Digital Food Donation Matching System

Project Members

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Project Summary

The goal of the Digital Food Donation Matching System is to prevent the amount of food prepared or stored from being wasted. It is a digital food donation management system; a platform to facilitate the exchange of commodities between people who have excess or surplus cooked/raw/stored/prepared food and people who need food like charities, food banks, and community centers in need or individuals. The platform is a central place that helps to ensure that food reaches the people who need it most and that none goes to waste.

Application Description

This application will allow donors like restaurants, stores, individuals, etc. to create profiles and list all the types and quantities of food they want to donate along with their preferred pick-up timings. That concludes the fundamentals of the donor side. On the consumer side, charities, food banks, and individuals can create profiles and then select filters to look for the type of food they want. They will also be able to set preferences for the types of food they need and their current needs to receive notifications.

The platform will include a database of non-profit organizations and food banks along with the details of a list of donated items. Additionally, the application will also incorporate a cloud-based notification system to ensure that all the donors and recipients get real-time updates. Moreover, the donors will be able to track the status of their donations and look at the live dashboard of their donations.

Creative Component

We plan to eventually incorporate three creative components into the platform to set it apart from the competition and utilize the resources more efficiently with the use of pair-matching algorithms, a cloud notification system, and other thoughtful ideas.

Pair Matching Personalization System

Key Benefits

The most technically challenging features component of the food donation management system would be to create a personalized and quick experience for both donors and recipients. Rather than relying on the manual process, the Pair Matching Personalization System aims at using parameters like proximity(location), category of food (perishable vs non-perishable), number of people the food can feed, date and time of posting a donation, etc. to create a recommendation system to reduce the food waste and optimize the supply and demand chain.

The personalization ensures that donors are matched with recipients promptly reducing the likelihood of food being wasted. Donors can be assured that their food is not being wasted without any people taking a look at the donor posting.

Working of the system with example

To achieve this, there will be four major tasks at hand. Collection of data on donor availability, recipient needs, the kinds of food being donated, and all the other parameters required. Next, would clean the data, and add algorithmic analysis to detect donation and reception patterns. After this, parameters will be required like location, food necessity, number of people, etc. to create a matching system. Finally, these parameters are passed into the algorithm as input to match and coordinate the logistics of the food donations.

For instance, a grocery store has a surplus of canned goods that need to be put up for donation. This system runs an algorithm to look for local food banks in need of similar kinds of food and prioritize the ones that have had a history of great reviews in terms of receiving food and then distributing it to the needy efficiently. The algorithm deprioritized recipients who have received similar items recently to ensure that the food is being distributed equitably among the community.

This personalization ensures that food donations are distributed strategically, curbing inefficiencies and supporting a more balanced, data-driven approach to solving food wastage problems.

Cloud-Based Notification System

Key Benefits

The Cloud-Based Notification System is an essential part of the donation management platform. The goal of a notification system is to ensure that the communication between donors and recipients is seamless and in real-time, allowing for efficient food distribution with minimal delays. The use of cloud infrastructure for this

system provides it with more scalability and ensures that the platform can handle fluctuating demand without any interruption. This includes features like a multi-channel alerts

system—email, SMS, and app notifications—both donors and recipients are instantly informed about updates, matches, or time-sensitive deliveries, reducing response times and preventing potential delays in food delivery.

This will not only enhance transparency but also accountability throughout the donation process by maintaining real-time records of interactions and updates. The best part—recipients can receive instant updates on available donations, while donors are kept in the loop about their contributions and any ongoing transactions. The cloud-based nature of this system allows for flexible scaling, meaning the platform can manage thousands of users and notifications without compromising speed or accuracy, further ensuring that no donation goes unnoticed or unused.

Working on the System with an example

The Cloud-Based notification system operates through multiple steps. Recipients enter their requirements and food requirements. As soon as donors upload some food available for donation, relevant recipients get the notification. The donors also receive a notification as soon as someone books food. Notifications are sent out via the most appropriate channel—SMS, push notifications for users with the app, and email updates.

The example use case for this will be a local restaurant that has a surplus of food be it cooked food that has a lower life span or shelved food like milk, bread, or eggs, that has a longer shelf life. There is a food bank running low on inventory and needs food. The matching algorithm has triggers set to notify the food bank about the potential donation match. The restaurant and the food bank can coordinate the logistics and ensure the food reaches without spoilage.

This cloud-based notification system for food management not only ensures food wastage is reduced but also improves the insecurity around donated food, and reduces the risk of food spoilage due to miscommunication which will lead to a more responsive and scalable food donation network.

Rate and Review System

Ratings and reviews written by customers allow other customers to look at feedback on products, services, or businesses. These systems consist of two main components: Ratings, which provide a numerical or symbolic representation of user satisfaction, often represented as stars (e.g., 1-5 stars), and the second is reviews, where users write detailed feedback about their experiences, opinions, and recommendations. Together, these elements give potential customers/consumers valuable insights into the quality and reliability of services, which is extremely important for credibility, transparency, and trust within the donation space. This review helps train a dataset that would be useful for the recommendation framework.

Usefulness

The usefulness can be potentially extended to four major areas viz. -

1. **Donors**: The platform provides a convenient way for donors to manage their surplus food, reduce waste, and support their community. They not only contribute but also get the satisfaction of knowing that their food is being distributed optimally.
2. **Recipients**: The platform ensures that recipients receive the food they need, improving food security and reducing hunger. The system makes sure that food being distributed is not saturated to one locality to ensure equitable distribution.
3. **Environmental Impact**: The platform helps minimize the environmental impact of food in terms of its production, processing, and disposal leading to a reduction in food waste. Ultimately leading to improved waste management and reduced carbon footprint.
4. **Economic Benefits**: The platform can help reduce the economic costs associated with food waste, such as disposal fees, lost revenue, and potential costs to purchase the goods that perished due to lack of efficient usage.

Realness

The food donation management systems will draw data from several key sources to accurately match donors to recipients:

- **Public Databases**: These databases will include resources such as food bank directories, restaurants that offer food for donation, and public datasets related to food insecurity. This allows the platform to identify and distinguish areas where food is needed most and where surplus food is available.
- **User-Generated Data**: Here we capture and store the information like donor and recipient profiles, records of food donations, and real-time donation details (such as food types, quantities, and locations) that will be collected to be analyzed. This helps the platform tailor the recommendations to ensure timely and appropriate matches between donors and recipients.
- **APIs**: The system will integrate with various services to feed real-time data, retrieve existing data, monitor user interactions, and gather additional insights, ensuring the most relevant data about food availability and recipient needs is processed.

Data will be captured in formats like JSON (which will be used for APIs) and CSV (used for user-generated data), allowing the platform to manage and analyze large datasets effectively.

Datasets Description

To build an efficient food donation tracker that aligns with the mission, we would utilize two key datasets:

Dataset 1: Food Donation Records

Link–(https://www.kaggle.com/competitions/food-bank-donation-forecasting/data)

This particular dataset was picked from Kaggle which provides detailed information and a view of food donations made by several sources like organizations and individuals - like restaurants, grocery stores, etc.

- Cardinality: 145,000
- Degree: 9

The fields/columns in the dataset include Item No., Description, Storage Type, Donor Information, Posting Date, FBC Product Type Code, Quantity, Unit of Measure, and Ext. Gross Weight

We plan to use the dataset in the following ways - Firstly, in tracking and managing inventory by ensuring that food donations are efficiently monitored, and the platform has a real-time view of available food. Secondly, in analyzing donation trends by identifying trends based on the frequency, types, and sources of donations. Also, in optimizing the food distribution by matching the donated items with recipients based on food types, storage needs, and recipient preferences.

Dataset 2: Food Supply Chain Metrics

Link–(https://refed-roadmap.s3-us-west-2.amazonaws.com/csv/public_downloads/food_waste_monitor/ReFED_US_Food_Surplus_Summary.csv)

- Cardinality: 38,000
- Degree: 31

We plan to combine both datasets 1 & 2. This dataset provides a broader view of surplus food and waste among different sectors and categories. An overview of the fields in the dataset includes: Year; Sector; Sub-Sector; Food Type; Tons Surplus; Tons Supply; US Dollars Surplus; Tons of Waste; Tons Donations; Environmental Impact (MTCO2E)

We plan to leverage this dataset in the following ways: By identifying food surplus sources majorly by pinpointing the sectors and businesses with large surpluses for targeted food recovery and donation. We could also reduce food wastage by targeting high-waste sectors to increase the redirection of surplus food to people in need. We could also track environmental benefits in future by quantifying the reduction in environmental impact achieved through food donations.

Dataset 3: Food Statewise Surplus Food Metrics

Link–(https://refed-roadmap.s3-us-west-2.amazonaws.com/csv/public_downloads/food_waste_monitor/ReFED_US_State_Food_Surplus_Detail.csv)

- Cardinality: ~550,000
- Degree: 31

A few columns present in this dataset are: year, state, sector, sub_sector, sub_sector_category, food_type, food_category, tons_surplus, tons_waster, tons_uneaten, tons_donations, tons_industrial_uses, tons_animal_feed, tons_composting, tons_incineration, tons_dumping, etc.

We plan to leverage this dataset in the following ways: To monitor food waste and surplus in different sectors, to track donation efforts, and to assess the environmental impact (such as carbon and methane footprints) of wasted or unused food. It could also be used to improve sustainability, target surplus recovery efforts, and promote food donation.

Functionality Description

User Profiles and Registration

This functionality is responsible for the user profile creation either on the donor side or the recipient side. The user will go to this application, and click on sign up to register into the system. The registration asks for basic information from the user such as organization/user name, address, contact information, user password, etc. This information is essential to track the activity of every user. Further, once the user is logged in, they can easily manage their profile information such as update contact details/ address, type of donor(restaurant, individual, grocery store), etc.

Donor Functionalities

Once the user is logged in as a donor, they have access to several key features on their dashboard, the main features include:

1. Donors can create, update, and delete listings for food they want to donate, including the type and quantity of food, Preferred pick-up timings, Expiration dates for perishable items, etc.
2. Donors can track their activities for donation historical as well as active.
3. Donors can view donation requests they may receive from a recipient
4. Donors can schedule the donation by setting their availability for food pick-ups.
5. Donors can update their profile information.

Additionally, the donor can view the reviews and feedback they receive from the recipient. They can see their overall rating right on the dashboard.

Recipient Functionalities

Once the user is logged in as a Recipient, they have access to several key features on their dashboard, the main features include:

1. Recipients can search for available food donations using filters such as food type, quantity, and location.

2. Recipients can set preferences for the types of food they need and their current requirements.
3. Recipients can make requests to the donor(s).
4. Recipients can view the previous requests that they sent to donors. The requests/bookings will be stored in a separate Booking table which will have the status of the bookings. We will use this booking table to track the status of the request. Since this table will have foreign key to listings, we can easily track the items, donors and other details using joins and use that to show the user booking history.
5. Recipients can opt to receive alerts when suitable donations become available.
6. Recipients can update their profile information

Additionally, the Recipient can review and write feedback to the donor.

Matching System

The system utilizes the matching system to pair the donor with the target recipient. The pair-matching algorithm essentially uses parameters such as proximity, food category, quantity, and timing to match donors with suitable recipients. As the user makes a search based on a preference set, the system, based on historical data and current needs, suggests an optimal match for the recipients.

Since the matching/recommendation system is a key feature, dedicated folks will be working on it to generate recommendations. The recommendations will be refreshed on a daily basis and stored in the database - recommendations table. While recipients search for food, the results will be ranked based on the recommendations.

Sample Query:

```
select listingIds, score
from listings l
left join recommendations r on
l.donor_id = r.donor_id
where recipient = ‘sample recipient’
order by score;
```

Notification System

The communication between donor and recipient is essential for a smooth and safe transition of the food from one location to another. A cloud-based notification system ensures timely

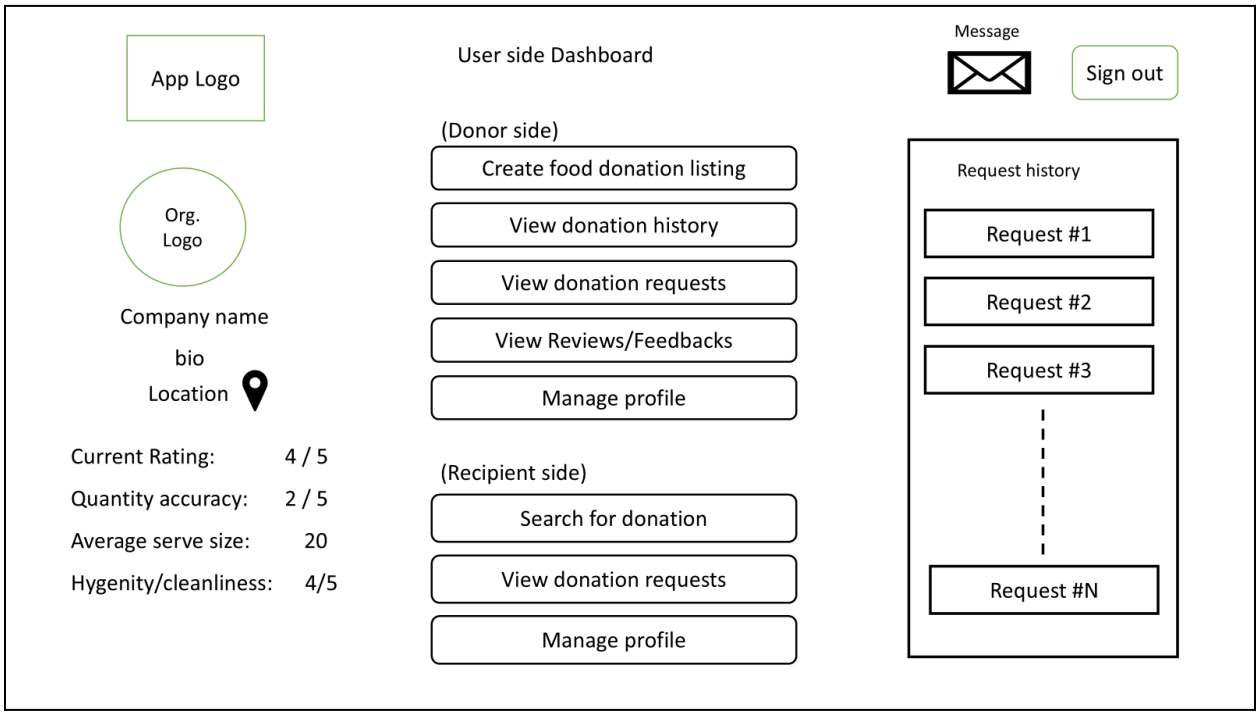
communication between the user. The system ensures that the users receive updates via email, SMS, and app notifications.

Rating and Review System

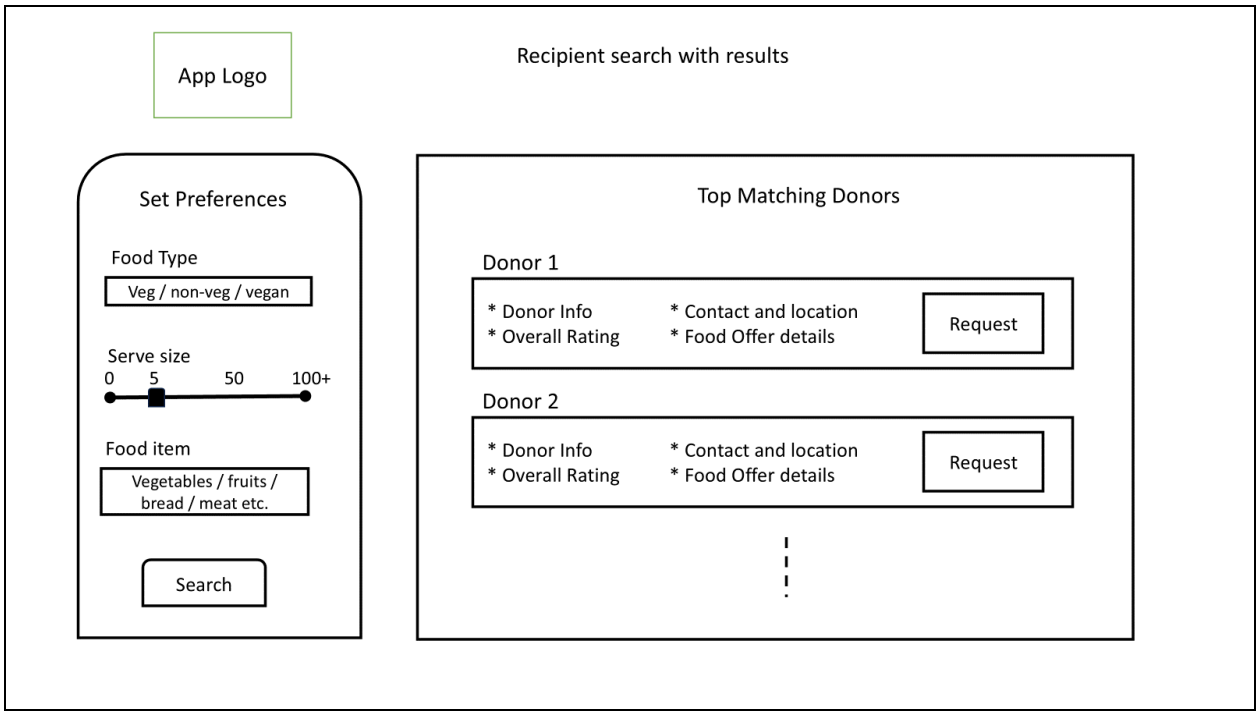
A review and feedback system is essential for gathering user opinions and experiences, enabling continuous improvement of products or services. It helps identify strengths and areas for enhancement, fostering customer satisfaction and trust. The review given by the recipient reflects the reputation of the donor. The higher the overall rating of a donor, the better the chances of being approached by a recipient on the system. The recipient would be able to view the overall rating of a donor as they search for the donor with the system. Moreover, the recipient can post their experiences and feedback to the donor.

By offering these functionalities, this donation management system creates a comprehensive ecosystem for food donation management, allowing users to efficiently create, update, delete, and search for donation opportunities while fostering a community dedicated to reducing food waste and addressing food insecurity.

Low Fidelity UI Mockup



UI of Dashboard at User side



UI of search results for the Receipt

Work Distribution

1. Documentation and records: Omkar Dhekane , Sai Krishna Rohith Kattamuri
    a. This work involves creating design documents for feature modeling, documentation of the code written for future readability, project reports, presentation reports
2. Frontend Development: Sai Prakash Gorti , Omkar Dhekane
    a. This work includes the creation of frontend UI for the application
    b. API handling to link frontend UI to backend endpoints
3. Database Design and Advanced Query Creation:
    a. Creation of databases - deciding entities, fields, relationships: Nikunj Agarwal , Sai Prakash Gorti
    b. Creation of ER Diagrams: Sai Krishna Rohith Kattamuri , Omkar Dhekane
    c. Hosting of databases on the cloud: Sai Prakash Gorti , Nikunj Agarwal
    d. Record creation and insertion: Omkar Dhekane , Sai Krishna Rohith Kattamuri
    e. Advanced queries including triggers, procedures, optimizations: Nikunj Agarwal , Sai Prakash Gorti , Omkar Dhekane , Sai Krishna Rohith Kattamuri
4. Backend systems:
    a. User sign-in, registration, and profile update functionality: Sai Krishna Rohith Kattamuri
    b. Food Items Upload and Food Items Display Based on Search: Nikunj Agarwal

c. Donor - Recipient Match Recommendation Algorithm: Omkar Dhekane, Sai Prakash Gorti
d. Cloud Based Notification: Sai Prakash Gorti
e. Performance Optimization: Sai Krishna Rohith Kattamuri, Nikunj Agarwal