

SE & PP Coursework II: The Prototype

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Summary

This project is a prototype based on Oscar's Engineering Design Review (EDR) in our group discussing the implementation of the Shared Grocery Ordering Integration system. Using a React-based frontend and a JavaScript/Express backend, it allows users within a shared household to collectively browse products, add items to a shared cart, and review individual and total costs before proceeding to checkout.

The prototype features a dynamically filtered product catalogue and product information pages displaying details such as nutritional data, allergens, and ingredients when available. Users can add items to a shared cart, which calculates individual shares of the cost. The cart page summarizes these details, while the checkout page displays costs for each household member and simulates payment through a PayPal gateway.

To simulate supermarket data, the prototype uses a hardcoded item table instead of live APIs. The backend employs JSON files to represent relational structures linking users, households, orders, and items. Key software engineering practices included containerization with Docker, version control using Git, dependency management with Node Package Manager (NPM), and automated restarts via Nodemon. We used Observability through logging, and continuous integration through GitHub Actions.

Overall, the entire EDR was implemented accurately, except some fields in the database being modified.

Project Development Process

Project Management

From the beginning, we agreed to host weekly meetings where we would discuss and work on the project. During our first meeting, we had to make a decision on what EDR to implement, and what tech stack to use. After discussing our individual strengths and preferences, the team selected Oscar's EDR, and agreed to on using React for the frontend, and JSON files to simulate a database. We considered the design from the EDR, discussed what were we going to implement, then created a general timeline of the project, split into points. We all agreed to first finish the frontend and only after that make further research and implement the backend. For the frontend, we decided to split the site into four pages, and have each teammate work on one page to distribute the work evenly. After each meeting, we then set action points and assigned them to each person

to be completed before the next meeting, as shown in Figure 1. Overall, we ended up hosting six in-person meetings over a span of five weeks.

Action items:

- ☒ ~~Make research on the Main page (TJ)~~
- ☒ ~~Make research on the Items Description page (Ash)~~
- ☒ ~~Make research on the Grocery Cart page (Oscar)~~
- ☒ ~~Make research on the Checkout page (Fred)~~
- ☒ ~~Ask the professor whether the website should be responsive (Any)~~

Figure 1: Action items for each member after first meeting

Design

The system is built using React for the front-end and an Express.js backend, some pages using Bootstrap for styling. The design includes four main pages: Catalogue, Product, Cart, and Checkout.

The Catalogue Page features a filter panel on the left, where filtering options are dynamically generated based on the attributes of the available items. The rest of the screen displays the catalogue, with each item showing an image, title, price, and an "Add to Cart" button.

Clicking on an item opens the Product Page, which displays the item's image, title, category, description, price, and an "Add to Cart" button. When available, it also shows allergens, ingredients, and a nutritional table, providing users with comprehensive product information.

The Cart Page lists all items added by the flat. Each row includes a fraction indicating how many of the item the user has added versus the flat total, a small item image, the title, weight, calories, and cost breakdowns for the user and the flat. A modal button is toggled when clicking on the fraction, allowing the users to modify their selected quantities. At the bottom, the page summarizes the user's share and the total, with a button to proceed to checkout.

The Checkout Page shows one box per user in the flat, displaying their profile picture, name, and the amount they owe. A "Pay Your Share" button simulates redirecting users to a payment gateway.

The backend simulates a realistic server environment using JSON files as a mock database. These files contain a mix of handmade and AI-generated dummy data to represent users, households, and supermarket items. The frontend interacts with the backend solely through server requests, mimicking the behaviour of a real database, and allowing developers to easily integrate our design into SSH servers by modifying the API endpoints.

Software engineering Techniques

The project employs proper software development practices. We used git for version control, with GitHub hosting our remote repository. Branch protection rules such as

requiring pull request approvals from each member, before merging to main, were put in place to prevent merge conflicts. Moreover, we used different branches for each feature implemented which helped us work simultaneously without conflict.

We implemented automated tests using Jest, to verify functionality when pushing, including the backend logic. A continuous integration workflow was implemented via GitHub Actions, which involves automated testing, including the unit tests with Jest, and continuous deployment. This checked that after each commit, the code would remain functional, then handled deployment. ESLint and build-checks were also integrated into this workflow. Evidence of the continuous integration workflow is shown in Figure 2

For containerization we use Docker, creating two files for the frontend and backend respectively, although we did later learn that Docker Compose can handle both simultaneously. Lastly, during development we used logging to keep track of the system’s internal state, as a form of Observability.

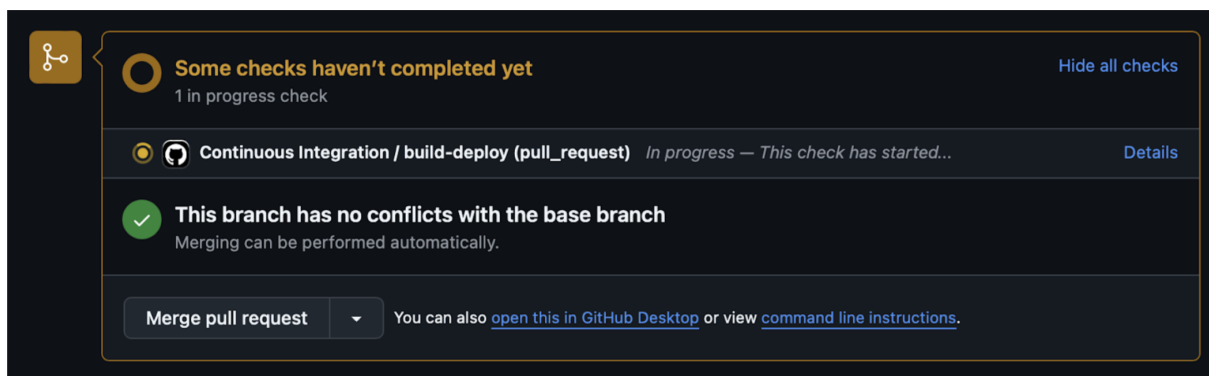


Figure 2: Example continuous integration on pull request

Agile development principles guided the project, allowing iterative improvements and continuous feedback. For example, roughly half-way into the project we decided to change the implementation of the backend from a simple collection of JSON files that the site directly accesses, to the more realistic version as described above. This approach of responding to changes in our expectations for the prototype, rather than sticking to a rigid plan agreed on at the start, helped align the prototype with the project’s objectives.

Reflections

From Ash

on Fred: Fred demonstrated a high involvement in the project, although front-end development was not his primary area of interest. Despite this, he actively participated in discussions about the design of the software and offered valuable feedback on how the web pages could be improved. This openness and willingness to contribute across disciplines were commendable. Fred was also the major contributor to testing in our project, as he was serious about ensuring the quality of the product. While he was working on testing, he updated to the others about his progression and concerns, this made us easy to understand and discuss testing with him. Although initially unfamiliar with some aspects of testing, he quickly learned the necessary skills and completed his tasks efficiently. Fred was also very cooperative, always willing to meet and discuss progress, communication with him is never a hassle. He communicated his availability

and consistently showed up on time. Moving forward, I would suggest that Fred continue to embrace new challenges outside his primary area of expertise, as his ability to learn quickly and contribute meaningfully is a great asset to any team.

on TJ: TJ's passion for front-end development was evident throughout the project. He was enthusiastic about discussing design ideas and collaborating with others to refine the user interface. It was also his idea to build the project with React and Vite. The proactive attitude of TJ was a highlight: he willingly took on tasks, even when he was not entirely confident about how to solve a problem, he would still approach challenges with optimism. His confidence in addressing errors was reassuring and often inspired the group to find solutions collectively. For example, when we had merge problems and failure of building, he was the first one to try to solve the errors. The cooperative nature of TJ extended to meetings, where he consistently arrived early to secure spaces for the team and ensure a productive environment. If he has something that might make him late he would tell the others in advance. To enhance his contributions further, I would encourage TJ to continue expanding his technical knowledge, particularly in back-end development, as his enthusiasm and dedication suggest he could excel across a broader range of roles.

on Oscar: Oscar's exceptional programming skills and quick learning were invaluable to the team. Oscar was efficient in making ideas into reality. They consistently completed tasks at an impressive speed and frequently assisted others who were struggling to keep up. Oscar's strengths were particularly evident in implementing the logic components of the project. They were also the one that had the most experience in Javascript programming. Their commitment to improving the clarity and quality of the code, even when the program was already functional, demonstrated their dedication to producing high-quality work. At the start of the project, I was struggling with React because I did not have any experience with Javascript, and Oscar taught me how to implement logic with it, this greatly help my production of the project. Oscar's ability to think critically and propose optimizations added significant value to the project. Looking ahead, I would suggest Oscar continue to share their knowledge and mentor team members, as their technical expertise and supportive nature make them a natural leader in collaborative settings.

Overall, everyone in the group was a pleasure to work with, contributing unique strengths and fostering a positive, productive team dynamic.

From TJ

On Fred: Fred was a good teammate to work with. He came into this project with not too much programming experience outside coursework but he was eager to take on the challenges of learning new things. He had this sort of calm demeanour when we were in meetings, paying close attention and making suggestions where necessary. He took it up on himself to learn about the testing framework just to to implement unit testing in our projects and also learnt to use Bootstrap too despite not being the biggest fan of front-end web development. Safe to say, he's not the type to shy away from learning new concepts and is not the type to let everyone do all the work. He always made sure he was working on something, pitched in good ideas where needed, honest and transparent in his dealings. As far as communication goes, I think he was really good in that area, whether it came to planning meetings, discussing topics, making changes or anything else

in general. He made sure to provide his clear input/ intention, be it in person or in the group chat. Another thing I had noticed, is he would not completely let something be due to laziness. He diligently went in depth where it was needed, like making multiple tests, making styling adjustments or fixing an operational issue. Overall, I see him as a chill guy, who's willing to get his head down and do what's needed of him. I'd advice he takes his ability to learn and explore tech stacks and increase his skill set.

On Oscar: Oscar gave me the impression he was a really smart person with a lot of experience in things like this and glad to say I was not wrong. He's the type of person to pay close attention to detail and likes to keep things organized. He is the type of person you would want on your design team. I would say he is the one that gave our group that sense of urgency we needed. It is so easy to put things off and if i am being honest, left to myself, I would have finished the project a lot later than when we did. Fortunately, his presence here gave us all the mentality to finish as early as possible so we would have time for other things. As a result, we were a while ahead of most other groups and had enough time to address any sudden issues or concerns. He also was able to tackle problems I encounter that seemed to be out of control. For example, after the implementation of the backend, the project kept failing to build and lint checks output a lot of errors. He took it upon himself to fix them and did so impressively. Another thing I noticed is that he likes to take initiative to do stuff, he implemented the linkage between our pages, designed the header we used for the project and implemented a lot of the underlying backend processing our project uses. My only critique would be, to me. at times I was not made aware of some of the things he was changing or implementing but all in all he was an amazing member and I was grateful to work with him.

On Ash: Ash, like Oscar also gave me the impression he was quite experienced and he in fact was. During the design phase, he introduced us to the concept of wire-framing to figure out how we would design the front end for the main page. It was a first for me, and I found out it is used in the professional Industry as well. I also was not aware of the fact that JSON files work directly with JavaScript as I had never worked with JSON much before. Thanks to him, I was made aware of that. Even though he had a lot of experience and knowledge, he did not know everything, and was quick to accepting when he lacked knowledge in an area For example, working with react and typescript. Those were relatively new to him, so he took out time to watch videos to learn how to make use of both. From my recollection so far, he pitched in with his experience and knowledge in a lot of smaller areas where we could do things a bit more efficiently. My only critique would be that at times, I could not really feel his presence in meetings as much as the others. In as much as I said he pitched in with great ideas some of the time, a lot of times I think perhaps he did not make himself heard enough in terms of contributing his thoughts on something. It was only at certain moments I was able to catch what he said. In summary, Ash is an experienced and knowledgable person, I learned al ot by speaking with him, I would just suggest he vocalizes things more clearly in group settings.

From Fred

TJ: TJ was a very useful person to have on the team. While all of the work was split evenly between the 4 of us, TJ was good in the beginning at getting us started. For example, he had the idea of starting our project using React with Vite, and came

to our first meeting already having set up a Vite project for us to start with. While setting up a Vite project on its own is probably not very difficult, it was essential to give us the momentum to get started very quickly, and most likely put us a week ahead of where we would have been otherwise (because we were meeting once a week at that point). He also took the initiative to get us started on implementing software development techniques, like continuous integration. And while other people worked on the CI as well, TJ getting the ball rolling on that was crucial to us getting it set up quickly. TJ also wrote the README file and while that isn't particularly useful for the functionality of the prototype, it does make the whole repository feel a lot more 'professional' which I like. TJ clearly has a lot of expertise in front-end development, moving forward I would suggest he builds more on his foundations in this field as he obviously has a talent for it.

Ash: Ash was a very reliable and hardworking member of the team. While the work was evenly divided among all of us, Ash consistently showed that he could be trusted to complete his tasks accurately and efficiently. He approached his responsibilities with a level of thoroughness and dedication that gave us all confidence in the quality of his work. As we started having more in-person meetings, his contributions to group discussions became more frequent and often very insightful. It was clear that he was not only invested in his individual tasks but also in the overall success of the project. For example, Ash, along with Oscar, took the initiative to overhaul our server system to run on a separate process, allowing it to simulate a realistic server environment. While this required a significant amount of effort, it has proven to be a crucial improvement, making our prototype feel much more complete and polished. In hindsight, this was a decision I likely wouldn't have pushed for myself, as I might have stuck with our simpler, older method. However, this change has had a lasting impact on the overall quality of our project, and we're already seeing the benefits of their work. Ash's ability to identify and execute impactful technical solutions was essential to our progress. Moving forward, he should continue striving for the best possible results in his projects, as he clearly has the skill and insight to deliver high-value outcomes.

Oscar: Oscar was a crucial part of the team, who always contributed in our group discussions when we met in person. He was reliably challenging ideas and putting his own ideas forward, to ensure our group was not complacent with taking shortcuts or working with easier methods. He was also very helpful, for example, when he and Ash had remade the server system, he was willing to explain to me how the new system worked, and how to change my parts of the project to integrate correctly with it. He was also willing to change the part of the project he was working on quickly in order to help other people with their workload, shown when he took it upon himself to help resolve the issues we were having with ESLint in setting up our continuous integration. Oscar also pushed early on for us to get started on the project earlier, and we are all reaping the rewards of the decision now in the final week as, compared to other groups, our workload is quite light. I am grateful that Oscar encouraged us to do this, because without his discipline I may have left my work until the last minute, and been much more stressed right now. Not only is he a skilled programmer, Oscar was an incredibly useful asset to the team who made sure the project as a whole was completed efficiently. Moving forward, Oscar should continue to contribute and challenge ideas in the projects he works on.

From Oscar

TJ: TJ took great initiative in the frontend section of the prototype. At the beginning of the project, when we split which pages should each of us focus on, he was very adamant on doing the catalogue page, which to me, is the most complex, and most requiring of technical knowledge. He did the entire frontend for the filter panel and the catalogue, everything short of connecting it to the backend. He rapidly learned how to do this, and delivered it before our next meeting.

Moreover, TJ lead the implementation for continuous integration, continuous deployment, and containerization. I was, not very comfortable implementing these, so I really appreciate him doing it. TJ has a good understanding of most of the material covered in the lectures, and he, along with Fred, helped me fully understand some of the practices we had to implement and use. He gave our project a level of professionalism that might have been missing otherwise.

On top of his technical contributions, TJ was a great teammate to work with. He always came prepared to meetings, arriving early to make sure we had a space to work, and generally a pleasure to work with. If there's one suggestion I'd give, it would be for TJ to push himself to explore backend development more, as I did feel he was less comfortable with it. Given his initiative and ability to learn quickly, I believe he could become just as effective in backend development as he already is in frontend work.

Fred: Fred showed initiative throughout the project and was a reliable and thoughtful teammate. Initially, we was not particularly excited about frontend development, yet he insisted in learning and built the checkout page on his own. I respected his willingness to step up and take on tasks outside his comfort zone, particularly since it would have been entirely reasonable for someone else to handle the frontend work on the checkout page while he focused on another area. I believe it is important for students to challenge themselves in unfamiliar areas, and he demonstrated his dedication to the team, and helped maintain a balanced workload.

Fred's also set up our entire testing system. This is an important software engineering technique, but and none of us had worked with automatic testing in JavaScript. Fred, having no experience with automatic testing whatsoever, learned how to use and implement it.

Fred was also just an easy person to collaborate with. He communicated clearly, was always punctual for meetings, and contributed thoughtful feedback during discussions. Before implementing the backend server, Fred preferred on simply managing the data as React states for simplicity, worried we would otherwise not have time to finish the project. While these concerns were valid, implementing the backend server ultimately brought our product closer to the EDR and better demonstrated its feasibility. In the future, I do think it would be better to be more perfectionist, even if it may carry some additional work, at least for projects as important as these are.

Ash: I worked closely with Ash throughout the project, and he was a strong team player who contributed a lot, especially on the technical side. Together, we built the backend server and the database, then handled all of the connections to frontend except for the checkout page, which Fred managed to do himself. He helped add a lot of polish to the prototype and made it feel much more complete. Ash's attention to detail were really evident in this part of the project, and I appreciated his dedication to getting it right.

He also helped me design the UI for the cart page, which I was in charge for, the header, and designed the product page.

That said, I do think Ash could have shown more initiative, especially at the start of the project. There were times when he struggled with the technical side, and it delayed us for a week because he hesitated to ask for help. It's a minor issue, but being more proactive could have saved us some time. Once he got past that, though, Ash really stepped up and delivered high-quality work.

Ash was easy to work with, and his contributions made a big difference to the success of the project. He has a lot of potential, and I think he should keep focusing on taking initiative and tackling complex problems. With continued growth in technical skills and initiative, I believe Ash will consistently make significant contributions to any team he joins.