Design Studio 2 - part 1
Discussion 9am Team #5

EXECUTIVE SUMMARY

Although we live in a predominantly affluent nation, the United States of America, there are many who have fallen on hard times. In fact, any of us, at any time, may find ourselves in need of food. Our team seeks to help those in need of food supplies in a specific way. We are proposing the design of a software application that will connect food-dispensing outlets such as grocery stores, restaurants, farmers' markets, and other food outlets, to those in need.

The over abundance of food that will soon be expiring can be transferred to food-transporters, and eventually make it to those in need of sustenance. Food outlets, such as the ones listed above, often have food items that are required by policy or state-law to be removed from shelves due to upcoming expiration dates. These food items are still edible and safe to consume if they make it into the hands of those in need on time. This application was chosen amongst other proposed solutions because of its likelihood of success. Our team concluded that there is a market for this application on the grounds that all users of this software are incentivized to participate. The food-dispensing outlets will benefit through the advertisement of their goodwill, tax write-offs, and not having to dispose of edible food products. Because of this benefit to the food outlets, they would be willing to pay a relatively low price to incentivize drivers to deliver food products to those deemed in need via a short consumer screening. So in our design, we envision three groups participating in the application: Food outlets/donors, Drivers, and the Needy.

01 - AUDIENCE AND OTHER STAKEHOLDERS

Below is the description of corporations and individuals who are involved in the development of NoLeftOver and interested in joining our food reuse program. These actors will interact with NoLeftOver on different roles and responsibilities as well as their influences in the operation of the project will also be listed.

Concerning our potential users, we envision them as:

- **Grocery stores/outlets and food suppliers**
  - Due to their role in providing excess and edible food from overproduction, close to expired date, or food that does not meet packaging specifications for those who are in need. Instead of throwing away these excess food, grocery stores and food outlets can donate them to NoLeftOver and we will be in charge of distributing and delivering them to hungry people or food banks and food secure organizations. Donating food will be beneficial for the brand's reputation as people will know them through their goodwill endeavors.

- **Restaurants/hotels/farmer's/schools/cafeterias**
  - Due to their need in contributing excess and unused food coming from different sources including overbuying, overproduction, uncertain market demand, inaccurate serving size and food portion control, etc. to people with lack of food.

- **Food insecurity**
  - Due to their need in receiving food from donors and food providers. People with difficulty in retrieving food and experiencing hunger will use the app to access and consume those excess food provided/donated from individual donors and food organizations.

- **Drivers**
  - Due to their role in being the means of transporting food from donors to recipients or food banks/organizations.

- **Volunteers**
  - Due to their need to join our food rescue program to save wasted food from being thrown away to landfills that would contribute to the contamination of the environment and climate change. Volunteers will be in charge of holding food rescue programs on the app to propagate our message of waste reduction and raise people's awareness of the impacts of food waste.

- **Food donors**
  - Due to their need in donating and distributing excess food that are still edible and unexpired food to the hands of those who need them the most. Food donors can either be individuals or any organizations who wish to make their contribution to the development of our program.

And concerning our potential stakeholders, we have ascertained that they will be comprised of the following:

- **Government**
  - Due to their need in aiding hunger and vulnerable families and achieving food security goals. Government agencies are one of the major forces in combating hunger in the country with a variety of feeding programs, fundings and nutrition assistance. Food secure program from NoLeftOver will provide a great contribution to end food insecurity with the support and assistance of the government.
- **Local community**
  - NoLeftOver can play a crucial role in the well being of the local communities. With goals of distributing otherwise unwanted food items to people in need can benefit communities overall in decreasing food insecurity. As less and less people are experiencing food insecurity, the quality of life and poverty rates will become better as well. Furthermore, the entire community can join in on this upward initiative for bettering lives. Together people can make their communities a better place.

02 - GOALS, CONSTRAINTS, ASSUMPTIONS FOR THE OVERALL DESIGN SOLUTION

Our primary goal is to find a solution to the essence of the problem at hand. Every year, roughly one third of the food produced for human consumption goes to waste. In this case we are aiming to connect packaged foods near expiration or excess produce to serve those who are food insecure by hiring drivers and volunteers with incentives. Of course there will be limitations to what resources we can make use of as a team, and there will be assumptions made along the way that we need to be made conscious of.

- **Goals**
  - **Prevent food waste and address the global food issue:** Growing food requires water, seeds, labor, machinery, energy, and fertilizer. Letting food go to waste is a frivolous use of natural resources that drives up costs, inflates food prices, and weakens the food supply chain. In addition to taking up space, decomposing food releases methane, a powerful greenhouse gas. Our goal is to ensure excess wholesome food that was otherwise being tossed away, helps feed people, not landfills. Making an effort towards fighting the global food crisis and climate change.

  - **Fight food insecurity and improve nutrition in food-insecure communities:** Our goal is to address barriers to accessing healthy food for food-insecure communities. People who are food insecure may be at an increased risk for a variety of negative health outcomes and health disparities. By providing assistance for people in poverty to access healthy food, we aim to improve nutrition in food-insecure communities.

  - **Embrace "imperfect" produce:** A significant portion of produce that goes to waste are ugly fruits and vegetables. Sometimes the dents and scars or weird shapes and sizes have given them cosmetic challenges which kept them out of retail stores. Sometimes, there might be packing mistakes that keep them off of the store shelves. But they're perfectly edible, delicious and just as nutritious. Our goal is to provide an outlet which in a way rescues these ugly produce and gives them a better purpose.

  - **Inspire thoughtful consumption of food:** NoLeftOver will also drive the initiative of thoughtful consumption of food. With educational information available in our application, we aim to transform mindless consumption into conscious decisions. Our goal is to encourage consumers and manufacturers to make sustainable consuming choices.

  - **Offer people a chance to contribute to a good cause:** NoLeftOver will facilitate surplus food donations and give back to the community. Besides large food outlets, we encourage everyone who wants to make a difference to donate groceries to people in need. There's also other ways to put in effort like becoming a volunteer to make a change.

➢ **Constraints**

- **Users must provide a login to access NoLeftOver:** NoLeftOver is an account-based application. Hence, users will need to create an account and sign in before accessing the app. As users might need to provide their personal information while using the app, a login is required for private data security and authentication purposes.

- **NoLeftOver must be accessible via any public network connection:** in order to provide users with convenient access and accommodation while using the app to donate/receive food or join volunteering activities, NoLeftOver must be accessible through any public network connection or private cellular network.

- **NoLeftOver must be operated on different web browsers and mobile apps:** The app should be easy to navigate through the Internet and accessible from a variety of popular web browsers and platforms. It should be built to use on different types of technological devices with varied operating systems to provide portability and convenience for users.

- **NoLeftOver must have a built-in interactive map:** An interactive map is required for navigation purposes. Drivers will pick up excess food from donors and grocery stores/outlets and transport them to households and individuals who are in need. Hence, an interactive map must be developed to represent users' locations and delivery progress.

- **To access NoLeftOver, users must have Internet access or WiFi connection:** Users must connect to the Internet or WiFi to interact with active features of NoLeftOver as well as getting constant updates of our programs, the availability of food and information about the delivery/pickup progress.

- **NoLeftOver shall enable Live Chat feature:** in order to assist users with fast response and solution as they might face issues during donation, delivery or receivement process. Live Chat helps our support team monitor situations that users are facing and provide them with constant assistance and appropriate approaches/options.

- **The UI of NoLeftOver should be user-friendly:** The user interface of the app should be designed simple and easy to use. Users should be able to use the app to achieve their purposes with sufficient information and instructions from simple features and functions.

- **Different UI versions of the application will be provided to different groups of users:** to serve different purposes of different groups of users, NoLeftOver may provide distinguishing features and operations from the app's user interface. When a user logs into NoLeftOver, depending on which role (food donors, food

receivers or delivery men) that user is, the UI of the app will show information and instructions about the related activities with appropriate interface.

- **Assumptions**
  - **Food donors and receivers are comfortable with sharing their locations:** Our ultimate goal is to prevent food waste while feeding those who are in need. Hence, we shall ask users to share their locations in order to get food from food donors and deliver them to recipients.

  - **Donated foods are edible, unexpired and qualified by the food safety laws and regulations:** Before making any donation, food donors shall be provided with a food guideline to ensure that the donated foods are safe and well-preserved. The donated food should meet the safety requirements as stated in the guideline since we are opposed to any harmful acts to others either intentionally or unintentionally.

  - **Food recipients are aware of the inconsistency and unavailability of food resources:** Since we're operating a non-profit and charitable program that helps prevent food waste and saves people who are in need, there might be an inconsistency in the food amounts and resources supplied to us. Due to the desirability and variation of recipients in the needs of food and ingredient items, the availability of food might be affected.

  - **All users provide a stable access to the app to get notified about the donation and delivery progress:** It's essential that all users have at least one stable access to technology since the operation of NoLeftOver requires public network connection. The availability of food resources and information about the donate, receive or pick-up processes will constantly be updated on the app. Hence, a constant and stable access to the app will prevent users from missing our notifications.

  - **When users face any issues, they would contact support service through provided contact information:** issues and concerns might arise during donation, delivery or food receivement process. Thus, we enable a support service for users to provide them with the best solutions and approaches to walk them through their difficulties. We also expect users to contact our support team to provide them detailed information about the situation they're dealing with. That would help us address the issues and provide constant assistance to users.

03 - MAIN DESIGN

- **Application Design:**
  - **Create User accounts**: Allow users who identify themselves as food insecure and can provide supporting documents to sign up for NoLeftOver's receiving list. Individuals who would like to volunteer or donate food items can sign up as a donor. Drivers who would want to earn incentives by distributing food items to food recipients can sign up to become Drivers.

  - **Alert system:** Arranges efficient communication between food donors and charities and fast delivery of excess food. Delivery drivers, caterers and anyone working with large volumes of edible but rejected food create alerts in the app. Food pantries, processors and composters immediately receive these alerts and contact the source for delivery arrangements.

  - **Communication system:** To ensure smooth and efficient transactions. Drivers, consumers, and food providers will be able to keep in touch with one another. If any issues arise users will be able to directly contact the responsible person and solve any issues as soon as possible to prevent delays or mistakes.

  - **View/select available food items (consumers):** Food consumers will be given a list of available food items provided by food outlets/donors and their associated information. The consumers will be able to select the items they would want to receive. The quantity of food items they are allowed to choose will be calculated considering the family size and item value. For example, each food item will be labeled with its appropriate market price, and consumers will be able to select items until the total price meets their predetermined limit.

  - **Select from the list of available delivery time slots (consumers):** To ensure the freshness of products and better suit consumer's needs, a feature provided by NoLeftOver is allowing consumers to pre-select a delivery time-slot from the list of available times. Therefore, consumers can pick the times that they will be available at home and the information will be passed on to potential drivers to make the delivery.

  - **List food items/quantity (Food outlets/donors):** Food outlets, retailers and donors can input the items ready to be distributed. Alongside the number of each item, the form will require the item's expiration dates, nutritional information and market form. There will also be an available comment section where item providers can explain the reason the item is for distribution. For example: excess inventory, discoloration/scarring, packaging error, near expiration date, etc. They give item consumers a better understanding as they make decisions.

- **Provide pick-up times and information (Food outlets/donors):** To better suit food outlets', retailer's and donor's availability, the system will ask and provide the time slot where drivers will come for the pickups. Food outlets, retailers and donors will also have the ability to set up time periods where they are available to accept pick-ups. This way, they won't be bothered or interrupted unexpectedly outside of the time slots they chose.

- **Assign driver pick-up/drop-off tasks:** The system would offer close-by drivers pick-up/drop-off tasks near the driver's area. To best save fuel and resources, the system will assign pick-up for multiple orders at once and the driver can go around and drop each off at the drop off locations.

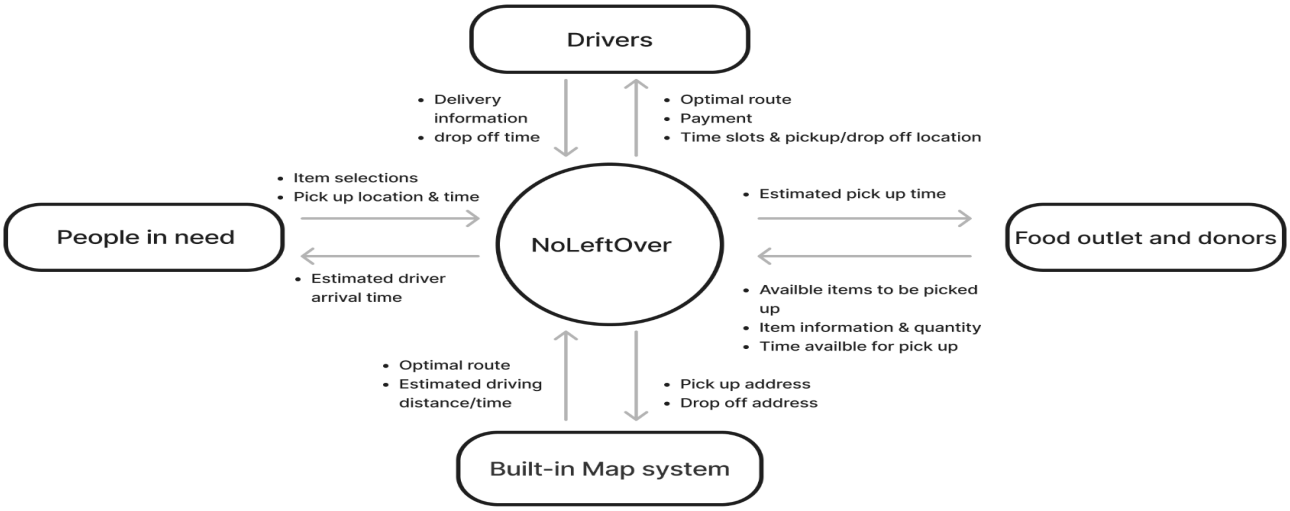
- **Provide the optimal route (Drivers):** To best save time and resources, the system would organize pick -up/drop-off locations and provide the best route for drivers to take and will use the route to provide an estimated time for other users. By reducing delivery time, this can benefit all users in terms of saving time and getting item's faster and fresher.

- **Give payment estimate of each delivery:** To attract more drivers, each order will come with incentives calculated based on the total time it takes to deliver. To ensure fairness, the calculation will not be based on travel time alone. Time for picking-up and dropping-off will also be considered and included in the payment. Furthermore, each completed order will be seen as a bonus, thus making drivers want to pick-up more orders at once and deliver them one by one.

- **Inform the time frame (Drivers):** To avoid interrupting food providers unexpectedly or making deliveries while people are not at home, drivers will need to be well informed about the times when the pick-up/drop-off will be expected. If it's near the closing time frame, an order may need to be canceled or further communications will need to be made.

- **Order cancellation and rescheduling:** Due to unforeseen circumstances, an order placed and be canceled or rescheduled. For example, if the driver was delayed and could not pick up or drop off an order in time, after communication both parties can request cancellation with valid reasonings.

Application Design Example



➢ **Interaction Design**

Three user interfaces will be produced, each providing a user experience that will serve the needs of the three major user-groups. These are the food-outlets/donors, drivers, and the recipients of food (consumers). Logins will correspond to the appropriate interface for each. The UI will comprise various screen layouts that can be adjusted to accommodate different devices and/or varying scenarios. Screen layout options will vary according to the type of device used. Touch screen enabled devices will allow for well-established gestures to navigate the GUI. The intention here is to provide familiar ways of interfacing with a GUI in order that the learning curve will be diminished.

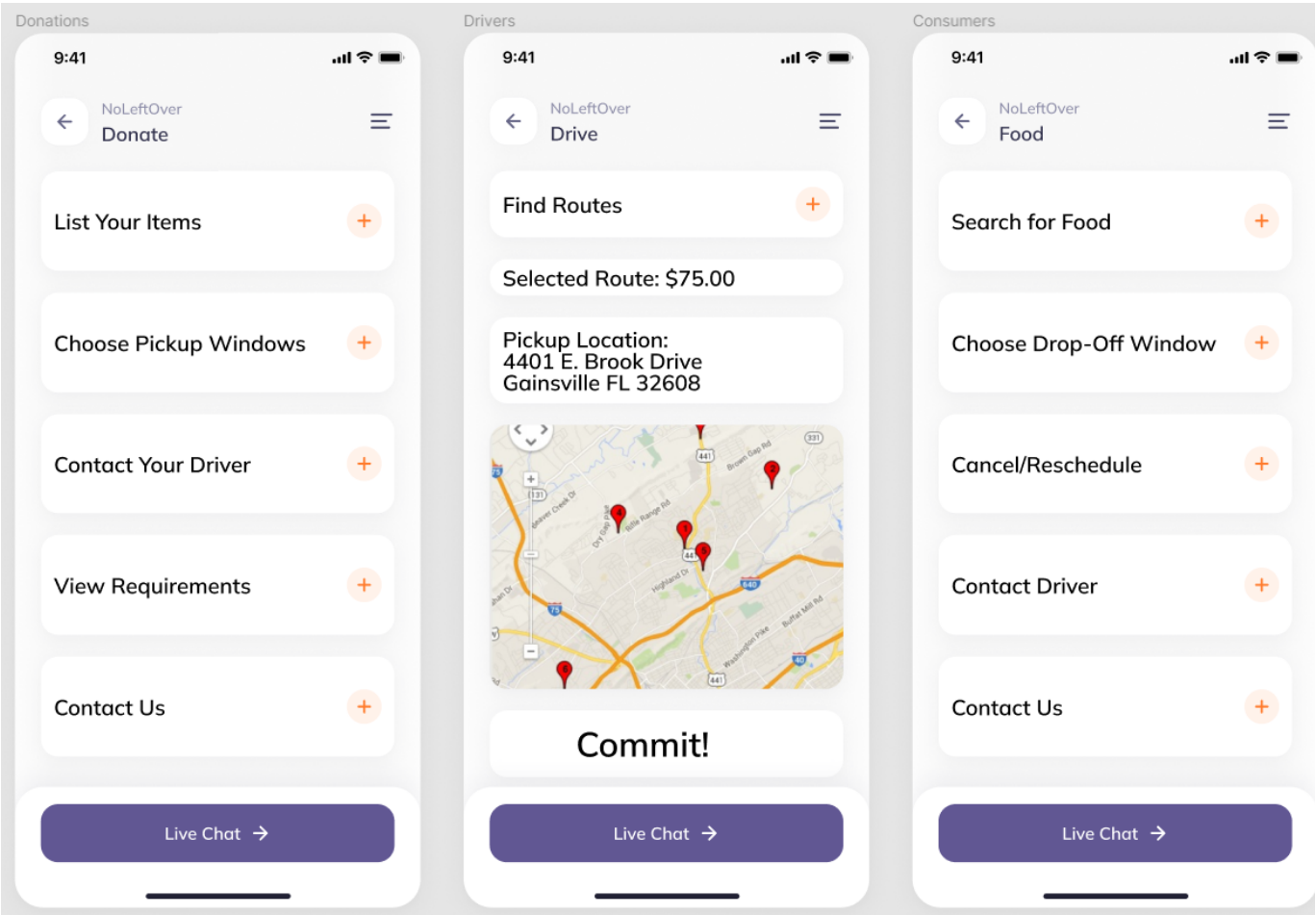
- An initial login/sign-up dashboard will be displayed whereby users will choose at sign-up which group they belong to. After selection, the dialogue will guide users to the necessary information required of them to participate.
- Food outlets/donors UI will:
  - allow for the listing of available items along with available quantities.
  - allow for the listing of food availability days & times.
  - provide a place to enter expiration dates.
  - be able to contact a driver en route.
  - be able to review policy requirements.
  - be provided with a link to phone and chat access.

- Drivers UI will:
  - allow for drivers to search for immediately and future available routes.
  - contain a plot of locations on a route.
  - display the payment amount for a particular route.
  - inform the driver of the time frame in which the route must be completed.

- allow drivers to commit to a route through the application.
- be provided a final ‘Commit’ dialogue.
- be provided with a link to phone and chat access.

- Consumers UI will:
  - see available food items in their area.
  - be able to select their items of interest.
  - be provided with a window of times when the items can be delivered.
  - have the ability to select a window of time for delivery
  - have the ability to cancel an order or reschedule a delivery time.
  - be able to contact a driver en route.
  - be provided with a link to phone and chat access.

Interaction Design Interfaces



➢ **Architecture Design**

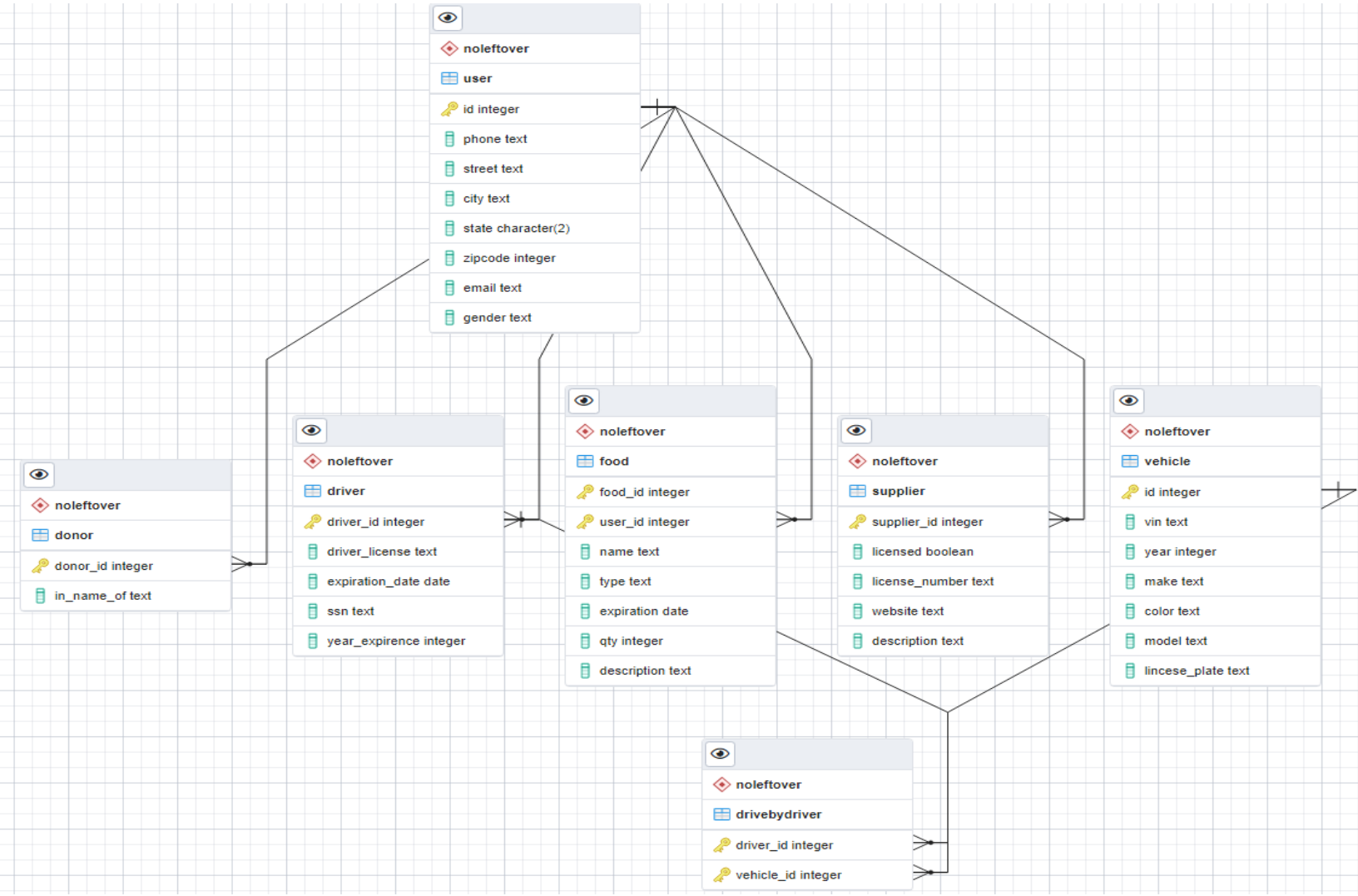
The architecture design serves as the basic backbone of a system. Maintaining the system's durability, consistency, and maintainability is critical in order to provide the greatest experience to the users. As a result, understanding the system needs, restrictions, and bottlenecks should be comprehensive to form the direction among developers and stakeholders.

- The server-side infrastructure:
  - All data will be stored and accessed using **PostgreSQL** relational database management. It aids in the preservation of data integrity, data correctness reduces data redundancy to a minimum or zero, data scalability, data flexibility, and simplifies the use of security mechanisms. The entity-relationship diagram can also help us gain from utilizing a relational database. The diagram below, for example, provides a fast overview of the relationships between models in the project NoLeftOver. As a result, developers may have a thorough understanding of the structure and create software by following the information on the diagram.
  - **Load-balancing** is a critical necessity for NoLeftOver since, with the increase of online traffic, a single server setup may bring the entire system down. A load balancer can assist in distributing incoming traffic evenly across servers designated in a load-balanced set. The private IPs are also hidden in this configuration, and users cannot directly reach the servers, which contributes to improved security. If one of the servers goes down or takes too long to respond, a load balancer may divert the incoming requests to other servers, avoiding bottlenecks and enhancing service availability.
  - **Database replication** can improve reliability and availability with a master-slave model. In most cases, a master database is only available for write operations, while a slave database receives copies of the master database's data and is available for read operations. For all operations, such as insert, remove, and update, the master must receive all data modified to replicate continuously and send it to the slaves. Supporting database replication can improve performance significantly by allowing multiple queries to be executed concurrently. Replicating data, furthermore, can enhance availability and reliability because when one of the database servers crashes or is destroyed by natural disasters, all data will be preserved and accessible from everywhere.

- The client-side application:
  - This software will be available across platforms, increasing the likelihood that every person can receive assistance from their communities.
  - This software will be connected with Google Maps to allow drivers, donors, and users to easily and effectively access the services.

- The application also allows users to be notified when food supplies are available in their areas to pick up.
- The application will allow users to use biometric authentication for quick login.

Architecture Design Diagram (Entity-Relationship)



04 - ALTERNATIVES CONSIDERED

- **Alternative #1: Allowing regular people from nearby neighborhoods and homes to donate food from their homes and let consumers to self-pickup.**

    - Description: The *NoLeftOver* application will have an added feature that permits regular consumers to donate their food, of any amount, to other consumers for pick up only. This added feature will allow regular customer accounts to list their food donation items the same way as donor accounts; however, the donation listings created by consumers will not have the delivery option because of the small amount of food donations. This feature will allow neighbors to donate their food to one another, which enhances the interconnection amongst the neighborhoods and eliminates food wastes disposed of by families and homes.

    - Comparison of Approaches: The original version of the *NoLeftOver* app does not have this feature implemented; And, adding this feature would cause further complications with the safety and security of the customers since everyone would be able to sign-up for a customer account and this allows room for illegal activities. Furthermore, the pick-up only option for customer donations will mislead food recipients and discourage them from using the app. Major donors like restaurants, grocery stores, supermarkets, etc. may mistakenly use customer accounts for listing. As a result, we have decided to only allow major donor groups to donate food items.

- **Alternative #2: Designing separate applications for each target user group instead of different UIs on a single *NoLeftOver* application.**

    - Description: The single *NoLeftOver* app will be replaced with three different functional apps designed specifically for each group of audience: *NoLeftOver* app for consumers, *NoLeftOverDonation* for donors, and *NoLeftOverDelivery* for delivery drivers. The users' inputs will be interconnected and updated constantly and consistently across the three apps. This would allow the three apps to have high performances and light storage memory due to the loads and memory being distributed into three different applications instead of having it on one single system.

    - Comparison of Approaches: Although this method of dividing the *NoLeftOver* app into three separate applications would increase performances and reduce the memory loads, it would significantly extends the development timeline which is cost-inefficient and time-consuming as we have to come up with multiple architecture designs and interaction designs for the three systems. Another downside of having multiple systems is that there will be higher maintenance costs associated with the overall systems. Therefore, we decided to omit this multi-system approach to designing our *NoLeftOver* system.

- **Alternative #3: Adding a feature for donors to choose to give their food explicitly for a certain recipient group.**

    - Description: By adding this feature, during the food donation listing process, donors will have an optional field to choose the recipient group(s) for their food donations (homeless shelters, orphanages, low-income households, etc.) or they could choose for everyone. This feature will allow a more targeted approach to focus on the recipient group(s) that need more assistance or a certain type of food.

    - Comparison of Approaches: This feature will be beneficial to those most-in-need recipient groups, however, it will unfairly distribute donations for everyone else. Donors may have personal references toward a certain group(s) and this will cause unequal distribution of food donations and conflict-of-interest for donors using donation as a tax deduction method. In conclusion, it is better to have food donations be equally distributed among every recipient group(s) and automatedly decided by the app, and not donor parties.

- **Alternative #4: Implementing a constant-update-of-the-delivery-process feature similar to that found in the UberEats app (picked up, current location/route, arrived).**

    - Description: The *NoLeftOver* UI for consumers/recipients will have an interactive map integration onto the app, and it will update the exact location of the driver and where the driver is on the map. There will be a status information on each food donation order; The status information will be of four variations: placed, picked up, on the way, and delivered. Recipients will be able to track the status of their food packages/orders either on the interactive map or the status information bar.

    - Comparison of Approaches: Although it can be useful information for recipients to get an idea of where their food packages/orders are at and be prepared to receive them promptly, it may cause privacy and security issues for the delivery drivers. In addition, this feature is not practical for the *NoLeftOver* app as it is not a for-profit food delivery service like UberEats or Grubhub where delivery drivers get the incentive to provide fast delivery services. The *NoLeftOver* system will prioritize convenience and efficiency over fast services; the main purpose of this system is to get as much food to as many people as possible while limiting the costs associated. Therefore, delivery drivers will probably gather as many food donations for donors as possible and deliver them in mass quantities to as many recipients on the route as possible.

05 - ETHICAL ANALYSIS

Technology interacts with humans daily and it is vital to ensure that it conforms to the ethical needs of the society and the standards that have been put in place concerning human decency and acceptability. The lines of code that we write as information technology personnel have a moral implication for the users and the developers. As developers put down the code they are writing it is important to ensure that it is safe for the users, it is important to consider the human factor in computing to ensure that there are no hazards. For the application that my team wishes to develop, the ethics we considered include:

- Security aspect; the application should be able to ensure the anonymity of the users in the application. Data that is obtained through the users accessing the system could be confidential and considered private by the users, it is, therefore, important to provide them with assurance and confidence while using the application.
- The food made available to the recipients should also be healthy and not hazardous to their health. The food security assessment should be involved in the inspection of the products to verify if they are consumer-friendly.
- The application should also provide a sense of belonging to the users, it should avail products that belong to all races and not only focus on one. Having such differentiation makes the given race a target for attack from dangerous people who wish to cause them harm.
- Tradition and conformity ethics; under this ethical aspect our application should be able to respect the traditional aspect of availing fresh food only and the application should not deliver expired food. The application should also stick to providing free products and not proceed to sell the products
- The software we are developing could create a barrier to use by those who do not have smartphones. The application also requires the internet and it could disadvantage those who have issues with internet connection. This could be mitigated through the local governments and other sponsors contributing to the installation of the internet and having offers made on the sale of smartphones.
- Our application would involve the use of data centers and servers which would mean that the electricity consumed is in large amounts and causes an increase in the carbon footprint of the society. This can be mitigated through the use of data centers that are located in strategic places that ensure the emissions are cut down. The application could also be disadvantageous to the retail companies because customers could fail to shop and wait for the near expiration dates to gain products. This can be mitigated through collaboration with the local governments to ensure those in need of the food are the ones being supplied with the food.