

### **Introduction (from phase 1) - Josh & James**

Keith was born in 1997 and is currently of age 26. Keith is currently living and studying in Toronto, Canada and attending University of Toronto. Coming abroad, Keith has been facing new challenges and obstacles when trying to assimilate into a new society. Trying to fit into a place with new faces, different cultures and a different environment, far from home, Keith finds much struggle throughout his path in Toronto. While Keith comes across problems that challenge his social adaptability, Keith also finds struggle with maintaining financial stability as an international student. With expenses including rent, hydro, food, clothing, transportation, tuition and other necessities, Keith becomes challenged when making ends meet. To combat the expensive living costs of Toronto, Keith has been finding ways to save money, preferably in a way that would be efficient and save his time. As a group, we thought Keith would be a perfect client to help out by designing him something that could significantly impact his quality of life.

### **Problem Statement (from phase 1) - Josh**

Keith is struggling to find time-efficient and easier ways to save money on everyday purchases which includes items such as clothing, groceries and other necessary items. Keith would like to spend time chasing after coupons and signing up for online deals, but Keith finds the process time consuming and finds little extra time to achieve this. Keith also finds the process of signing up online for email coupons and in-app deals is too difficult because of the lack of user-friendliness. In the few coupon apps Keith has signed up for, none of these apps contains a point system that rewards the user for regular use of the app and its coupons. These apps also do not offer any customer service help which Keith says he needs because of his lack of experience with newer technology. These apps have little customization for his profile that would help the offers shown on his front page. Keith also says he would have liked a wishlist system to be implemented within the apps which Keith can add “wished” items to and receive notifications whenever one of those items drops in price. The last thing Keith had a problem with within these apps is that they lacked a search bar that allowed the user to search for a certain item for availability and price. To help Keith’s problem, we proposed to design another app specifically for Keith, tailored to his requirements that would help his problem of saving time and money while adding the little details he wanted within the other coupon apps.

### **Requirement Analysis (from phase 1) - Anik & Ashwin**

Keith requires that the app can help him save money on his purchases across various categories. The client wishes that the experience when using this mobile app would be much more seamless and user friendly compared to other generic apps. Below lists the requirements that Keith has explicitly mentioned should be integrated into the app:

- Create and manage his profile, including preferences for types of deals, shopping habits and budget limits (User profile).
- Personalisation in terms of showing relevant offers and coupons related to his interests or current needs.

- Notifications for deals, price drops and recommendations based on his preferences and shopping history.
  - Privacy, whenever location data is being used.
- Price and deal comparison, which allows him to compare prices for products across different retailers.
- Budget tracking, which allows him to manage his spending, categorize expenses and set budget goals.
- Shopping list and wishlist, that allows him to create and manage shopping lists and wishlist and notify him if the items are on sale.
- No hidden fees, subscriptions, advertisements that impact user experience
- Search bar, that allows him to find more offers related to specific stores
- Multi-languages, which allows him to switch to other languages other than English.
- Tutorial guide, that helps him to learn and navigate around the application.
- IOS and Android compatibility.
- Customer support, that allows him to seek help either via an app in chat functionality.

### **Proposed Solution (from phase 2) - Aishwin**

Keith is looking for an application to help him save money that follows the listed requirements above in order to have a better experience when using them. To address this, our solution is a mobile coupon application that aims to gather coupons and special offers all across the internet into one single platform. Compared to his previous experience with other applications, this app provides an easy to use user interface that specializes in coupons across many categories. The application can find deals in food, grocery, transportation, academics and much more. By recognizing that Keith has his own unique tastes and interests, personalization algorithms are in effect based on his personal data. This would have relevant coupons and discounts on the homepage that have a strong connection to his current needs. An A.I algorithm will play a vital role in gathering all these offers based on the user data, send out recommendations to the user, and predict patterns for the likelihood of future coupons. The following lists some of the technical specifications the app runs on:

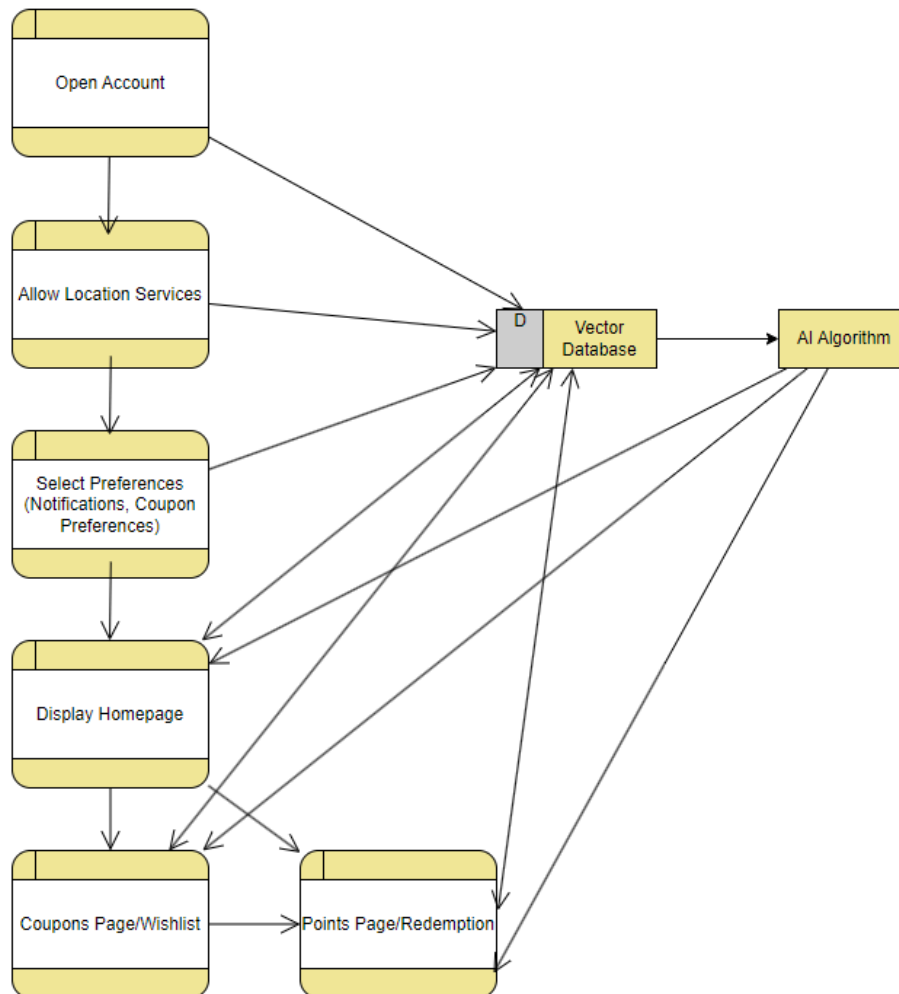
- **Web Scraping:** Fundamental system to navigate the Internet/Social Media platforms and find relevant offers, promotions, and discounts.

- **Database Management:** Usage of servers and databases for the user profile and storing data of all coupons.
- **User Interaction:** Data tracked by click rates, re-visits to particular promotions making use of analytics software such as Google Analytics for mobile apps.
- **Search Algorithms:** The search bar will initially be the user's best way of finding coupons. Implementation of keyword algorithms will allow for more relevant and up to date results. Filters based on relevance as popularity/success ranking and autocomplete.
- **Cloud Services:** Requirement for future proofing and scalability during high demands during seasonal offers.
- **Communication Channels:** To offer customer support through live chat on the app & fixing bugs.

### **System Architecture (from phase 2) - Anik**

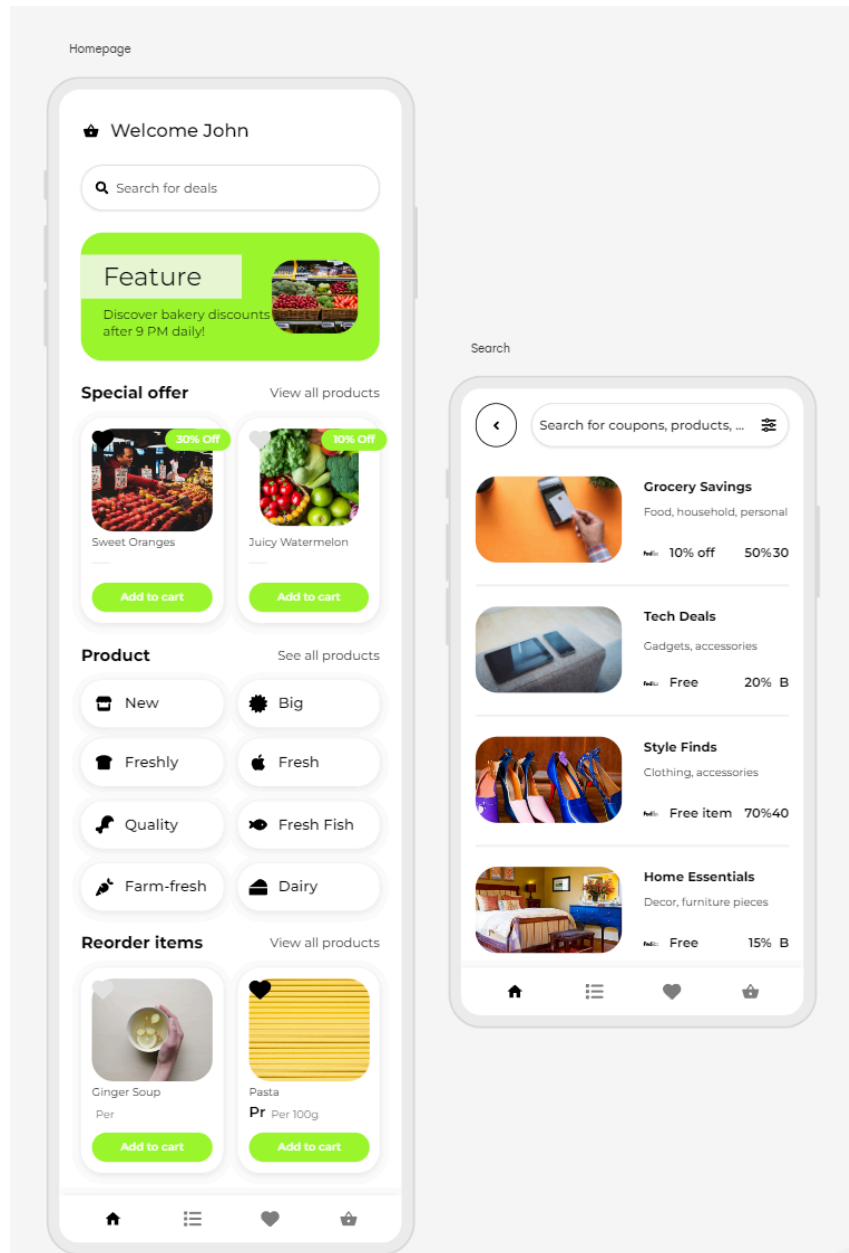
The application will be accessed as a mobile application and will allow Keith to easily access discounts and products. The products and coupons the customer is served will be sent through an algorithm which utilizes past purchases and location to sort specific data. The specific algorithm will be created using vector databases which are databases that use AI to organize previous data into categories and link items together. This allows the application to serve the customer very specific deals along with the products that are on sale that they most need. The application will be coded in Javascript and utilize react native as frontend to bring a pretty UI and UX to the customer.

## Data Flow



When entering the application the customer will sign up using their email and password, they will be asked whether they would like to enable location services. If they enable this feature that information is sent to our database where we can utilize the AI algorithm to locate coupons and items within their location range. After enabling location we are able to provide preferences for them to select to help the algorithm decide what type of things the user likes and how to provide them coupons and items that relate to their interests. After they select their preferences they will be able to use the application and will be given a base set of coupons, items that they would possibly be interested in to start. Over time, the more they use the app the more it will be catered to them as it stores information about what they purchase, which coupons they use and stores that to the vector database which can connect common items and coupons back to them.

## Diagram (UI Example)



[View Figma Prototype](#)

The example above we designed shows the coupons and products the customer may see when they first enter the application. Utilizing the vector database we will be able to scrape coupons off the internet and provide them straight to the specific users that will make the most use out of them. We will also give the user the option to be notified of sales for items that they are interested in and the quick availability of coupons. Data of what they click on, purchase, which coupons they use will all be stored into the vector database to be used in the algorithm. This

makes sure they will always get coupons on things they are interested in and won't be getting things that are useless to them.

### **Implementation Plan (from phase 2)**

To implement the solution for Keith, 5 steps are required:

#### **Step 1, Research and Planning**

Market analysis is necessary to understand our competitors. We need to develop a product which is different from all others. In this stage, we need to gather information and requirements from the client, including desired features, security concerns, platform preferences (Android and iOS), and any specific user interface. Then choose the appropriate technologies for both client-side (Android/iOS app development) and server-side (database, server, API development). Decide on the ML and AI technologies for personalization and recommendation systems. Privacy is important; therefore, an encryption method and security protocol should be implemented to safeguard the user data and transaction within the app.

#### **Step 2, Development**

We need to first set up the development environment with necessary IDEs, development tools, and access to cloud services for both Android and iOS platforms. Then, we should design and implement a secure database for storing user profiles, coupon data, and user interactions. Importation of AI algorithms for personalized coupon recommendations. This involves training ML models with historical data and integrating these models with the application to notify user-specific deals. Develop the app for both Android and iOS platforms, ensuring compatibility with the latest versions. Implement the UI/UX based on the prototype, integrating the backend services and ML models. Integrate encryption algorithms and secure communication protocols to protect user data and ensure privacy.

#### **Step 3, Testing**

When the application is completed, we then need to conduct tests for individual components in the application to ensure they work as expected. Conduct integration tests between app features to make sure that they collaborate with each other without any issues. Conduct performance tests to evaluate the smoothness of using the application, for example what the time taken for the application to react to users' actions. Security testing is also essential to identify any possible vulnerabilities.

#### **Step 4, Deployment**

Upload the application to Google Play Store and Apple App Store according to the policies, so the users can download the application from a safe source. Deploy the backend services, databases, and ML models to our server, so the application can be used with internet access.

## Step 5, Maintenance

After all, we should keep an eye on the continuous performance of the application. Support team should be available to solve any queries and technical support team should be ready to fix any frontend or backend problems immediately to ensure the smooth running of the application.

## **Analysis of the Design (new in phase 3 - \*170 min words per section\*)**

### **Security (Anik):**

Security is a huge aspect of creating an app especially when dealing with personal info and tracking items. Due to the nature of this application and how we will be catering things to Keith based on his information, it is very important that we prioritize security. The application will be storing information to our database (vector database) which utilizes ai algorithms to sort information. To make sure security is guaranteed all of this information will be stored behind proper authentication. Keith will have the option on the app to accept terms stating that we will be saving info to cater coupons and products to his needs and all of the options and terms he selects will be very transparent. On top of this Keith will have the option to enable two-factor authentication to secure his information and account safely. Data breaches and password leaks are common occurrences in 2024 so we will make sure that all passwords meet a specific guideline of including a number, uppercase and lowercase letters and being at least 10 characters long. Making sure that we meet current security guidelines and keeping Keith's stored information safe while also being completely transparent about our terms and what we are storing will help keep Keith in feel secure while using the application.

### **Privacy (Sami):**

Your privacy is the main concern for our app. This is how we ensure that your personal details are kept secure and used responsibly.

**Transparency and Choice:** We are upfront about what information we collect from the beginning, and we explain why. We make everything clear in simple language so that you can make informed choices; therefore, you can determine what you would like to disclose.

**Collecting Only What's Necessary:** This involves only gathering information that makes it possible to improve your experience—for example, finding the most advantageous offers or deals for you. This way, privacy risks are minimized while keeping your digital footprint small.

**Robust Protection:** Using advanced encryption, we protect your data during its transfer to us as well as its storage in our systems; hence, transforming your personal data into a code which is known by us only and cannot be accessed without permission.

**User Control Over Data:** Our application allows you to access and manage your data easily. Want to update your preferences? It is straightforward. Should deleting an account ever be necessary? That's possible too. We give you power over how your information gets utilized.

**Education and Support:** We are dedicated to ensuring that you understand your legal right to privacy and how we protect your data. Our team of support is always there to help you with any questions you might have, as well as tips on maintaining your confidentiality.

**Anonymization and Aggregation:** Where possible, we anonymize your data. To this end, we will henceforth remove all the details which could be used to identify you from such information so that it can benefit every user, like improving app features or introducing new deals.

**Ongoing Vigilance:** In order to combat new challenges and therefore adopt state-of-the-art security technologies, our privacy practices are reviewed and updated on an ongoing basis. Nothing is more important than your trust in our app, which we strive very hard for.

Through striking a balance between the need for personalizing information for a personalized experience and respect towards privacy, we foster an environment where saving money does not require worrying about personal details.

#### Equity (James):

It is important to ensure that all users in the community, not just Keith, are able to access the application. Firstly, the application should include inclusive design features, such as voice control, ability to adjust font size and colour blind mode. Secondly, our application should be personalised, the ability to analyse an individual's preferences and present the users with desired offers. Furthermore, a variety of businesses should also be included, from local enterprises to large chain suppliers, in order to satisfy different users with different needs and ensure that the coupon system covers a maximum range. Considering digital divide and its impact on access to saving opportunities, we should develop a low-bandwidth version of the application to address this issue to allow the application to be used with limited internet access and old digital devices. Finally, equity also means active engagement with user feedback to continuously improve and adapt our services to meet the ever-changing needs of a diverse user base. We should commit to listen and learn from our users, so that the application meets the users' expectations and remains a useful tool to them.



### Sustainability (everyone):

(Josh) Although continuous use of this app will make Keith more technologically fluent, the money saving and time saving designs of the app will have Keith continuing to use our app.

(Aishwin) The app's design eliminates the need for paper coupons which makes it environmentally sustainable in the long run. More so, with offers from local businesses that have a much smaller ecological footprint, Keith now has an incentive to shop and support these businesses which can reduce the harm bigger companies have on the environment.

(Anik) Keith will be able to shop quicker and more efficiently due to the app providing him the things he wants directly with no need to search for a long period of time. This will in turn reduce his carbon footprint as he has to spend less time searching through multiple sites and wasting more energy. (James) The application also encourages sustainable shopping habits by alerting Keith to discounts and offers on eco-friendly products specifically. Our platform can extend beyond just providing convenience to our users, in our future developments, we can work towards developing an environmentally friendly community by encouraging our users to purchase eco-friendly products, for example, providing extra discounts or inviting eco-friendly producers to join the team.

### Ethical Considerations (Aishwin):

When building this application, it is important for us to think about the possible ethical concerns and considerations to make. Majority of these ethical considerations stem from the app's heavy reliance on the user's personal info but also due to the consequences web scraping data mining can have. By using the workable ethical theory of utilitarianism, the implementation of the app would aim to maximize utility and see if the benefits outweigh the harms. With personalization features and interest based recommendations, Keith's personal data and preferences need to be collected and stored. This would also include location based data for the purpose of nearby discounts. However, with data collection also comes the consequence of misuse or data sharing for profits. To address this, the application prioritizes security and being transparent in how the data by us and the app, such as notifying users about tracking location. Saving money, time, and ultimately having an improved quality of life outweigh these harms (considering that privacy concerns are limited). As a result the app collecting user's personal data is ethical under this theory. Several features of the application run on the principle of utility and trying to maximize Keith's happiness. Having a diverse collection of coupons allows more opportunities to save money and have more freedom in spending. In compliance to Keith's requirement of having a seamless user interface, the app's design at heart aims to maximize utility through ease of use and transparency, something that previous apps lacked. Potential harms might include more impulsive buys or businesses losing out on profit. However, businesses that capitalize on these coupons get an increase in exposure leading to more customers. A budgeting feature in the design of the app acts as a preventive measure for Keith to keep his spending in check. Under the act utilitarianism perspective, these benefits outweigh the harms and increases Keith's overall utility indicating that the action is ethical.

### Societal Impact (Josh):

Should this app be released publicly, it could benefit other people like Keith who struggle to save money while conserving time. Whether it be an international student like Keith, a single parent with many children or a house manager that regularly fulfills errands for the kitchen, this app can help users become time-efficient and save money. As Keith requested a more user-friendly app, other users who struggle to adapt to new technology could benefit from our app. People isolated from technology and inexperienced, especially the older demographic, can benefit from this app. The efficient and user-friendly apps are very attractive to more casual tech users and can spread awareness about them, which can ultimately encourage saving money and help citizens make more financially-wise decisions. This app can help citizens who endure financial hardship to find ways to regain stability and rework their spending habits. The wishlist and point systems will help users gain access to more expensive items a user could be waiting for to go on sale, ultimately helping people and their families improve their quality of life through our app.

### Conclusion - everyone

(Josh) By assessing Keith's problem, discussing requirements and planning out a solution, we were able to create an app tailored to his needs and his problem. Throughout the process, we learned how to design a coupon app that new tech users would find user-friendly.

(Aishwin) By analyzing the design of our application it is evident that the app takes into consideration the possible security and privacy concerns, how accessible and sustainable the design is, and the impact on ethics and society as a whole.

(Anik) Following strict guidelines for security and having transparent terms and conditions Keith will be able to feel secure while using the application. Keeping Keith's information secure will be a priority for us in the application.

(Sami) Our app places a high priority on privacy, protecting user data with straightforward processes and cutting-edge security features. Keith will be confident to know that we're still committed to boosting user privacy and trust, establishing a standard for moral data use in digital couponing.

(James) Besides providing convenience to our users, we can work towards developing an environmentally-friendly community. In the future development and improvement of the application, our main focus can be on promoting eco-friendly products and producers. In this way, we are helping to keep the environment clean and providing help to those who are willing to keep the environment clean.