

Nourish Middlesex

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Problem Statement and Solution Proposal

Food insecurity is still a complex and persistent issue in Middlesex County, New Jersey, affecting a variety of groups, such as low-income families, older adults, children, and those who are homeless. The initial focus of our study was New Brunswick due to its abundance of food pantries and well-documented high rates of poverty. As we delved deeper into our research, we found that this city is not the only one experiencing food insecurity. These results led us to reevaluate our solution's geographic reach. By connecting low-income individuals with local food resources throughout Middlesex County, our website, Nourish Middlesex, aims to assist in closing the gap between food givers and those facing food insecurity. Our platform seeks to increase the effectiveness and accessibility of food aid by offering features like finding local food banks, seeing real-time inventory updates, and scheduling pickups or deliveries. Additionally, we plan to collaborate with farms, restaurants, and supermarkets to repurpose excess food that would otherwise be wasted. By designing a research-based digital solution, Nourish Middlesex aims to be a dependable community-based solution to a pervasive and changing problem.

After determining that focusing only on food insecurity in New Brunswick did not adequately capture the scope of the problem in Middlesex County, we decided to update our initial problem statement. Although a sizable portion of the population in New Brunswick lives below the poverty line, other cities also face comparable socioeconomic difficulties and have high rates of low-income families in need of food assistance. Economic inequality, poor transportation, and geographic food deserts are the leading causes of the problems that neighboring communities like Carteret, Perth Amboy, and Woodbridge experience (Voorhees Fellows 2018 Food Insecurity in Middlesex-County-2018). If New Brunswick had been the exclusive focus, other vulnerable areas that experience similar levels of need would have been left out. By including the various circumstances impacting citizens across the county, we were able to study a more thorough and equitable assessment of food insecurity. Our solution can

overcome structural and logistical obstacles to food access by considering these aspects, which enables our solution to reach a larger audience and have the greatest possible impact. Increasing our knowledge has also helped us create a scalable and inclusive platform. Our strategy guarantees that Nourish Middlesex accurately depicts the issue and caters to groups most impacted by it.

In Middlesex County, New Jersey, food insecurity seriously affects many community aspects. Although New Brunswick and other high-poverty districts were the primary emphasis, research suggests that food insecurity may exist throughout the country. Food inadequacy, or homes that occasionally or frequently lacked enough food, affected about 10% of New Jersey's population in 2023 . A shortage of affordable housing, unemployment, and poverty are some of the main causes of this problem. Household budgets for food are further strained by the high cost of living in New Jersey, where 50% of households spent 30% or more of their income on rent in 2022 (Did you know nearly 10% of New Jersey's population is food insecure?). Many low-income areas lack access to healthy food sellers and frequently use less nutrient-dense substitutes. Food instability is especially harmful to children and the elderly. 9.8% of New Jersey children experienced food insecurity in 2021 (Food Access). For children in particular, the first few years are crucial to a healthy development. Physically, food insecurity can lead to stunted growth, higher chances of bone fracture and breaks, impaired immune system along with other health complications. Mentally, it may result in slowed brain development, lower than average attention span, increased chance of apathy and depression, lower IQ and higher risk of cognitive disease. These consequences highlight the importance of ensuring children have access not only to food but to proper nutrition as without it the effects can last a lifetime.

Furthermore, food insecurity is plagued by “silos” that are created by public and private entities. The phrase “silo” refers to the idea that different organizations, such as public and private entities, are working on food insecurity in isolation from one another, rather than collaborating. Each entity or group is focusing on their own separate solutions or strategies without sharing information, resources, or coordinating efforts with others. This lack of collaboration creates inefficiencies and makes it harder to effectively address the broader issue of food insecurity. There are still racial differences in food

inadequacy, with Latinx and Black households reporting higher rates than White households (Did you know nearly 10% of New Jersey's population is food insecure?). Improving Middlesex County's food security can help address these complex issues.

Stakeholder and Customer Analysis

Our goal for our project is to create a website that can provide people who are facing food insecurity in Middlesex County with the proper food needs. Naturally, for a project of this size and vision, there will be many customer and stakeholder groups involved. Firstly the customers are those who will be using the website to gain access to food. These people will be residents of Middlesex County who are currently food insecure. These customers can be of any age, race, or sex. Their pain point is that they are food insecure. This could be because of financial issues, homelessness, as well as other issues. If these people solve one of their issues and are no longer food insecure then there is no need for them to use our website anymore.

The next stakeholder that is a part of our project would be the primary users. Our primary users are the core of Nourish Middlesex and include food-insecure individuals and families, food bank staff, and food donors. Food insecure individuals and families often deal with long wait times at food banks, uncertainty around what's available, and transportation barriers. These users need a reliable and accessible way to locate nearby food banks, check real-time inventory, and schedule pick-ups or deliveries. Nourish Middlesex provides a user-focused platform that can significantly ease their burden; however, some may have concerns about digital access, privacy, or using new technology.

In addition, food banks, their staff, and volunteers can also utilize the platform to update and analyze inventory and organize pickup or delivery appointments (Taylor, Tucker & Richman, 2012). They often face logistical strain due to limited resources, inconsistent inventory management, and unpredictable demand. Our platform provides an efficient system to update stock, organize appointments, and improve communication with recipients. This can help streamline operations and reduce bottlenecks but may raise concerns about added responsibilities and the learning curve of adopting a new system. Another key

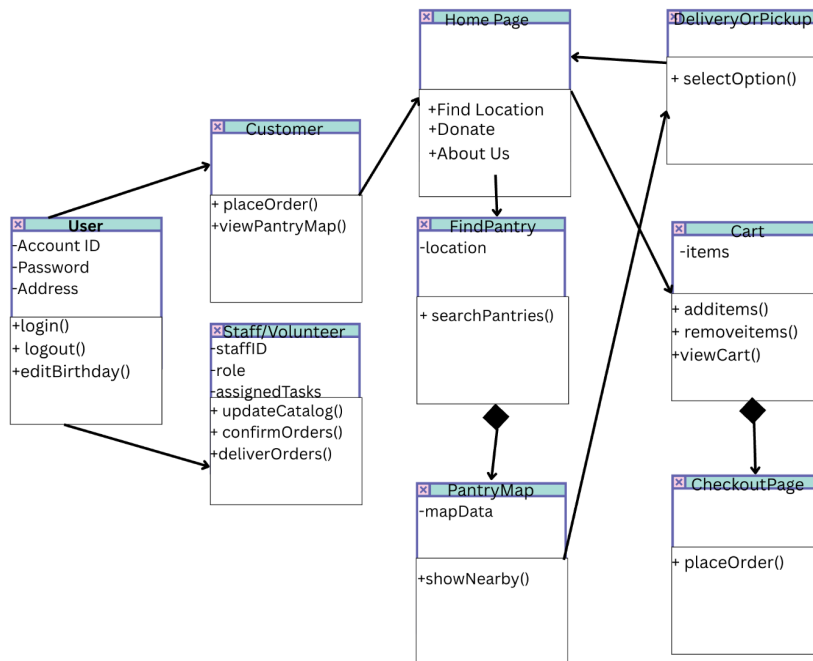
group includes food donors including supermarkets, farms, restaurants, etc. as they play a key role in redirecting food that would otherwise go to waste. These donors currently encounter friction when coordinating drop-offs, tracking their contributions, or ensuring food safety compliance. With Nourish they have the accessibility of a transparent way to schedule donations and see their community impact. However, they may face pain points regarding liability concerns, or whether the system aligns with their operational schedules.

In regards to stakeholders and secondary users, nonprofit organizations and community partners support food access initiatives but often operate in silos, leading to duplicated efforts and inefficient distribution. They need a centralized tool to collaborate, share insights, and expand their reach. While many would welcome this change, they may also be hesitant to change existing workflows and loss of control. Moreover, local governments and policymakers are invested in combating food insecurity and food waste but often lack timely data and effective coordination tools. Our platform can provide valuable community insights and measurable outcomes to guide policy decisions but concerns may arise due to the reliance on a third-party system.

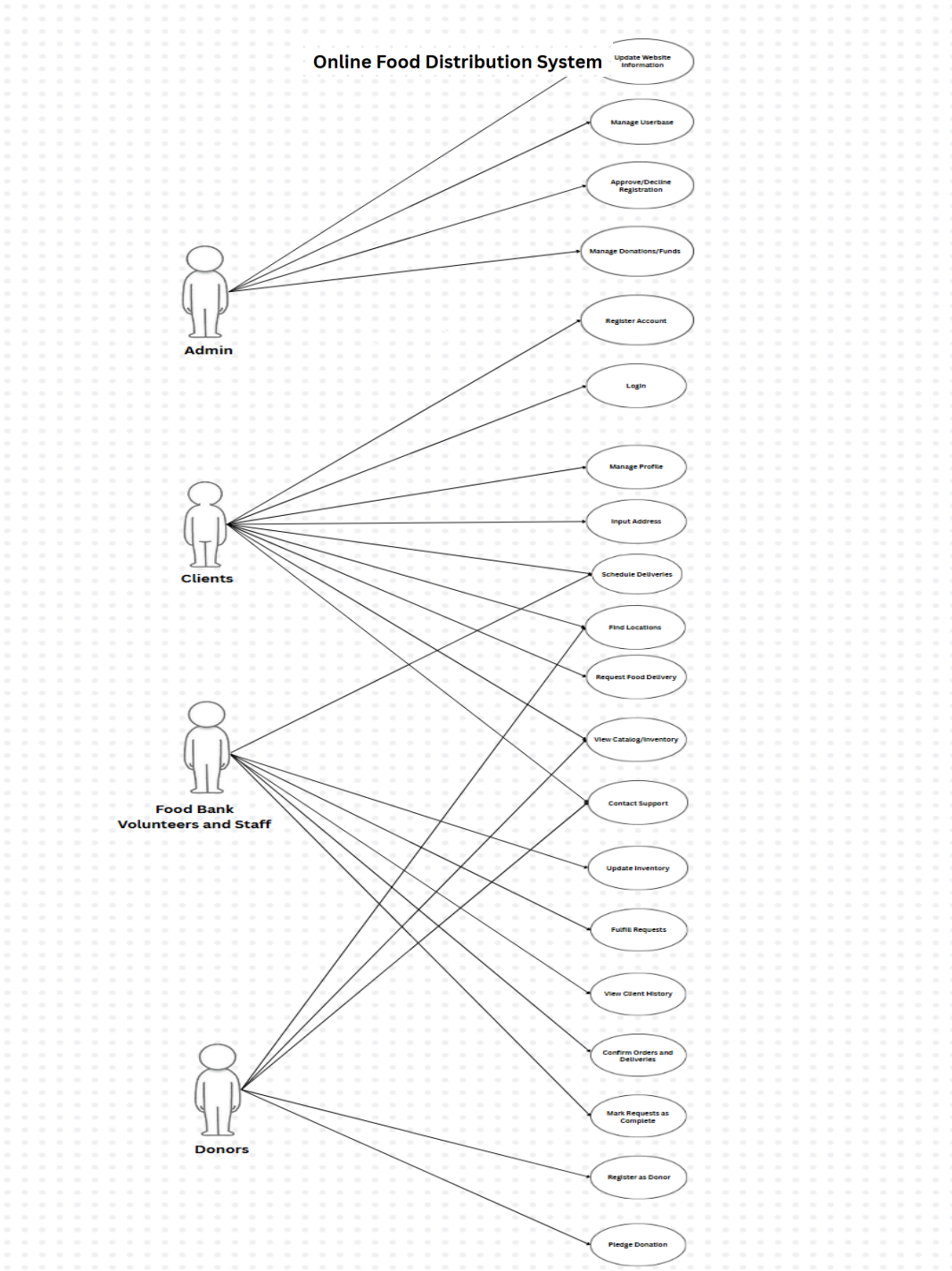
Furthermore, technology and data partners are essential for building and maintaining the platform as they ensure it is secure, scalable, and responsive to user needs. Their needs include technical requirements, consistent feedback, and a roadmap for development. As this can be beneficial at the same time they may face pain points including long-term sustainability, data ownership, and the resources needed to keep the platform running effectively. Finally, healthcare and educational institutions serve individuals who are often at high risk of food insecurity, such as students and low-income patients (Gurganus, Marfo, Schwartz, & Cooksey Stowers, 2021). While they may not be directly involved in food distribution, they regularly see the effects of inadequate nutrition. Their main challenge is not having an easy, centralized way to connect families with food resources or track the effectiveness of those referrals. Nourish Middlesex can support their efforts by providing a trusted resource to refer families to, giving them confidence that those in need can easily access nearby food banks and available support.

UML Diagrams

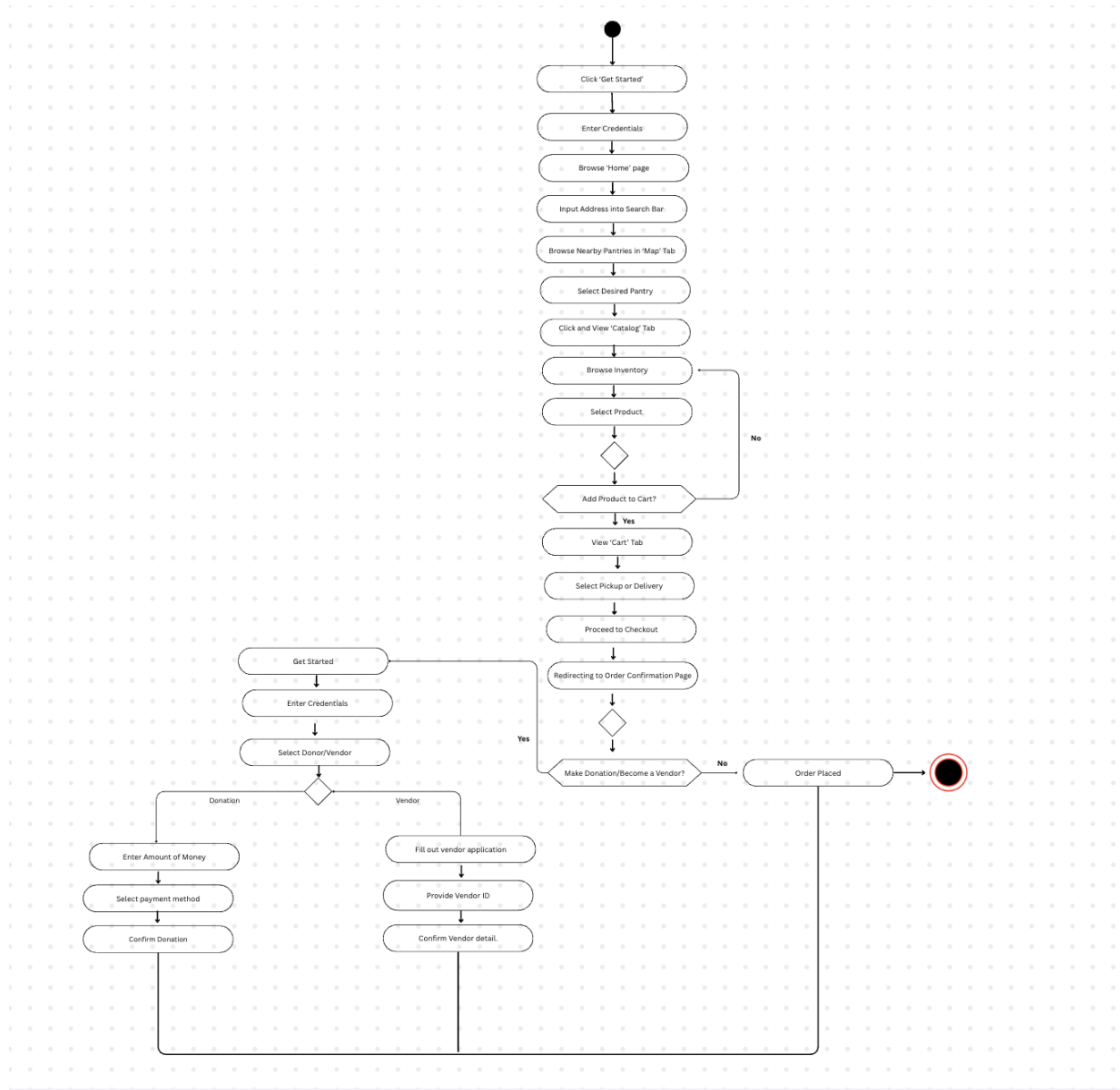
Class Diagram:



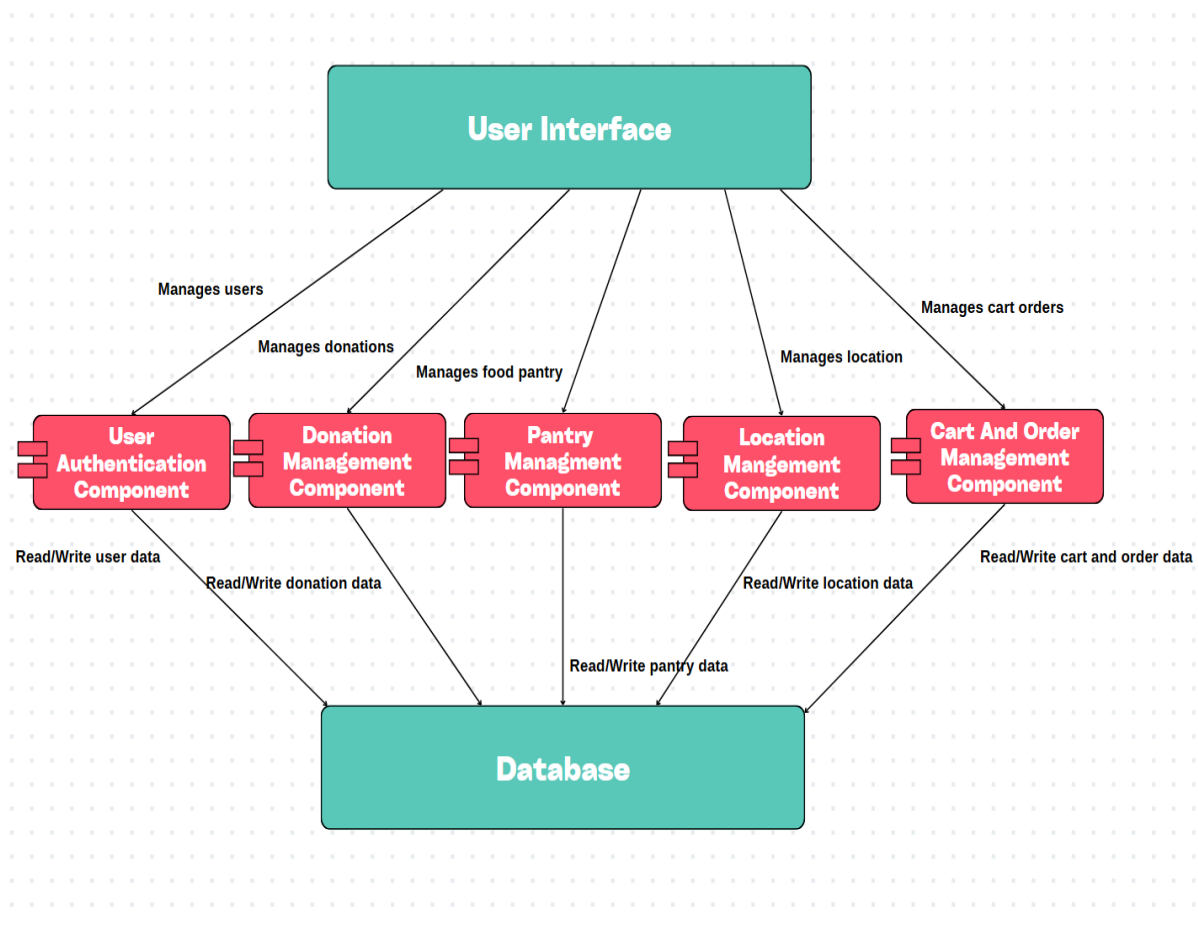
Use Case Diagram:



Activity Diagram:



Component Diagram:



Requirements

Nourish Middlesex is a digital solution designed to address food insecurity across Middlesex County, New Jersey. The system focuses on making it easier for individuals and families in need to find nearby food banks, check inventory and schedule food pickups or deliveries. For our website to be successful, we created three UML diagrams that represent how our site is meant to operate: Class, Use Case, and Activity.

Key components:

- Log in page
- Main/home page- with a search bar that opens up a map
- Map page- where the map opens up- browsing nearby food pantries
- Catalog page- to browse inventory
- Cart page- users select Delivery/Pickup - checkout/ order confirmation
- About us page
- Donation page

Class Diagram

This UML class diagram is a visual representation of the design of a food pantry support website, emphasizing various user roles, functionalities, and system capabilities. The User class is focused at the system's center, which branches into two derived classes: Customer and Staff/Volunteer. Customers can log in, place orders for items, and view the pantry map using methods like `placeOrder()` and `viewPantryMap()`. Staff and volunteers also have the right to update the catalog, confirm orders, and make deliveries with function calls such as `updateCatalog()` and `deliverOrders()`. Navigation from various pages in the site is also shown in the diagram from the `HomePage`, where users locate pantries, learn about the organization, or donate. A class called `FindPantry` uses the `PantryMap` to display food pantry addresses from user specifications, making them easy to find.

From the user experience and functionality perspective, the website must have secure login/logout authentication, an easy map-based search interface for finding local pantries, and the capacity to support

delivery and pickup workflows. Users must be able to surf through a Catalog of products, add them to a Cart, and checkout through a streamlined CheckoutPage. The UI should guide the user step by step, from discovering a pantry to getting their order. For staff, backend functionality is required to manage item availability, task management, and logistics organization. Key requirements of the site include real-time availability of pantries, secure management of user accounts by using their name as their “Account ID” and birthdays as their password, proper order tracking, and community volunteer support. Lastly, the system is designed to reduce food insecurity by connecting individuals with nearby pantries while offering open channels for volunteers to assist.

Use Case Diagram

The Use Case Diagram provides a visual representation of how different "actors" – external entities/users – interact with the system. We identified four main actor groups for the Nourish Middlesex digital site: Administrators, clients, food bank volunteers and staff, and donors. Each actor interacts with the platform in specific ways to support food distribution and access across Middlesex. Each of the actors in this system are depicted as a stick figure or person in the diagram shown above with arrows pointing to each of their possible actions (or known as use cases). Administrators manage the site's content and users by updating food bank information, approving or rejecting user registrations and overseeing donations. Clients, who are the individuals experiencing food insecurity and the main targeted users of Nourish Middlesex, can register accounts, input personal information such as their address, browse available food inventory and request deliveries or pickups. Furthermore, volunteers and food bank staff use the system to handle inventory, track and fulfill client requests, schedule deliveries and mark orders as complete. Donors also play a key role in how the platform functions. Whether they're local businesses, farms for individuals, they'll need the ability to register, view inventory needs and coordinate donations. These use cases highlight the core functions required for the platform to work effectively and help streamline food access across Middlesex County.

While ensuring the website is functional, secure, and user-friendly is crucial, it is also essential to show how different users may interact with the system in detail. Website administrators keep the site functional, so visually displaying their specific tasks can help ensure that the interface is secure, user-friendly, and functional. Clients, who are the people experiencing food insecurity, rely on the website services, so mapping out the ways they may interact with the site is key to determining if there are any places for improvement. It is important for developers to understand how a client interacts with the site to ensure a smooth and accessible experience because of the likelihood that individuals facing food insecurity may not have easy access to the Internet themselves. The use case diagram shows all actions the client may take starting from Register Account to Login. Once in, the client can Manage Profile and Input Address, which is recorded in the system for staff and volunteers to schedule food deliveries to them. Additionally, inputting their address allows the site to show them where the closest food banks are in their area. Food bank staff and volunteers are critical for external operations, like providing food to the poor or fulfilling requests and must be able to use the site to coordinate their operations. They are also responsible for updating inventory and restocking on supplies if necessary. Laying out the use cases for staff and volunteers allows developers to make possible adjustments to the system so it can fulfill day-to-day activities and ultimately improve service capabilities. Lastly, donors interact with the site to donate food or money to help those experiencing food insecurity. Similar to staff and volunteers, listing out their use cases allows developers to make the donation process seamless and keep that specific function in the system working properly.

Activity Diagram

The Activity Diagram outlines the main processes and shows how activities flow within our Nourish Middlesex system. The key processes are ‘Adding Items to Cart for Pick-Up/Delivery’ and ‘Making a Donation/Becoming a Vendor.’ The diagram starts with a solid circle and arrow to show where the process begins. Action steps are displayed in rounded rectangles connected by arrows to show the order, diamonds mark decision points, and a half-filled circle signifies the end of the diagram. The

‘Adding Items to Cart for Pick-Up/Delivery’ process begins with a ‘Get Started’ button that takes users to a Credentials page where they enter basic details like name, birthday, and city. This leads to the Home Page with a search bar where users can input an address to display nearby food pantries on a pop-up map from the ‘Map’ tab. Users select a pantry, browse the ‘Catalog’ tab for available items, add items to their ‘Cart,’ and either view the cart or keep browsing. In the ‘Cart’ tab, users decide whether to have groceries delivered to the address entered on the Home Page or pick them up at the chosen pantry. They then proceed to checkout and are redirected to an Order Confirmation page, completing the process of receiving their resources.

Nourish Middlesex is a website that includes more advanced technological website features which allows people to become donors or vendors. The process of the donation/vendor is that the user has a choice to either donate or be a vendor. Once the decision is made it will go through a key process for the choice. In terms of donation, the user enters the amount of money → choose payment method → confirmation of donation. If the user selects a vendor, it directs to application form → vendor ID authentication → confirmation of vendor. The overall goal of the activity diagram is to show the functionality that a user can go through within the website. In addition, it allows you to see what the functions are after clicking on a certain tab. The diagram is vital for developers as it shows concurrent activities that occur while doing one thing. For example, making a donation of money will also update the bank balance available for the food pantry.

Component Diagram

- Major System Components: (Labeled in Red)
- Dependencies: The Database
- Interfaces: ex: UI -> login, register, sign out
- Integration System: ex: UI -> Backend (Database), Cart & Order -> Pantry Management
- Data Flow:
 - User interface manages each component

- Data from components are read/written and stored in database

Project Summary

Overall our group worked very well together and we were very glad how our project came out. Yet with any task there are always some speed bumps and difficulties. One challenge we encountered was envisioning the various components of our website without a physical blueprint to guide us. When creating our UML diagrams, we had to ensure that each diagram was consistent with the others to avoid contradictions. Because we didn't start with a tangible sketch of our website's structure, it was difficult to account for all the necessary elements that would help achieve our intended goal. Through this project, we came to appreciate the significance of each step in developing a solution to a social issue. While design can be exciting, it's also a critical process that ensures every aspect of the website functions cohesively to enhance user satisfaction.

Another problem we faced at the beginning of the project was communication. Getting everyone on the same page and figuring out what days people could work on the project was challenging. Also some members were not even in class during the day we first started the project. However, we were able to create a group chat on Group Me to communicate effectively outside of class. Additionally, we used Group Me to discuss the more specific aspects of our project and coordinate specific tasks for each group member. We also would make a shared Google Doc where we could bounce ideas off of each other and see what worked best! Both of these methods helped with our communication and made our final project much better.

One of the first problems we faced was picking our problem statement. We knew we wanted to do something with a food pantry but were not sure exactly how we would go about it. We also had to make sure it could work well on a website and not be too complicated. Our first problem statement was too broad, so we had to narrow it down. At first, we wanted to solely focus on food insecurity in New Brunswick, New Jersey, hence the initial name "Nourish New Brunswick," but we ended up choosing Middlesex County because there was not a lot of sources that specifically pertained to New Brunswick.

Many of the sources we were finding addressed food insecurity in Middlesex County as a whole, so we figured it would be easier to broaden our scope a bit more while addressing the same specific problem: food insecurity. We also chose to primarily focus on low income families, seniors, children, and the homeless – anyone who was statistically more vulnerable to poverty. We all agreed that this was specific enough to have as our main target group. After we successfully figured out our problem statement we were able to move through our project very smoothly.

During the research phase of the project, there were limited resources and articles that aligned with our project statement and solutions. There would be some articles that are the same ones that other members found, so some people would have to research deeper into the project problem statements and find unique maps and articles that help support our problem statement of “Nourish Middlesex.”

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