UNIVERSITY OF BIRMINGHAM

Coursework II: The Prototype

SSH - Shared Grocery Ordering

Submitted by:

habibis

Diba Malikzadeh

Liba Mahmood

Vladimir Kalmykov

Miqdad Albuali

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https://github.com/noonereedus/habibis

Summary

Our group chose to implement the shared grocery ordering feature for the **Student Smart Homes (SSH)** app due to its practicality and alignment with SSH's goal of simplifying student living. Among the proposed EDRs, this feature addresses a common challenge: managing shared household expenses and grocery deliveries. Unlike other concepts that relied on complex hardware integration, such as the SSH Camera, this project was more feasible to simulate while still presenting *meaningful technical challenges.*

The shared grocery ordering feature allows students to create or join group orders, add items to a shared basket, and view individual and group cost breakdowns. Key functionalities include *dynamic cost calculation*, *individual payment management*, and *order finalisation* upon payment by all participants. These features streamline the shared ordering process and reduce the burden of manual coordination.

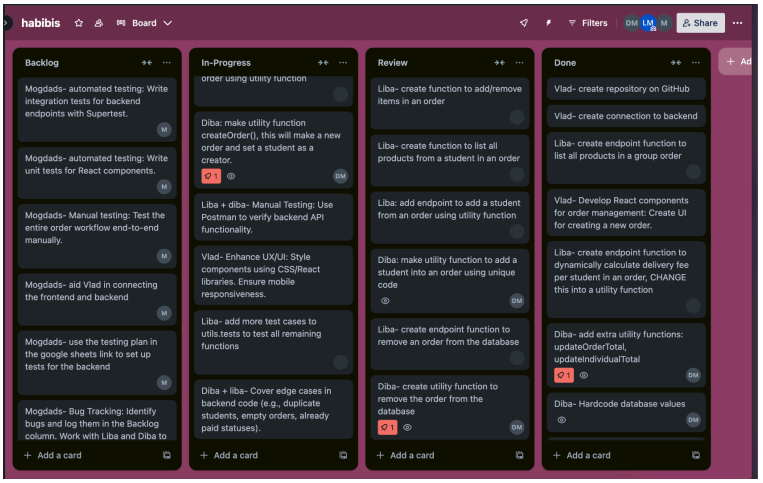
The prototype demonstrates the design's viability, with a backend powered by **PostgreSQL** and **Express.js** for *robust data management* and APIs, and a **React-based** frontend that integrates seamlessly with the backend. *Continuous integration and deployment pipelines* were established using **GitHub Actions**, with hosting on **Render** and deployment through **GitHub Pages**. Advanced features like real-time notifications were excluded to focus on delivering a *functional and effective prototype.*

Report

Project Management

Our approach to project management focused on *structured planning*, *clear task allocation* and *effective communication* to ensure smooth development. During initial group meetings, we identified key deliverables, broke them into actionable tasks, and assigned tasks based on individual strengths and expertise. Backend utilities like delivery fee calculations and database schema design were prioritised early, followed by frontend development and testing.

We adopted a **Kanban-inspired** workflow through **Trello** to track progress, manage responsibilities, and update tasks dynamically. *Real-time communication* in our group chat and weekly in-person meetings helped us r*esolve issues promptly, adapt plans,* and *maintain team cohesion.* Clear commit messages and well-commented code streamlined collaboration and facilitated seamless integration of contributions.

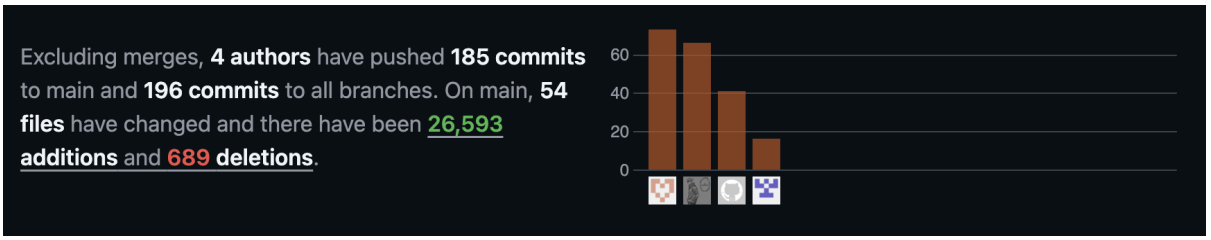


This structured approach, supported by regular in-person collaboration, continuous communication, and meticulous documentation, allowed us to efficiently address technical challenges and adapt to evolving requirements. As a result, we demonstrated exemplary project management, ensuring the successful delivery of a functional and well-organised prototype.

Software Engineering Techniques

Our prototype employed *advanced software engineering techniques* to ensure robust development and seamless collaboration, demonstrating exemplary use of tools and processes throughout its lifecycle.

We utilised *Git* for **version control,** with each team member forking the main repository and submitting pull requests for code reviews before merging. A dedicated react **branch** was created, while descriptive commit messages and repository documentation ensured transparency and traceability, minimising any conflicts.



Note: *Liba's contributions may show incorrectly, due to using wrong credentials initially, but are visible in the commit history. From left to right, these accounts belong to: Diba, Vlad, Liba's initial account , and Liba's correct account.*

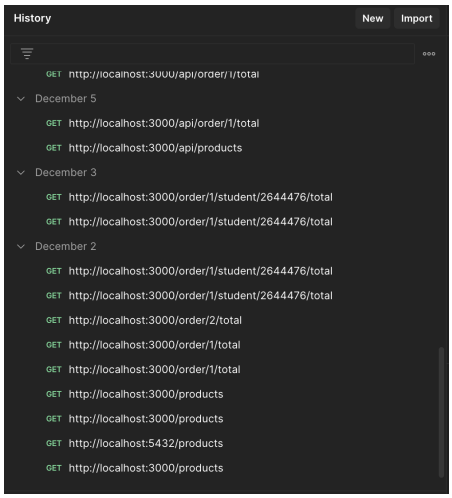
A **CI/CD pipeline** was established using *GitHub Actions*, automating testing and deployment. Backend utilities and frontend components were validated in the pipeline, preventing bugs during merges. Successful builds triggered automated deployments:

(As seen on the right, all tests passed in the CI pipeline before deployment.)

Backend: Hosted on *Render* to facilitate live testing and scalability.

Frontend: Deployed via *GitHub Pages* for immediate user access and interaction.

Npm scripts simplified tasks like testing and building the frontend. The `package.json` file effectively managed dependencies, including libraries like *React* for the frontend, *Express.js* for the backend, and *Jest* for testing.



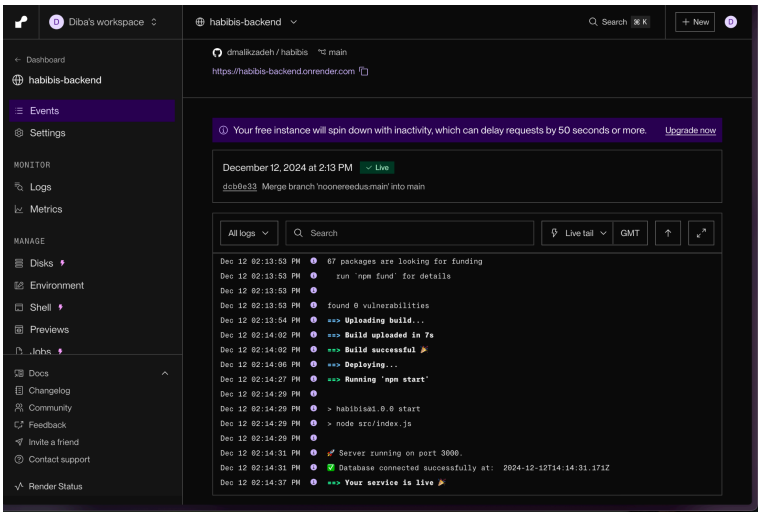
Testing was a priority throughout development:

Manual Testing: *Postman* was used to validate API endpoints for critical features like order creation, item management, and cost calculations.

(Postman logs, as shown on the left, highlight tests performed on one computer, supplemented by testing efforts from the rest of the team throughout backend development.)

Automated Testing: *Jest*, *Babel* and *Supertest* were employed for unit and integration tests. Delivery fee calculations, database queries, and endpoint integrations were rigorously tested to ensure reliability.

Docker was utilised during initial development to ensure *consistent local environments* and *prevent dependency conflicts* across systems. As the project evolved, we transitioned to *Render* for deployment, leveraging its simplicity, scalability, and production-readiness.

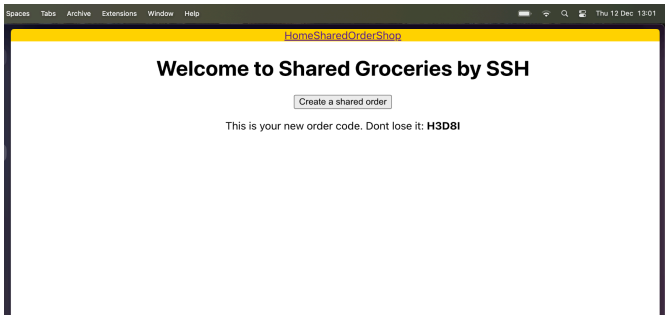


Basic logging in the backend tracked API requests and errors, aiding debugging. *Render's monitoring tools* offered insights into server performance, ensuring stability and simulating key **observability** practices.

By employing these techniques, we delivered a robust and scalable prototype that adhered to best practices.

Technical Accomplishments

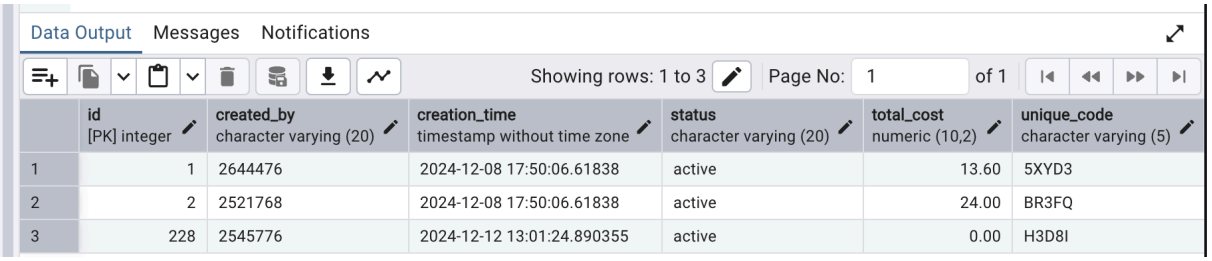
The shared grocery ordering prototype exemplifies a sophisticated and scalable implementation of the proposed EDR, *validating its feasibility* and *demonstrating technical innovation for real-world use*. The project tackled significant challenges, delivering a robust solution that aligns with the goals of Student Smart Homes (SSH).



Our **React-based** frontend provides intuitive navigation, with key features like *individual basket management*, *real-time cost updates*, and *visual payment tracking*. These components integrate seamlessly with the backend, enhancing *usability* and ensuring a clear overview of the group order for all participants.

A live demonstration is hosted at: https://noonereedus.github.io/habibis/

The backend, built with **PostgreSQL** and **Express.js**, supports *dynamic* cost calculations, including delivery fee splits and individual totals, while handling simultaneous group orders. Its *database schema* was designed to ensure data consistency and adaptability, allowing seamless updates when students join, leave, or modify orders. Secure access control was implemented through unique join codes, ensuring only authorised users could interact with group orders.


Data Output | Messages | Notifications

Showing rows: 1 to 3 | Page No: 1 of 1

	id [PK] integer	created_by character varying (20)	creation_time timestamp without time zone	status character varying (20)	total_cost numeric (10,2)	unique_code character varying (5)
1	1	2644476	2024-12-08 17:50:06.61838	active	13.60	5XYD3
2	2	2521768	2024-12-08 17:50:06.61838	active	24.00	BR3FQ
3	228	2545776	2024-12-12 13:01:24.890355	active	0.00	H3D8I

As seen on PgAdmin, the backend database connects seamlessly and stores order with unique code 'H3D8I' successfully.

To simulate broader SSH app functionality, certain features were streamlined or pre-configured. Test data for students, orders, and products was created through SQL scripts, as implementing a full login system was outside the prototype's scope. Initially, group orders were hardcoded for testing purposes before full functionality for creating orders was developed. This approach allowed us to focus on core functionalities and validate design assumptions.

Key challenges included managing redundant test data in the database, resolved through the creation of a *reset script*, and integrating live data between the frontend and backend, which required iterative testing and refinements. The team adapted dynamically to ensure all aspects of the prototype were functional and aligned with the EDR's objectives.
By leveraging advanced tools, resolving complex challenges, and emphasising independent learning, we delivered a robust prototype that demonstrates both technical competence and the practicality of the design.

Reflections

Diba Malikzadeh

Reflection for Liba: Working with Liba on this project was an incredibly smooth and productive experience. Her proactive approach and dedication made her an essential part of the team. She set up the Kanban board, ensuring we had a clear and organised workflow to track progress effectively. Liba also reviewed lecture materials to identify key software engineering techniques we needed to include, helping us align our work with the assignment requirements.

Liba's primary focus was on developing and testing backend endpoints, and her contributions were instrumental in building a robust and reliable backend. She consistently delivered high-quality work, meeting deadlines and collaborating closely with me to ensure seamless integration of all features. Our partnership on backend development was highly effective, as she not only executed tasks I assigned but also actively contributed ideas and improvements. For example, when the database became cluttered during testing, she implemented a reset script to streamline the process, resolving the issue efficiently.

In addition to her technical skills, Liba's willingness to take initiative and her excellent communication made her a standout team member. She frequently updated the team on her progress and was always open to feedback, ensuring our work stayed aligned. Her ability to troubleshoot and address challenges independently was a significant asset to the project.

For future projects, I would encourage Liba to continue leveraging her organisational skills and technical expertise. Her collaborative nature and commitment to delivering high-quality work make her an ideal teammate, and I would gladly work with her again on any project.

Reflection for Vlad: Working with Vlad on this project was a positive experience, as he brought valuable skills and a proactive attitude to the team. At the start of the project, Vlad took the initiative to set up the GitHub repository, register our group, and ensure we had the necessary tools and infrastructure to begin development. This early leadership helped the team establish a strong foundation and ensured we started on the right track.

Vlad was primarily responsible for the frontend development using React, and his work laid the groundwork for the user interface. He designed the main components and ensured the frontend integrated well with the backend APIs, which was essential for showcasing the shared grocery ordering feature. Additionally, Vlad contributed to setting up the GitHub Actions workflow for continuous integration, automating tests to maintain code quality. These efforts significantly streamlined the development process and provided the team with consistent feedback.

Although Vlad started slightly later than other team members in terms of active development, he quickly caught up and focused on delivering key frontend features. While the frontend was not fully completed as we had envisioned, Vlad's work provided a strong base, and his collaborative approach ensured the team could build on his contributions effectively.

For future projects, I would encourage Vlad to maintain his proactive mindset throughout the entire development lifecycle and to focus on prioritising tasks to ensure timely completion of all deliverables. Overall, Vlad was a reliable and cooperative teammate whose efforts greatly benefited the project.

Reflection for Miqdad: Working with Miqdad during this project presented some challenges. Despite our efforts to engage him in the group's activities and tasks, his contributions to the project were minimal. We attempted to provide support through frequent communication, structured task assignments, and clear deadlines. Unfortunately, these efforts did not yield significant results, which placed additional pressure on the rest of the team.

One key area for improvement would be active participation. Regular updates on progress, even if facing challenges, would allow the team to offer timely assistance and maintain alignment. For instance, Miqdad could have benefited from taking ownership of smaller, well-defined tasks to build confidence and establish a sense of responsibility. Additionally, more proactive communication would have helped the group better understand any obstacles he was facing and adjust accordingly.

In the future, I would suggest Miqdad focus on improving time management and task prioritisation. Breaking down tasks into smaller steps and seeking clarification when unsure can help build confidence and accountability. Moreover, fostering a more collaborative mindset by engaging in team discussions and offering input, even on areas outside of direct responsibility, can create a stronger sense of involvement and shared ownership.

While his lack of contribution was a challenge for the group, I hope Mogdads can reflect on this experience as an opportunity for growth. By addressing these areas, I believe he has the potential to become a more reliable and effective team member in future collaborations.

Liba Mahmood

Reflections for Diba: Diba consistently delivered an exceptional quality of work and her contributions were pivotal in creating a functional and robust backend. Diba often took the lead on tasks to help guide the team in solving complex issues and keeping morale high. At the start of the project, Diba took the initiative to set up the database in SQL, fostering a strong foundation that kept the project on track.

Diba's core focus was developing the backend utility functions using Node.js, crucial for the shared order grocery features to work. Her well-organised and well-commented code allowed for smooth collaboration, enabling me to easily add endpoint functions. Diba's communication was always clear and prompt, ensuring that we could work closely together to resolve database issues and keep the project moving forward.

Additionally, her dedication and adaptability allowed her to step in and assist with frontend tasks as well, which was incredibly efficient. Diba's task management was always ahead of deadlines and she remained focused throughout. One challenge we faced was integrating the database with the backend, but Diba's initiative and quick thinking helped us to find a solution. Looking forward, I would suggest Diba continue to provide guidance and support to the team, ensuring tasks are evenly distributed. Overall, Diba is an exceptional teammate, and I am confident that her skills, work ethic, and leadership will continue to make her a valuable asset to any team. I look forward to collaborating with her in the future.

Reflections for Vlad: Vlad was consistently proactive when handling frontend tasks, demonstrating strong technical and leadership skills, as well as a solid understanding of frontend-backend integration. He was focused on delivering quality work, often taking the lead on tasks to guide the team and ensure that the user interface was both functional and well-integrated with the backend APIs. His expertise in managing frontend technologies, combined with his leadership, kept the team on track and maintained a smooth workflow throughout the project.

Vlad's communication was clear and he regularly kept the team updated on his progress. When we encountered a fetching error, he clearly communicated the issue, which allowed me to quickly address the backend problem. Despite the pressure of limited time, his steady communication proved to be a valuable asset, ensuring that we stayed aligned and could resolve issues efficiently.

Overall, Vlad was a reliable and focused teammate. His ability to handle challenges under pressure, paired with his technical expertise and leadership, was a key factor in keeping the project on track. Moving forward, Vlad can continue to improve his proactivity to complete tasks on time. I believe Vlad's strong leadership skills, clear communication, and technical proficiency will continue to be valuable in any team, especially in managing and integrating frontend and backend systems. His proactive approach to problem-solving will always make him an asset in future projects.

Reflections for Miqdad: Working with Miqdad has been challenging due to his lack of communication and contribution overall. Despite our multiple attempts to provide support through frequent communication, assigning tasks on trello and to offer him support, he missed deadlines and there was no significant engagement from his side.

Miqdad was responsible for the testing elements of our code, such as manual testing on Postman, unit testing for database endpoints and utilities, code coverage analysis and A/B testing. At one point, he looked at our Git repository, and mentioned he would look into code coverage analysis but did not follow through with this. We followed up and offered our support on numerous occasions, however, his lack of communication and involvement put extra strain on the rest of the team, who had to pick up his tasks.

In a team environment, effective communication and accountability are crucial, and Miqdad's lack of both created challenges. In the future, I would suggest Miqdad to contribute consistently and be transparent about any difficulties encountered. Miqdad

should work on improving his communication skills and keeping his team updated on his progress. Without this level of engagement, the team's productivity and morale are at risk. Going forward, I hope Miqdad can take responsibility for his work and develop a stronger work ethic to ensure more effective teamwork. I believe he has the potential to be a valuable contributor, but this will require a more proactive approach in future projects.

Vladimir Kalmykov

Reflections for Diba: Looking back at the time we've spent working on the prototype, I am itching to say that Diba is ill-suited to be a programmer. That would simply be a waste of her management talents and responsible personality. She has continuously demonstrated dedication that put mine to shame and made sure that her parts of the project are not the only ones working.

As I have mentioned before, I did try to look out for my teammates and showed readiness to take on their tasks in case difficulties would arise. During the process of building the prototype such need has arisen several times, with a certain team member giving up their jobs entirely. Both me and Diba made sure to interfere and make sure their objectives are met with our assistance. As a result, I was often distracted from my key responsibilities and in the end did not manage to complete my work to the originally intended extent. This regret is not something Diba is going to share. While cleaning up the mess after her teammates, she has made sure that her parts have also been polished to perfection. Diba's high standards and ability to see the project in its entire scale would make her an excellent project manager or a team lead. I hope that she learns to be stricter to her teammates, and extends those high standards to them as well.

Reflection for Liba: I did see the group assignment as a gamble in the beginning since we never worked on projects nor even homework together with my teammates before. During the very first stages of our assignment planning I was prepared to have to complete parts of the assignment intended for my teammates, or at the very least to get distracted all the time to break down tasks for them. It goes without saying that my caution was entirely pointless. Liba has been an unbelievably effective member of our team who's demonstrated a great level of independence, always following through on her promises and going beyond. Whenever Liba was done with an objective, I would not always know immediately, since she'd never ask me for instructions and easily planned out her next steps. Same way I would often miss the times Liba was struggling, since she always managed to quickly come out on top without assistance.

While I praise Liba's focus and independence, this does not mean she was distant - on the contrary, Liba has been a responsive and cooperative partner throughout the entire development process. When distributing the roles, I suggested she pair up with Diba and try extreme programming for the backend development. As a result, they ended up being the most efficient duo I have worked with. Right now, it's a decision I am the most proud of in the entire development process. I hope that Liba continues to balance between self-sufficiency and openness and manages to effectively partner up with any professional she encounters besides Diba.

Reflections for Miqdad: Miqdad is a person I have known the longest in our team since I had the pleasure of studying with him during the Foundation year. At the time he had shown himself to be an extraordinarily capable individual, but also a great procrastinator. It is exactly for that reason that I decided to offer him the tester's role - it is an important part of the project, but it would allow him to work at a slower pace and start later. In the meantime he would be able to help us with full-stack development, should a problem have arisen. Knowing full well that after some time Miqdad would dedicate himself entirely to the project, I did not worry much about his inactivity.

After some time had passed, I had a terrible realisation that Miqdad's work ethics were incompatible with a project of this scale. While acing an assignment on the last day has never been an issue for him, this one requires learning the tech stack, acquitting oneself with the responsibilities of one's colleagues - things that take much more time. At that point it was rather late to find a perfect solution; Miqdad was mostly unavailable digitally while posting pictures from parties daily - probably because deeply inside he realised that he had staggered for too long

As another international student, I relate to Miqdad deeply and cannot judge him harshly, since I, too, found myself at my lowest productivity during this semester. I believe that Miqdad has learnt much from this experience. I truly hope that it will help him make better decisions and manage his time better in the future - he is too talented not to.

Miqdad Albuali

Reflections for Diba: Liba worked on the backend part of the code, she did a lot of progress efficiently and independently. She was consistent with showing us updates and communicate with us. She was highly independent yet she showed a lot of collaboration and engagement.

Reflections for Liba: Showed good management skills and techniques. Her efforts with dividing tasks, monitoring progress, and defining goals was an essential part of the group project. She also helped others with overcoming challenges during the process to make sure the work keeps going smoothly. She also worked a lot on the backend part with Liba.

Reflections for Vlad: He worked on the frontend. He has done a huge amount of work for this. His clear goals and high expectations contributed to his huge practical efforts. He also helped managing the group along with Diba. He communicated well about managing the team and showed us consistent updates about his tasks.