Smart Food Waste Reduction System Using A Web-Based Donation Platform

[1] Sandhiya C [2] Vishal E, [3] Prakash A [4] Vikashini G, [5] Kiruthika S

[1]Assistant Professor ,

[12345]Department of Computer Science and Engineering [12345]Nehru Institute of Engineering and Technology Coimbatore -641105

Abstract - Food waste is a significant global issue. It leads to the loss of valuable resources, even as many people struggle with hunger and food insecurity. A lot of surplus food from restaurants, hotels, and households is often thrown away because there is no effective system to redistribute it. The Waste Food Management Web Application was created to tackle this problem. It connects food donors with NGOs, shelters, and individuals in need .With this web application, donors can easily upload information about surplus food, including the food name, quantity, location, and expiry time. This allows receivers to request and collect the food promptly. The system has several essential features, including user and admin login, a dashboard for managing activities, food donation and request modules, a map view to locate nearby donors and receivers, and a notification system to alert users about new food donations. The application also sends email notifications to receivers each time new food donations are posted. Additionally, an AI assistant is integrated to help users and answer questions related to the platform. One key feature of the system is its offline capability. Donation data is stored locally when there is no internet connection and is automatically sent once connectivity is restored .By using this application, food donors and receivers can communicate effectively, ensuring that surplus food reaches those who need it. Overall, the Waste Food Management Web Application helps reduce food waste, improves food distribution, and supports social welfare by making the donation process simple, efficient, and accessible.

Keywords: Managing waste food, donating food, reducing food waste, distributing surplus food, providing support to NGOs, sending email notifications about how to manage and track food by location (Map), using AI assistance and storing data offline as part of a sustainable management approach for food.

1. INTRODUCTION

Food waste is a big problem in many areas around the world. Restaurants, hotels, and households often throw away large amounts of food because of poor management and a lack of proper distribution systems. At the same time, many people face hunger and do not have enough food. Therefore, we need a better system to reduce food waste and help deliver surplus food to those in need.

The Waste Food Management Web Application connects food donors with NGOs and recipients. Through this platform, donors can easily provide information about surplus food, and recipients can see and request this food. The system has features like user and admin login, a dashboard, food donation and request modules, a map view, notifications, and email alerts. It also works offline, allowing data to be saved when the internet is down and sent automatically once the connection is back. This system helps cut down on food waste and supports social welfare.

2. PROBLEM STATEMENT

Food waste is a big problem in many parts of the world. Restaurants, hotels, supermarkets, and households throw away large amounts of edible food. This often happens because of poor management and a lack of coordination between food donors and organizations that can distribute the food. Meanwhile, many people struggle with hunger and don't have enough to eat. Without an efficient system to handle surplus food, we waste resources that could help those in needWe need a simple and effective platform to connect food donors with NGOs and recipients. This system should allow donors to easily share information about surplus food, notify receivers of available donations, and help distribute food before it goes to waste. The Waste Food Management Web Application aims to solve this problem by offering a structured, tech-based solution for managing and distributing surplus food.

3. LITERATURE SURVEY

Recent studies show that a large amount of food is wasted globally due to improper management and lack of coordination between food donors and receivers. Researchers suggest that digital platforms can help reduce food wastage by connecting restaurants, households, and organizations with NGOs and people in need.

• Web-based applications have been developed to allow donors to upload details about surplus food and enable NGOs or receivers to request and collect the food. These systems improve communication between donors and receivers and help ensure efficient food distribution.

• Several food donation platforms integrate location-based services using map technologies such as Google Maps. These systems help users identify nearby food donors and receivers, making food collection faster and reducing the chances of food spoilage.

• Modern food donation systems include notification features such as email alerts and in-app notifications. These notifications inform NGOs or receivers when new food donations are available, enabling quicker response and better coordination.

• Artificial Intelligence is being integrated into many web applications to provide assistance and guidance to users. AI assistants can help users understand the system, answer queries, and improve overall user experience.

• Despite these advancements, many existing systems lack features such as offline functionality, intelligent assistance, and automated communication systems. These limitations highlight the need for a more efficient and user-friendly waste food management platform.

4. EXISTING SYSTEM

Under the existing system, food donation and distribution services are handled by simple methods or basic communication systems. The restaurants, hotels, or households that have surplus food available find it difficult to reach NGOs or needy people who require food. This has led to a waste of a large amount of food because of inadequate coordination and management.Some organizations use social networking sites, phone calls, or message service to convey messages to others regarding available food donations. This is not an efficient process because it is not managed properly. The process is not efficient enough to reach the proper person at the proper time. There is also no proper management to track food donations. This is because of inadequate features such as notifications, location-based services, or data management. Because of these inadequate features, food distribution is not efficient, leading to a waste of a large amount of food. Therefore, a more efficient process is required to manage food donations.

5. PROPOSED SYSTEM OVERVIEW

5.1 System Goals

To minimize wastage of food by designing an efficient online platform through which donors can share their excess food with those in need.

• To bring donors of food such as restaurants, hotels, and individuals in contact with NGOs and receivers

of the food, thus making the process of food donation and distribution more convenient.

• To send timely notifications to the receivers about the availability of new food donations through email.

• To make the system more efficient by including features such as location tracking and data storage in the

application, even when there is no internet connection.

5.2 High-Level Architecture

1. Frontend (User Interface):

The frontend is the user interface of the Waste Food Management Web Application. The frontend is the component of the system with which the users interact. The users of the system include the donors, the receivers, and the administrators. The users interact with the Waste Food Management Web Application through the frontend. The frontend of the system provides the users with different web pages. The web pages include the login page, the dashboard, the donate food page, the request food page, the map view page, the notifications page, and the profile page. The frontend of the system is created using HTML, CSS, and JavaScript. The use of the three technologies enables the creation of an interactive, responsive, and user-friendly frontend. The frontend of the system collects the input from the users and then transmits
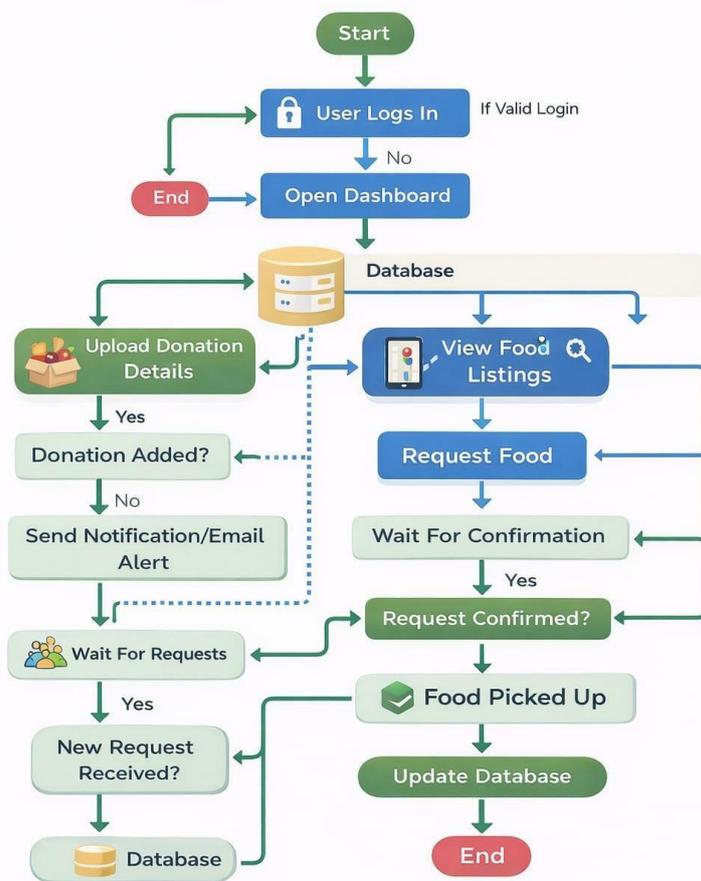
2. Backend (Application Server):

The backend serves as the primary processing function of the application and performs all system processes. Specifically, the backend: receives input from the front end, handles requests, communicates with the database. Examples of backend functions include: user authentication for logon/logoff, receiving/processing information about food donations & requests and sending messages and/or emails to recipients of donations from administrators. In addition, other features of the backend include implementation of an AI assistant for use by donors, recipients and/or volunteers; and the availability of map-based services. The backend guarantees that all processing is done securely and efficiently.

Node.js and Express.js have become the most commonly-utilized programming languages to create backends due to their ability to facilitate communication among multi-location parts of the system; as well as supporting real-time data processing/manipulation..

3. Database (Data Storage):

The database is used to store and manage all the data associated with the system. The data stored in the database includes user data, donor data, food donation data, request data, and notification data. When a user donates food to the system, and when another user requests food from the system, the data is stored in the database. The database also helps the system retrieve data when it is required. This helps in managing data in an orderly manner within the system. The database used in the system can be Firebase or MongoDB, which are useful in storing data in a secure manner and retrieving data quickly.

Flowchart of Waste Food Management Web Application

6 . SYSTEM DESIGN

As is, the System Design section summarizes how the Waste Food Management Web Application functions as a whole, listing out the major components of the system, and showing how those components interface with one another to make donations and distributions of food easy and effective. Additionally, it creates a simple, user-friendly interface for donors, receivers, and administrators of the application to access all of the services provided by the app via a single interface.

The first step in using the system is to log in securely through an authentication process before proceeding to the main dashboard. Once logged in, users will be directed to the dashboard (main control panel) for the application. From the dashboard, users can access each of the four modules listed above - Donating Food, Requesting Food, Notifications, and Map Location - as well as manage their profile.

The donating food module allows donors to enter specific information about the food they would like to donate (name, amount, pick-up location, expiration date/time). That information is sent to the back end and stored in the database prior to creating automated notifications and email alerts that notify receivers when new food is available. At the same time, receivers can also view the donated food through the request food module and request food if needed.

To assist with locating the donated food items for pick-up, the system provides an interactive map in the request food module. Users are able to search via the map by selecting different types of markers based on donation type, expiration date, or by entering a specific key.

7. METHODOLOGY

1. Requirements analysis:

This is where we (as a group) identify and analyze the requirements of the Waste Food Management Web Application. Although many people are aware of the issue of wasted food, the purpose of this application is to create an assessment of food waste and to explain how the application can assist in reducing food waste. There are several system requirements that will be included in this application, including user and administrator login, modules for users to donate and request food, the ability to try to locate food items via a map, message notifications to users, email notifications, and an artificial intelligence section. Also included will be how to use the application while offline. This information will help define the functional and non-functional requirements needed for the development of the Waste Food Management Web Application.

2. System Design:

During this phase, the architecture and structure of the Waste Food Management Web Application will be planned and prepared. The Waste Food Management Web Application has three major components: the front end, the back end, and the database. There will be numerous design activities that will occur during the system design phase, including user interface layouts, the structure of the dashboard, the flow of information, and the architecture of the system design. In addition, modules for donating food, requesting food, sending notifications, displaying a map view, and a profile management module will also be designed in this phase.

3. Development:

In this phase of the project, we will actually code and implement the Waste Food Management Web Application based on the design work completed in the previous phases. The front end of the Waste Food Management Web Application will be created using HTML, CSS, and JavaScript so that the site is user-friendly. The back end of the Waste Food Management Web Application will be created using Node.js (based on the Express.js framework) so that the application can handle the operations and communication between the front end and the database. The data will be stored in a traditional SQL database system.

4. Testing:

All functionality of the application is tested to verify that it is performing as intended. Testing can come in various forms, such as functional testing, integration testing, or usability testing. In this phase testing is performed on the Login System, Food Donation Process, Request Module, Notifications, and Offline Functionality to find errors or bugs that were present at the time of the system's launch.

5. Deployment:

The application is deployed at the end of the development process and is now usable by users. The web application will be hosted

on a server where users can access it via the internet, whether they are donors, receivers, or administrators. Checks will occur after the application has been deployed to ensure that it is running smoothly, and future enhancements or updates can be handled.

8. SYSTEM MODULE

User Registration and Login Module:

The User Registration and Login module is where registered users, which include donors and receivers, are able to register users into their security system by giving them basic information such as their name, email and password after they have registered they can log in using their credentials which will then allow them to access all of the application's features through the Dashboard, which allows the user to perform their respective transactions when they want to or whenever it is most convenient for them. Thus, this module was built to provide that only authorized user can use the system.

Admin Login and Management Module: The Admin Login and Management Module is where the admin logs into the system and has special log-in privileges and access to all activity within the application so that the admin can monitor and track users to verify that both the donor and the recipient have provided true information. The admin also manages user accounts and can view the food donation records as well as track all food request activity within the application. In addition to monitoring and tracking user activity, the admin is also responsible for controlling all of the operations of the system in order to ensure that the platform is functioning properly.

Dashboard Module:

The Dashboard Module is the main interface of the system in which registered users and recipients are able to view the various modules available, such as Donate Food, Request Food, Map View, Notifications, and Profile Management, along with any transaction that has been processed through any of those modules. Overall the Dashboard provides the end-user with a clear picture of how the system is currently being utilized.

Donate Food Module:

The Donate Food Module is where the donor enters all surplus or unused food items into the system that they would like to donate. Therefore, donors enter information into the system, such as the food name and how much food in units that the donor has to donate to the recipient.

Request Food Module :

The request module states that NGOs and receivers view all available donated food and can put in requests to pickup any needed donated food. The system processes the request and in turn, updates the status of the donated food item. This helps to ensure that donations get to those who need them and that the donated food is not wasted.

Notification And Mail Module:

This module sends out notifications and email alerts to receivers when a new donation of food has been added to the system. This allows the receivers to respond quickly to the new donations, so they can collect the food promptly.

Map View Module:

The map view management module provides location-based services, so users can find nearby; donors or receivers who have donated food. By displaying these locations on a map, it provides easy access to donors or volunteers to efficiently pickup food donations and deliver them to those who need them.

Profile Management Module:

This module allows users to update and manage their personal details such as name, email and contact number. Users can also access their donation history or request history through the profile management system.
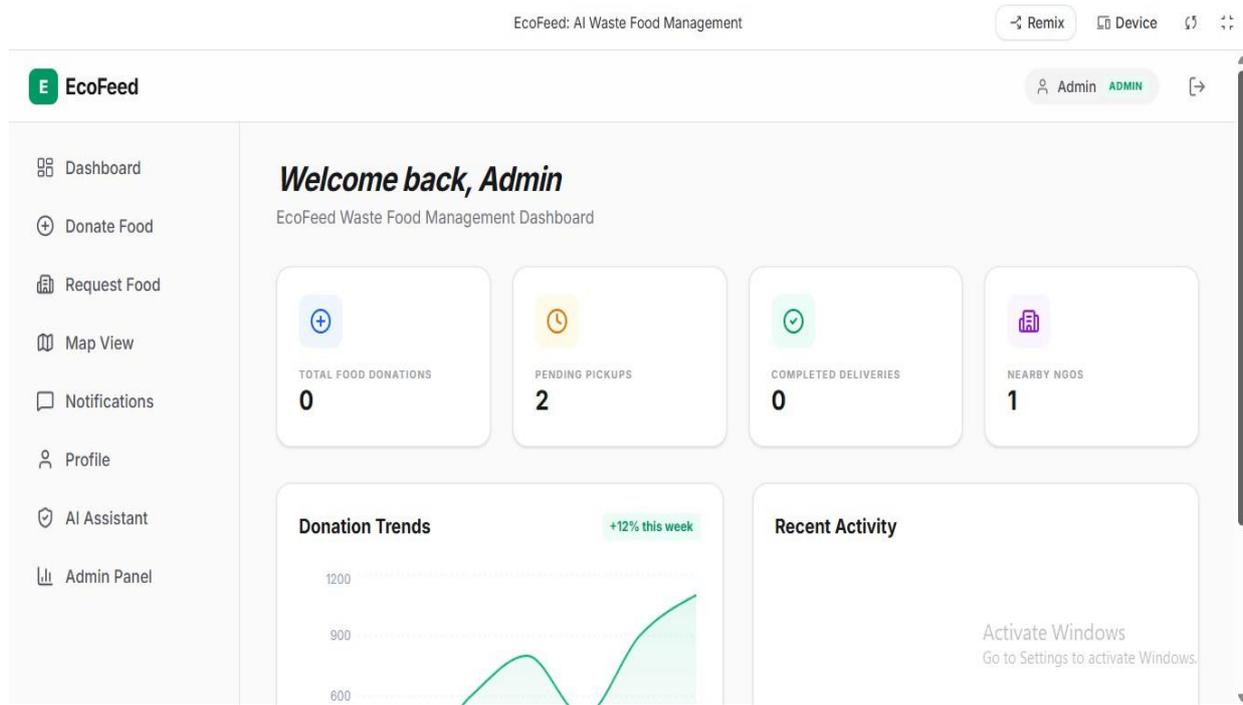
9. DATABASE DESIGN

For optimal performance, the Waste Food Management Web Application includes a reliable Database Design, which functions as a repository of all the required data and utilizes various database design tools to achieve that goal. By establishing a good database design, the application can create an efficient structure to store all the information about users, their donation and request information as well as accessibly retrieve these records as needed.

The Waste Food Management Web Application Database Design includes a variety of data types (user information, food donation information, food request records, notification information, etc.). For example, in the case of a user registering/logging into the system, the user will also have their first name, last name, email address, and password stored in the waste food management application's databaseThe waste food management application's database also contains a table to record the food donation requests made by the recipient/NGO, which allows for the organization and management of the donated food and how it has been collected by various organizations. Additionally, the database contains records of the notifications sent to the users, as well as the email recorded in conjunction with the record corresponding to that email for each user.The database is designed so that the communication between the front-end and back-end of the waste food management web application will be optimized for efficiency. The most commonly used technologies to store and organize the waste food management web application would include Firebase and MongoDB because both are popular technologies for secure data storage and quick retrieval.

10. USE CASE DIAGRAM:

Waste Food Management Web Application
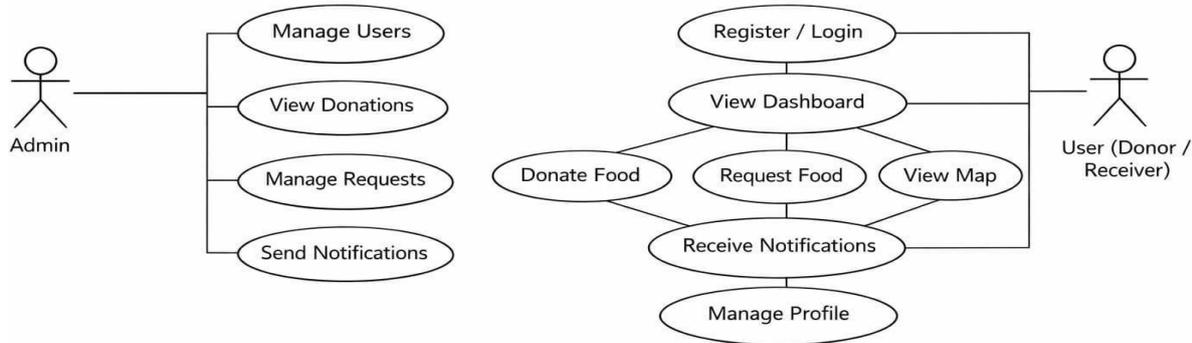
Use Case Diagram

A Use Case diagram shows how various individuals interact with the Waste Food Management Web app. It displays the major actors within the ecosystem and what functionalities each actor can achieve. Below are the primary actors identified within the Waste Food Management Ecosystem:

1. Admin

An Admin manages and oversees the platform. The admin can manage user accounts, view all the food donation information, track the requests made by the suppliers, and send notifications to the users about important news and food availability. The admin's purpose is to ensure that the Waste Food Management Platform functions correctly and manages all of its activities.

2. User (Donor / Receiver)

There are two different categories of Users: Donors and Receivers. The User must register and log in before using the app, and all Users can view their dashboard, which contains access to all of the app's features.A Donor can submit information about surplus food through the Donate Food function (food name, amount, location, expiration date, etc.) and a Receiver can view available food donations and request the amounts of food they need using the Request Food function. Additionally, users can locate Donors and Receivers near their current location by using the Map View feature.

3. Notification and Profile

The app will receive notifications and allow users to create profiles; all users will be notified through their mobile apps whenever there is a message for them (push notifications).

11. IMPLEMENTATION:

The implementation stage includes developing the Waste Food Management Web Application according to the system blueprint and incorporating all aspects of the application. At this stage, all three components (Front-end, Back-end and Database) are being developed and connected together to operate correctly.

Front-end Implementation - This stage focuses on creating a user interface (UI) to allow users to interact with the Waste Food Management Web Application. To create this interface, the front-end of the Waste Food Management Web Application will consist of different web pages including Login, Dashboard, Donate Food, Request Food, Map View, Notifications, and Profile. These web pages will be created using the following three programming languages: HTML, CSS, and JavaScript. The combination of these three technologies will allow users to interact with the Waste Food Management Web Application from multiple devices.Back-end Implementation - At this stage of the implementation process, the back-end part of the Waste Food Management Web Application will be developed. The back-end of the Waste Food Management Web Application will handle the process and logic of the Waste Food Management Web Application. The Back-end of the Waste Food Management Web Application will handle the following: User Authentication, Food Donation Transaction Details, Food Request Transactions, Notifications, and Communication between the front-end and the database. The back-end may be developed using Node.js and Express.js which will provide ease of access when handling User Requests and performing actions within the Waste Food Management Web Application.

Database Implementation - This stage will be responsible for storing and managing data in the Waste Food Management Web Application. This will include all User Information, Food Donation Transaction Information, Food Request Transaction Information, and Notification Transaction Information. The data will be securely stored within the Waste Food Management Web Application through the use of Firebase or MongoDB databases.

12. RESULT AND DISCUSSION:

The Waste Food Management Web Application was created and put in place and is an effective means of managing surplus food donation and distribution. Donors (such as restaurants, hotels, and homes) can easily enter surplus food details on the web application and receivers (including NGOs and individuals) can view and request available surplus food from the web application.The features of the application include user login, admin login, dashboard, donate food module, request food module, map view, notifications, email alerts, and profile management. By using these features, there will be more efficient communication between donor and receiver and the food can be distributed before it is wasted. The map view allows the users to find food donors close to them, which will make the collection of donations faster and easier.The application also has offline capabilities, allowing users to enter food donations even when there is no internet connection available, saving the data in a local database until an internet connection becomes available and the data can be uploaded. When any surplus food is donated, an email notification is automatically sent to receivers with the details about the donation and gives them an opportunity to respond quickly.Overall, the results of the study indicate that this system provides a structured and organized way of donating and distributing food and subsequently reduces the amount of food that is wasted

12. ADVANTAGES OF THE SYSTEM:

• Decreases Food Waste: By connecting donors and recipients through our web application, the Food Cycle system will also decrease food waste by providing the ability for food donors to donate their extra food items and then for the recipient of those items to receive them.

• Enhanced Communication: Through notification and email alerts, the Food Cycle system facilitates enhanced communication between food donors and recipients; therefore, food donors can be notified when someone has received their donated items and food recipients will also be notified when their request for donated items has been fulfilled.

• User-Friendly Interface: The Food Cycle system provides a very user-friendly interface (i.e. web application) that enables users to easily donate and/or request donated food products from the food donors/recipients.

• Geo-Location Based Search: The map view of the application allows the user to see other donors and/or recipients in their area and therefore allows for easier and more efficient collection of food.

• App Can Function Offline: At times where there is no internet access available, the application can save your data locally (i.e. on your device), then when internet access is available, the application will automatically sync your local data to the server.

• Better Distribution of Surplus Food: The Food Cycle application will provide a means of ensuring that surplus food is distributed to the appropriate individuals at the appropriate time, thereby promoting social well-being and assisting individuals who have a need.

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13. LIMITATIONS:

The system requires an internet connection for most of its features such as notifications, map view, and real-time updates to work properly.

• The success of the system depends on the active participation of donors and receivers. If fewer users use the platform, the food distribution process may become less effective.

• The application may initially operate within a limited geographical area, which may reduce the number of available food donations and requests.

• The system cannot fully verify the quality or safety of the donated food, as it depends on the information provided by donors.

• The system may not provide a direct delivery service, so food collection may depend on volunteers or receivers to pick up the food.

14. FUTURE ENHANCEMENT:

Enhancing the system can be made possible through the creation of a mobile app that will allow users to donate and request food via their smartphones easily to develop a mobile application that makes it easy for users to donate or request food via their smartphones.

• The inclusion of AI-based food quality detection will allow for the measurement of food quality using image recognition to determine the level of freshness of the donated food.

• A volunteer/delivery management system can be included to assist in the transportation of food from donors to recipients.

• The system can be expanded to support various languages to help increase the number of users who can easily use the application.

• Additions of real-time tracking and advanced notification systems will enhance the method of communication and increase the speed and efficiency of distributing food.

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16. CONCLUSION:

The Waste Food Management Web Application was created in order to minimize the amount of food that is wasted and to enhance the transfer of surplus food to individuals or groups who may require it. The Waste Food Management Web Application serves as a means for individuals to donate their excess food items easily, and for Non-governmental Organizations or Donors to make requests for food items they wish to collect as well as to collect them in a timely mannerThe Waste Food Management Web Application contains various features that are helpful in assisting in maintaining communication between those donating food and those receiving the donated food. The Waste Food Management Web Application has several useful features such as administrator and user login, dashboard, food donation module, food request module, map view, and notification system via e-mail will allow for an efficient organization of the surplus food through the Waste Food Management Web Application
The Waste Food Management Web Application has the capability of functioning offline, allowing all users of the Web Application to enter food donation data when there is no Internet connectivity. Overall, the Waste Food Management Web Application is an effective solution in minimizing food waste, distributing food more effectively, and promoting social welfare by ensuring that all surplus food is provided to individuals who are in need of food.