AAHAR AYOJAN: LEFT OVER FOOD MANAGEMENT SYSTEM

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Abstract

Food waste is a serious global problem that has significant environmental, economical, and social consequences. Many measures to decrease food waste have been proposed in recent years, including the creation of leftover food management systems. This study presents a web application-based leftover food management system with three modules: donors, non-governmental organizations, and volunteers. The system intends to bridge the gap between food waste and hunger by offering a platform for donors to give their leftover food to non-profit organizations, who may then distribute it to the needy through their volunteer network. This article presents an overview of the proposed system, including its functions and advantages. It also covers the system's challenges and limits, as well as future research directions to increase the system's performance.

Key Words- food management, waste food, hunger, leftover food, food donor, volunteers

1. Introduction

According to the Food and Agricultural Organization, food waste has become a severe problem throughout the world, with nearly one-third of the world's food output going to waste, amounting to 1.3 billion tons of food (FAO). Hunger and malnutrition, on the other hand, continue to be persistent concerns in many regions of the world. Creating a leftover food management system might be a good method to deal with these concerns.

The suggested system is a web application-based solution for managing leftover food that connects donors, non-governmental organizations, and volunteers. Donors can contribute leftover food via the online application, which is subsequently collected by non-governmental organizations and delivered to the needy via their volunteer network. The suggested system consists of three modules, each with its own set of functions. Donors can contribute their leftover food using the donor module by supplying information such as food kind, amount, and expiration date. The non-governmental organization module allows non-profit organizations to acquire and handle donated food, including storage and delivery. The volunteer module assists organizations in managing their volunteer network and assigning them to collect and deliver food.

There are various advantages of the suggested system. For starters, it can help minimize food waste by redistributing extra food to those in need. Second, it can address the issue of hunger and malnutrition by providing the poor with access to nutritional food. Finally, it can help to enhance sustainability by lowering greenhouse gas emissions caused by food waste. Notwithstanding these advantages, the system confronts problems and constraints, such as assuring food safety, sustaining donor and volunteer involvement, and ensuring the system's long-term viability.

The remainder of this paper is structured as follows: Section 2 provides a brief description of the literature review, while Section 3 analyzes existing similar systems. Sections 4 and 5 present the proposed system and its algorithm, respectively. Section 6 offers details regarding the technology stack used for the development of the application. Sections 7 describes how the application is implemented and its appearance along with the snapshots of the resultant application, and section 8 concludes.

2. Literature Review

Food waste is a huge issue that has ramifications for the environment, economy, and society. Numerous studies on the topic of food waste have been undertaken, and various methods have been offered to alleviate it. One such approach is leftover food management system, which attempt to reduce food waste while redistributing extra food to those in need.

Numerous research has advocated diverse ways and strategies for dealing with leftover food. Several studies, for example, have focused on the impact of technology in minimizing food waste. Ayesha Anzer [1] *et al.* presented a smartphone application that allows users to track their food intake and prevent food wastage. Kuo and Lin [2] *et al.*, on the other hand, created a smart bin system that employs sensors to monitor food waste and offer feedback to consumers.

Additional research has concentrated on the function of non-governmental organizations (NGOs) in decreasing food waste. R. Uma [3] *et al.*, for example, developed a food recovery network that connects food donors, NGOs, and recipients in order to decrease food waste and combat hunger. Similarly, Vikram R [4] emphasized the significance of food banks in reducing food waste and hunger.

In addition to technology and non-governmental organizations, other studies have focused on the importance of government policy in reducing food waste. Chalak and Kanafani [5], for example, developed a food waste reduction approach that includes measures such as food labelling and tax incentives to prevent food waste.

While various researchers [6] have provided solutions to the problem of leftover food management, there are still a number of challenges and limits that must be addressed. For example, guaranteeing food safety is a key problem that must be handled in order to protect the beneficiaries' health. Maintaining donor and volunteer participation is also critical for the long-term viability of any leftover food management system. Finally, assuring the system's scalability and cost are critical considerations to consider in order to make the system accessible to all.

In addition to the approaches outlined above, other research has focused on the impact of consumer behavior in decreasing food waste. For example, Stancu [7] *et al.* identified several factors that contribute to household food waste, such as purchasing too much food, confusion over food labelling, and a lack of meal planning. To address these difficulties, the authors proposed measures such as consumer education campaigns and enhanced food labelling.

In conclusion, past research and effort have presented numerous approaches and strategies for dealing with leftover food. Several studies have emphasized the role of technology, non-governmental organizations, and government policy in decreasing food waste and ensuring that extra food is allocated to those in need. Yet, addressing these systems' problems and limits is critical to ensuring their efficacy and sustainability. Future research might concentrate on increasing the functionality of existing systems and assessing their usefulness via field tests and data analysis.

3. Analysis of Existing System

The study and analysis of systems already existing around the field of interest, are discussed under this section.

3.1 Food Recovery Programs

To redistribute extra food to charity and food banks, several food recovery initiatives have been created [8]. While these initiatives have been successful in decreasing food waste and combating poverty, they confront a number of obstacles, including creating and maintaining a dependable network of donors and recipients, guaranteeing food safety, and adhering to rules and standards.

3.2 Food Banks

Food banks [9] gather extra food and give it to charity and community organizations. Food banks, on the other hand, confront a number of obstacles, including limited storage capacity, distribution issues, and preserving food quality and safety.

3.3 Food Waste Tracking Apps

Many smartphone applications have been created to track food waste and decrease food waste at the home level. These apps [9] allow users to measure their food intake, plan meals, and decrease food waste. Nevertheless, the efficiency of these applications is dependent on user interaction and may not be possible for larger-scale operations.

3.4 Smart Bin Systems

Sensors in smart bin systems monitor food waste and offer feedback to customers. While this approach may be helpful in minimizing food waste, it necessitates specialized equipment and may be prohibitively expensive for small-scale companies.

3.5 Food Recovery Networks

Food recovery networks unite food donors, NGOs, and recipients in order to decrease food waste and solve hunger. While this system shows potential, it confronts various obstacles, including assuring food safety, sustaining donor and volunteer participation, and building and maintaining a dependable network of contributors and recipients.

3.6 Demerits

Based on study around the existing systems, there are several demerits noticed, which are as follows

- Food safety is a significant problem that must be handled in order to avoid any health risks of the recipients.
- Food banks have limited storage space and distribution capabilities.
- Smart bin systems need specialized equipment and may be prohibitively expensive for small-scale enterprises.
- Food waste tracking applications' efficacy is dependent on user participation and may not be possible for larger-scale businesses.
- Donor and volunteer participation is critical for the long-term viability of food recovery networks.

- Food recovery initiatives and networks have difficulties in establishing and sustaining a trustworthy network of donors and recipients.
- Food recovery initiatives and networks have difficulties in adhering to legislation and standards.

4. Proposed System

This section gives a detailed understanding of the proposed system for leftover food management.

The suggested method is a web-based platform for giving unutilized food to the poor. The approach is intended to bridge the gap between donors and volunteers ready to collect leftover food and distribute it to those in need. The MERN stack, which comprises MongoDB, Express.js, AngularJS, and Node.js, is used to build the system. MongoDB is the database used to hold all donor, volunteer, and food donation requests data. Express.js acts as the system's backend framework, processing all requests and answers. AngularJS is used for frontend system development and provides a user-friendly interface for system interaction. Node.js is employed as the system's runtime environment.

The system is equipped with various features that make it easy for donors to make food donation requests by providing basic information. Donors can readily check their requests' status and examine any current unfinished donations. Contributors may view all of their previous donations, and donors can make changes to their profile information. Admins receive all the requests made by donors and can approve or reject donation requests based on the information given by the donor. If approved, admins can appoint an agent to collect the donation from the donor's house.

All pending donations, as well as their status, are visible to administrators. Admins can see all of the donations they've received, as well as all of the agents in the application. Volunteers will receive messages from admins to collect food from donors' houses and will be able to record their collection after the food has been collected. Volunteers may also check all the food contributions they have already collected and update their profile. The use case diagram of the proposed system is shown in Fig. 1.

4.1 Features

The proposed leftover food management system aims to address the challenges of food wastage and hunger by providing a user-friendly platform that connects food donors, NGOs, and volunteers. The system comprises three modules - donor, NGO, and volunteer - each with its unique features and functionalities, a use case diagram for which is depicted in Fig. 1.

Features of the implemented system are as follows-

- The system has three sorts of users: administrators, donors, and agents.
- Admins are in charge of overseeing all operations and accepting/rejecting donations as well as appointing agents.
- Donors are the major users who are ready to donate food along with the required information regarding the donation.
- Agents, or volunteers, have the responsibility to collect food from donors' houses.
- To utilize the system, each user must have a registered account.
- Upon registration, users are presented with a dashboard that summarizes pertinent information.
- The software supports basic user authentication features including signup, login, and logout.

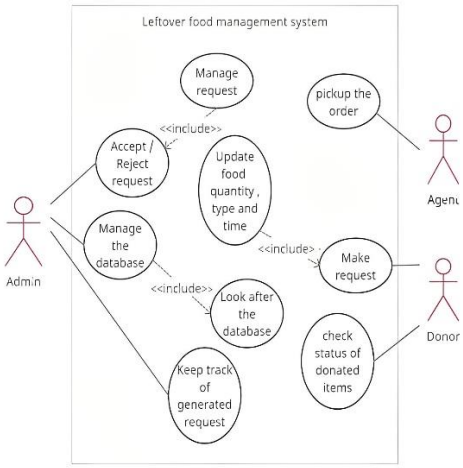

Fig. 1 Use Case Diagram for the proposed leftover food management system

4.1.1 Donor Features

- Donors can make food donation requests by providing basic information.
- Donor requests can be granted or refused, and donors can readily check their requests' status.
- Donors can examine any current unfinished donations.
- Donors may view all of their previous donations.
- Donors can make changes to their profile information.

4.1.2 Admin Features

- Admins receive all the requests made by donors.
- Admins can approve or reject donation requests based on the information given by the donor.
- If approved, admins can appoint an agent to collect the donation from the donor's house.
- Admins may see all pending donations as well as their status.
- Admins can see all the donations they've received.

- Administrators may also see all the agents in the application.
- Administrators can make changes to their profile.

4.1.3 Volunteer Features

- Administrators will assign volunteers to collect food from donors' houses.
- While collecting food from a donor's house, volunteers can label their haul.
- Volunteers can also view all of the food donations that they have previously collected.

Volunteers can make changes to their profile.

4.2 Merits

- Donors can easily make donation requests and track their status.
- Admins have a streamlined process for receiving and approving/rejecting donation requests.
- Agents are appointed efficiently by admins to collect donations.
- Volunteers are notified promptly to collect donations.
- Easy tracking and viewing of previous donations for all users.
- All users can update their profiles as and when needed.

5. Algorithm

The proposed system operates based on the following algorithm that users must follow upon opening the website for the first time. These steps are as follows:

1. Launch the application.
2. Register by providing the required information.
3. Choose the appropriate option of donor or volunteer.
4. Log in as the role selected and proceed further.
5. If logged in as donor, create donation and enter the necessary details.
6. Submit the donation request.
7. Click on Request for Food to view donation requests.
8. To request food, go to the Volunteer page and click on the Request Food option.
9. Enter the required details and click on the Request button.
10. To view the list of available food from donors, click on the Available Food button.

6. Technology Stack

This section provides a detailed description of the technologies used in the development of the web application. The MERN stack, which includes MongoDB, Express.js, AngularJS, and Node.js, was employed to develop the leftover food donation website. This technology stack was chosen for its ability to create secure and scalable web applications. To ensure high availability and scalability, the website was hosted on a cloud hosting service.

The technology stack is a crucial aspect of any web development project as it offers the required tools and frameworks to construct a scalable and efficient online application. The proposed system makes use of the MERN stack, which is made up of four main technologies: MongoDB, Express.js, Bootstrap, and Node.js. This stack was chosen for its capacity to manage massive volumes of data, provide a lightweight web application framework, provide flexible and adaptable design, and allow developers to utilize JavaScript for both front-end and back-end development. This part will go through the essential features and benefits of each technology in the MERN stack, as well as how they were used in the building of the leftover food donation website.

Security and usability tests were performed on the website. In order to assess the website's usability and efficiency, a group of users provided input during usability testing. Penetration testing was done as part of security testing to find security flaws on the website.

6.1 MERN

This is a web development stack that is used for building modern, full-stack web applications. It consists of four main technologies: MongoDB, Express.js, bootstrap, and Node.js. Here are some of the key features of each technology in the MERN stack:

6.2 MongoDB

This is a NoSQL database that is designed to store copious amounts of data. MongoDB is flexible, scalable, and can handle both structured and unstructured data. Some of its features include horizontal scaling, automatic sharing, and flexible data modeling.

6.3 Express.js

This is a web application framework that runs on top of Node.js. Express.js provides a simple, lightweight framework for building web applications and APIs. Some of its features include middleware support, routing, and template engines.

6.4 Bootstrap

It utilizes SASS for a modular and customizable architecture. Import only the components you need, enable global options like gradients and shadows, and write own CSS with the variables, maps, functions, and mixins.

6.5 Node.js

This is a JavaScript runtime that is built on Chrome's V8 JavaScript engine. Node.js allows developers to use JavaScript on both the front-end and back-end of web applications. Some of its features include event-driven architecture, non-blocking I/O, and the ability to handle multiple connections.

7. Implementation

The suggested system's implementation was built on a collection of current web development technologies that enable the production of scalable and secure online applications and the integration is represented in Fig. 2. The system allows donors to make food donation requests, which administrators may accept or reject. They can also select agents to collect the goods from the donors' houses. Volunteers receive reminders from administrators to collect food from donors' houses and record their collection after the food has been collected. Donors, contributors, and administrators may also see their prior donations and make changes to their profiles via the system. The introduction of the system is projected to help reduce food wastage.

7.1 Front-end Implementation

The web application's front-end is built with HTML, CSS, JavaScript, and the famous front-end framework, Bootstrap, which is noted for its user interface design skills. The front-end components, such as the user registration and login system, contribution form, and dashboards for the various modules according to the opted role, are created and implemented. To improve the front-end capabilities several libraries and technologies are used.

7.2 Back-end implementation

The web application's backend is built with Node.js and Express.js. Node.js is a runtime environment that allows server-side JavaScript code to be executed. Express.js is a web application framework with powerful functionality for handling HTTP requests and answers. The essential routes and APIs were initially developed and implemented, including the user login API, and contribution submission API. Each API is created to handle certain HTTP requests and deliver the appropriate answer. The MongoDB database is used to record user information, contribution information, and other relevant information. MongoDB is a NoSQL database that offers a scalable and flexible data storage and retrieval solution.

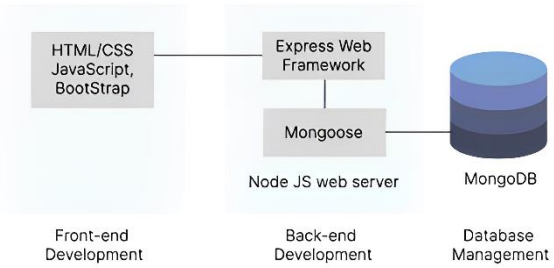

Fig. 2 Integration of frontend and backend technologies implementation

7.3 Results

This section provides an overview of the proposed system. Following are the resultant screenshots for the proposed leftover food waste management system, showing various components of the web application.

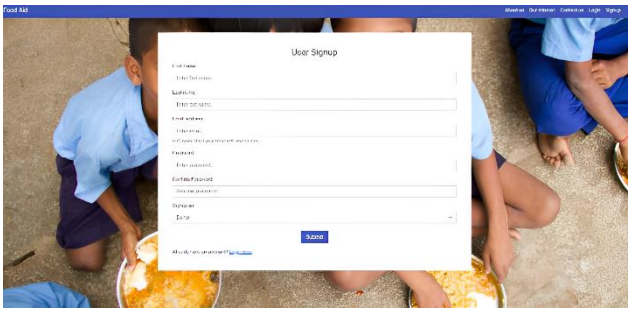

Fig. 3 Sign up Page

Fig. 3 depicts the sign up page, a user gets on first visit to the website, user need to signup first to access and use the application. New user can sign up by filling the aforementioned details including their roles.

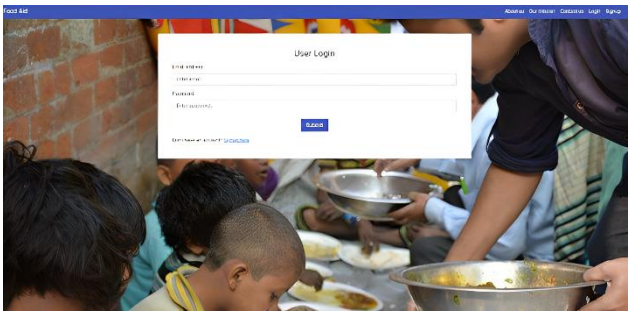

Fig. 4 Login Page

Once after signing up, user can log in the application with the page as shown in Fig. 4 and can act as a donor or/agent agent according the preferences filled by the user.

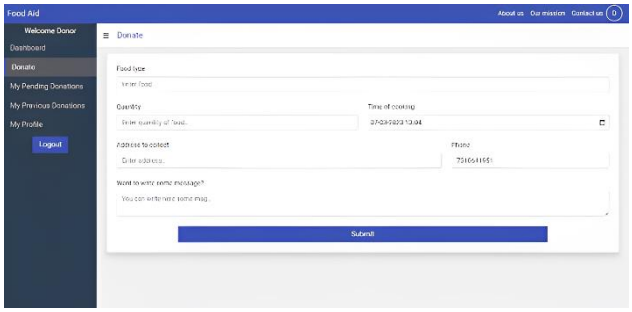

Fig. 5 Create Donation Page

Once the user logs in as a donor, they can create donation requests from the page as shown in Fig. 5 which should contain the detail regarding the food type, quantity ,time of cooking and some compulsory details which are required.

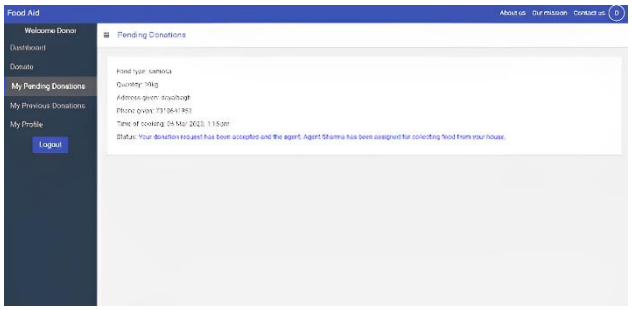

Fig. 6 Pending Donations Page

The donor can monitor and handle their donation requests from the page shown in Fig. 6. It displays all the details fed and also the status of the donation.

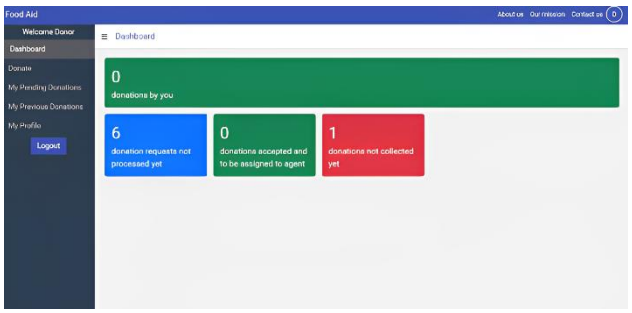

Fig. 7 Dashboard of donor

When a user logs in as a donor, their dashboard will look as shown in Fig 7. Donor can view the number of donation request that are pending, accepted and not collected yet.

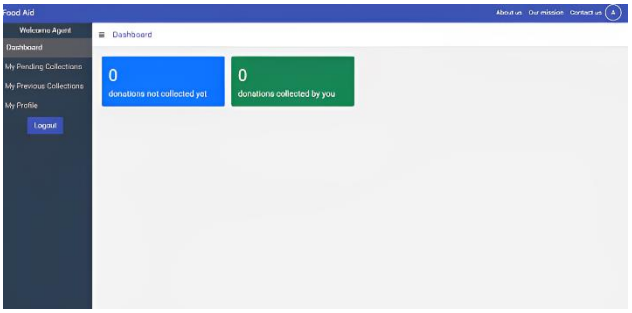

Fig. 8 Dashboard of Agent

When a user logs in as an Agent, their dashboard will look as shown in Fig 8. Agent can view the number of donations collected and not collected.

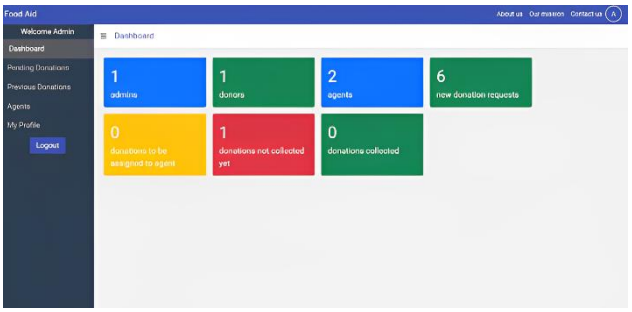

Fig. 9 Dashboard of admin

A snapshot of the Admin's dashboard is shown Fig. 9. Admin can view the number of donations to be assigned to agent, to be collected, new donation requests and donations which are not collected yet. In addition, admin can also view the number of donors and agents regestered in the application

8. Conclusion and Future Work

The proposed system offers a practical solution to tackle the pressing issue of food waste and food insecurity by providing a platform for food donation. The system is designed to efficiently manage and track food donations with highly user interactive interface for donors, volunteers, and administrators alike. By implementing the MERN stack, the system is scalable, secure, and flexible, making it suitable for a variety of settings and use cases.

To further enhance the system's effectiveness, the research proposes improvements such as machine learning algorithms to estimate the availability of food in a particular region and recommend donations accordingly. Additionally, the system may be expanded to accept other sorts of donations, such as clothes and household products.

Overall, the proposed system has the potential to make a significant impact in reducing food waste and addressing food insecurity. By implementing the suggested improvements and continuing to innovate in this field, we can create a more sustainable and equitable food system that

benefits everyone.

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