or seeking out opportunities to take initiative would help Kinson build confidence and further develop his technical skills. Looking ahead, I'd encourage Kinson to actively participate in group discussions and share his ideas, even if they're still forming. By doing so, he can foster a more dynamic and collaborative team environment. With improved communication, greater proactivity, and his evident willingness to learn, Kinson has the potential to become an even more effective and versatile colleague in future projects.

3.3.3 Lee Z.

It was a pleasure working with you on this project. Your technical expertise and dedication played a crucial role in our success. It was clear from the beginning that you had a strong command of the tech stack, and your ability to apply this knowledge helped us tackle challenges efficiently. As the project progressed, your commitment to the team and the work became even more apparent, and you consistently contributed a significant amount to our progress. While communication was initially a bit challenging in the group chat, it was great to see how quickly this improved once we started collaborating more closely. By the end, communication within the team was not only smooth but also felt natural and constructive. This improvement made a noticeable difference in our ability to work together effectively, and your openness to engaging more was a big part of that. One of the most valuable things you brought to the team was your ability to keep the mood light, even during stressful moments when deadlines loomed, and progress seemed uncertain. Your positive attitude helped maintain team morale and made the experience much more enjoyable for everyone. Going forward, I'd encourage you to continue building on your communication skills and to start engaging early in discussions, as this sets a collaborative tone from the start. With your technical skills, positive attitude, and growing ability to communicate fluently, you're an excellent teammate, and I look forward to working with you again.

3.4 Lee Z.

3.4.1 Ang Z.

Dayn was a crucial member of our team, contributing significantly to the technical implementation of our project. Working next to him and seeing him put in the hours even until the dead of night, I knew he had a strong sense of responsibility and the discipline to get the job done even when faced with challenges. Taking up the daunting task of implementing the backend, developing the necessary API endpoints, as well as integrating everything into one cohesive app, his strong programming skills and dedication to the project were evident in his work.

However, to further enhance our future collaborations, I suggest that Dayn could be more proactive in group discussions and decision-making processes. Given his technical prowess, it would be beneficial for him to share his insights and opinions more frequently, as this can lead to more innovative and robust solutions. Additionally, with his technical knowledge, he could help plan out objectives and delegate tasks to others which could help to optimize the team's workflow and ensure that everyone's skills are utilized efficiently. By taking on a more active leadership role and empowering other team members, Dayn can further elevate the team's performance.

To improve the efficiency of his code contributions, I suggest that Dayn consider breaking down large commits into smaller, more focused ones. He can make the code review process more manageable and efficient by splitting up the commits into different pull requests and incrementally adding features. This approach can also help to identify and fix issues more quickly, as changes can be reviewed and tested in smaller batches.

3.4.2 Chiu K.

Kinson was a team member who demonstrated a positive attitude and willingness to help but lacked the technological experience and the confidence to take on larger tasks regarding the development of our prototype.

To further enhance our future collaborations, I suggest that Kinson could focus on developing his technical skills and stepping outside of his comfort zone. By actively seeking out opportunities to learn and grow, he can become a more valuable asset to the team. Additionally, he should not be afraid to take on challenging tasks, even if he may not be confident in his abilities at first. By embracing challenges and learning from mistakes, Kinson can significantly improve his technical skills and become a more versatile team member. It would also benefit him to actively participate in group discussions and share his ideas, even if they may not be fully formed. By doing so, he can contribute to a more collaborative and creative team environment.

3.4.3 Goddefroy K.

Koenraad demonstrated exceptional leadership skills and initiative throughout the project. He effectively organized our team, set clear goals, and motivated us to work together efficiently. His passion for the project was contagious and inspired us to strive for excellence. Despite his relative inexperience with the technology stack, he did not use it as an excuse but instead, as a motivator to learn the stack, becoming a valuable contributor by tackling some front-end issues we set out, writing unit tests, and doing his best outside of the code base as well by leading the writing and organisation of the final group report.

To further enhance our future collaborations, I suggest that Koenraad could be more confident in delegating roles and tasks. While he did facilitate discussions and we looked to him as the leader, I believe that perhaps his lack of technical experience with our chosen tech stack might have limited his voice during the discussion.

This leads me to the next point that I believe that Koenraad could benefit from honing his technical skills and staying up-to-date with industry trends. By investing time in continuous learning and development, he can become a more proficient developer and a more valuable asset to the team. Given his qualities of passion for learning and curiosity towards software engineering, I do not doubt that Koenraad can further improve his performance and contribute to the team's overall success.