IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 4, February 2025

GreenBite: Digital Food Waste Manager

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Abstract: *Food wastage is a critical issue worldwide, contributing to hunger, economic losses, and environmental degradation. GreenBite: Food Waste Manager addresses this problem through an innovative web application designed to minimize food waste. The system offers features such as inventory management, expiry alerts, recipe suggestions, and a donation platform. Users can log food items with expiry dates, receive timely notifications, and explore recipes for leftover ingredients. Furthermore, the app connects users with nearby food banks and shelters using geolocation technology. By integrating image recognition, responsive design, and user-friendly interfaces, GreenBite promotes sustainability, community support, and efficient food management. This paper discusses the application's architecture, methodology, and future scope, emphasizing its potential to foster a sustainable and waste-free society.*

Keywords: Food waste management, sustainability, web application, geolocation, recipe suggestions, food donation.

I. INTRODUCTION

With global societies and the environment struggling significantly, food wastage today is a critical concern in the world. Wasting food leads to starving around the world, with much economic loss and deteriorated environmental conditions. Currently, millions of tons of edible food are wasted daily; this calls for efficient use and management of food, combat the issues, and strive toward healthy sustainability in all aspects.

The primary objective of this project is to design a web application that helps people minimize food waste by being very user-friendly. The application simplifies food management through logging food items with their expiry dates, timely alerts, and uploading photos for auto-filling product details using image recognition. It further enables creative reuse of leftovers through recipe suggestions and connects users with local shelters and food banks for food donation.

This project has a big potential to make a change by taking the issue of food waste to the grassroots level. It encourages consumption in responsible ways, cuts wastage, and involves community support to help other people.

II.LITERATURE REVIEW

[1] Lagorio, A., & Mangano, G. (2024a). Measuring the Effects of an Anti-Food-Waste Digital Application from the Operators' Perspective in Urban Contexts. Urban Science, 8(2), 57. https://doi.org/10.3390/urbansci8020057

This pilot study evaluates the experiences of users with smartphone apps aimed at reducing food waste, pointing out user expectations and experiences. It discusses the technical improvement possibilities and the necessity of more comprehensive features in food waste management apps, suggesting that user feedback is crucial for enhancing app functionality and effectiveness in tackling food waste. (Lagorio & Mangano, 2024)

[2] Balińska, A., Werenowska, A., & Jaska, E. (2024). The importance of mobile applications in reducing food waste - the example of the TooGoodToGo application. Journal of Modern Science, 56(2), 190–214. https://doi.org/10.13166/jms/188723

This empirical study shows the use of the TooGoodToGo application in urban food retailers, testing its effectiveness from the point of view of the operators in reducing food waste. It emphasizes the role that digital applications play in

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furthering sustainable practices in food management by suggesting that such platforms significantly contribute to reducing surplus food, while also bringing economic benefit to businesses. (Balińska et al., 2024)

III. EXISTING SYSTEM

Manual Food Tracking

Many people still rely on handwritten notes, mobile reminders, or simply their memory to track food expiry dates. However, this method is often unreliable, leading to food wastage due to forgetfulness, mismanagement, or unclear labeling. Without a proper system in place, expired food accumulates, increasing household waste and financial loss.

Supermarket Discounting

Some supermarkets and grocery stores offer discounts on products that are nearing their expiration date. While this strategy helps retailers reduce waste and allows consumers to purchase items at lower prices, it does not address food waste at an individual level. Consumers may still struggle with tracking expiration dates for items bought in bulk or managing perishable goods efficiently.

Food Waste Management Apps

Existing food waste management apps, such as TooGoodToGo and OLIO, focus primarily on surplus food redistribution by connecting individuals and businesses with excess food to those who need it. However, these platforms do not provide comprehensive features for personal food tracking, inventory management, or proactive waste prevention. As a result, users still lack an effective way to monitor and utilize their own food before it expires.

Food Donation Platforms

Many food banks, shelters, and non-profit organizations accept surplus food donations, helping to provide meals to those in need. However, the absence of a structured, real-time donation system makes it difficult for individuals to contribute efficiently. Donors often face challenges such as finding nearby food banks, understanding donation guidelines, and ensuring that the food remains fresh and usable by the time it reaches those in need. A more streamlined and accessible system could encourage greater participation in food donation efforts.

IV. PROPOSED SYSTEM

The proposed system is a web-based application designed to minimize food waste by providing user-friendly features and promoting sustainability. The following are the core components of the system:

Food Inventory Management

Users can log food items manually or via barcode scanning, including details such as name, quantity, purchase date, and expiry date. The system maintains this data in a structured database, enabling easy retrieval and updates. Categorization by type (e.g., dairy, vegetables, frozen foods) helps in efficient tracking and planning. An AI-powered prediction model could also suggest estimated spoilage dates based on storage conditions.

Expiry Alerts

The application proactively sends notifications to users about items approaching their expiry dates. Alerts can be customized based on urgency (e.g., 3-day, 1-day reminders) and preferred notification channels (push notifications, SMS, email). Users can also set priority levels for perishable items to ensure prompt consumption before spoilage.

Recipe Suggestions

A built-in dynamic recipe generator offers creative ways to use ingredients nearing expiration. By integrating with external APIs like Spoonacular, the system suggests diverse recipes based on available ingredients, dietary preferences, and cooking difficulty levels. Advanced features could include AI-powered meal planning based on user consumption habits.

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Donation Platform

A geolocation-based donation module connects users with nearby food banks, shelters, and community kitchens. Users can list surplus food items along with quantity and condition details, and the system will match them with relevant donation centers. Automated coordination, including pickup scheduling or drop-off location suggestions, enhances efficiency. Real-time tracking ensures that food donations are received and utilized promptly.

User Authentication and Profiles

Secure user authentication is implemented using industry standards like JWT (JSON Web Token) or OAuth for seamless and safe logins. Users can manage their profiles, track their food inventory, monitor waste reduction progress, and review past donations. Customizable notification settings allow users to personalize alerts and reminders based on their preferences. Integration with social media can also encourage community engagement and awareness.

V. METHODOLOGY

1. Problem Analysis and Research

The project commenced with an extensive study of food waste issues, incorporating a literature review, user surveys, and direct interviews with households and food banks. The research revealed critical challenges such as ineffective food inventory tracking, lack of timely expiry alerts, difficulties in utilizing surplus food, and the absence of a structured donation mechanism. These insights guided the identification of essential system features: food inventory management, expiry notifications, recipe suggestions, and a donation platform. A competitive analysis of existing solutions like TooGoodToGo and OLIO helped refine the unique value proposition of the application.

2. Requirement Gathering and Planning

Following problem identification, technical and functional requirements were gathered. User needs were translated into specific features, ensuring a balance between usability and functionality. Wireframes and interactive prototypes were created using Figma to visualize the user journey and system interactions. A modular development approach was adopted to facilitate scalability and seamless integration of future enhancements. The development roadmap was divided into clear milestones, covering backend, frontend, testing, and deployment phases.

3. Development Phases

Backend Development

A robust backend infrastructure was developed using Python (Flask/Django) or Node.js, ensuring efficient API management for food inventory tracking, expiry notifications, recipe suggestions, and donation handling. A PostgreSQL or MongoDB database was implemented to store structured food data, user profiles, and donation records. The system architecture was designed to handle high concurrency and support multiple users efficiently.

Frontend Development

The user interface was developed using React.js, ensuring responsiveness across devices. Bootstrap or Tailwind CSS was integrated to enhance aesthetics and optimize navigation. The frontend included an interactive dashboard for users to log food items, receive expiry alerts, explore recipe suggestions, and access donation functionalities.

4. Integration

Seamless integration between system modules ensured consistent data flow. The inventory tracking system directly influenced expiry alerts and recipe suggestions, while the geolocation-based donation module connected users with nearby food banks. The authentication mechanism, using JWT (JSON Web Token) or OAuth, secured user sessions, protecting personal data and preventing unauthorized access. APIs were also integrated with external services such as Spoonacular for recipe recommendations and Google Maps API for real-time food bank location tracking.

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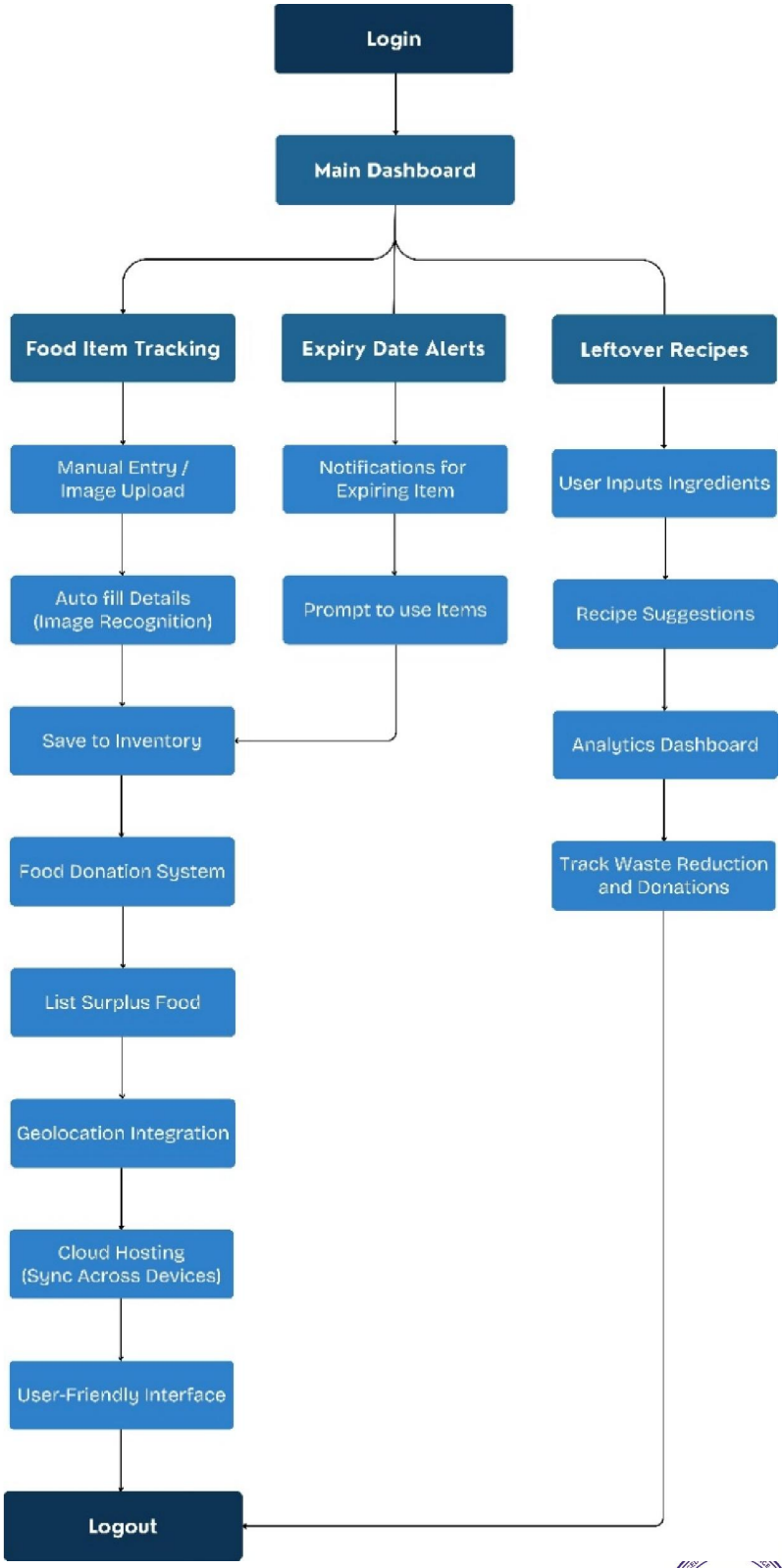

Fig. 1 Proposed System flow for Digital Food Waste Management

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5. Testing and Validation

Unit Testing: Each module (inventory, alerts, donations) was tested independently to validate functionality.
Integration Testing: Ensured seamless interactions between frontend and backend components.
Performance Testing: Evaluated system responsiveness and scalability under high user loads.
User Testing: A beta version was released to selected users for real-world feedback, leading to iterative improvements in usability and system efficiency.

6. Deployment

The application was deployed as a Minimum Viable Product (MVP) on cloud-based platforms like AWS, Firebase, or Heroku, ensuring high availability and scalability. The deployment pipeline included CI/CD (Continuous Integration and Continuous Deployment) to automate updates and bug fixes. Future enhancements, such as AI-driven food consumption predictions, mobile app versions, and enhanced donation coordination features, were outlined in the post-deployment roadmap to expand the application's impact in reducing food waste and promoting sustainability.

VI. FUTURE SCOPE

The potential for further developments in the application of advanced technologies for food waste management is significant. Some promising directions are the following:

Barcode and QR Code Scanning

Adding barcode and QR code scanning will allow users to quickly log food items by retrieving product details like expiry dates, making inventory management seamless and efficient.

Smart Kitchen Integration

Smart kitchen features, such as IoT-enabled devices, can automate inventory updates and send real-time alerts for expiring items, enhancing user convenience.

Global Accessibility

Multilingual support and region-specific customizations can expand the app's reach to a global audience, promoting sustainable practices worldwide.

Donation Tracking and Reporting

A donation tracking feature can help users monitor their contributions, including metrics on the quantity of food donated and its environmental impact.

Expansion into Commercial Sectors

The app's functionality can be extended to restaurants and supermarkets, allowing them to manage surplus food effectively and contribute to waste reduction on a larger scale.

VII. CONCLUSION

The Food Waste Management Web Application addresses a serious worldwide problem by providing a holistic and user-friendly platform that could reduce food wastage. This project promotes efficient food usage and community support through features such as food tracking, expiry alerts, recipe suggestions, and donation facilitation, making it practical and scalable to various users. With the potential for future upgrade capabilities such as smart kitchen integration and multilingual capabilities, this project not only addresses the present challenge of food waste but also gives a pathway for sustainable innovation in food management.

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