WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

ZeroBin: From Extra to Essential – A Smart Food Waste Redistribution Platform

Sushant Patil[1], Swaroop Bokadekar[2], Shrishail Patil[3], Samrat Mugali[4], Sudarshan Ainapur[5]

[1]Head of Dept.CSE dept. Maratha Mandal's Engineering College, Belagavi, Karnataka, 590001, India
[2]UG Scholar , Maratha Mandal's Engineering College, Belagavi, Karnataka,590001, India
[3] UG Scholar, Maratha Mandal's Engineering College, Belagavi, Karnataka,590001, India
[4] UG Scholar, Maratha Mandal's Engineering College, Belagavi, Karnataka,590001, India
[5] UG Scholar, Maratha Mandal's Engineering College, Belagavi, Karnataka,590001,India

A B S T R A C T :

Food wastage continues to be a major global challenge, with millions of tons of edible food discarded daily while millions remain hungry. ZeroBin: From Extra to Essential introduces a technology-driven solution that bridges donors and recipients through a smart, web-based platform. Developed using HTML and CSS for the frontend and MongoDB for the backend, the system enables food donors to list surplus items, NGOs to request food, and administrators to coordinate timely pickups. Unlike existing donation platforms that rely on manual processes or fragmented workflows, ZeroBin provides scalability, structured coordination, and improved accountability. Future enhancements include AI/ML for surplus prediction, blockchain for transparency, and gamification for user engagement, positioning ZeroBin as a next-generation solution for sustainable food redistribution.

Keywords: Index Terms—ZeroBin, Food Wastage, MongoDB,HTML/CSS, Sustainable Development, Future Scope

1. INTRODUCTION

Global food waste is projected to reach 2.1 billion tones by 2030, despite rising hunger worldwide. In India alone, nearly 40% of produced food is wasted due to inefficient distribution systems. Traditional NGO-based food collection or donation apps often fail due to manual coordination, lack of intelligence, and limited scalability. ZeroBin addresses these challenges by introducing a centralized, web-driven platform that ensures surplus food is redistributed before spoilage. By integrating MongoDB for scalable storage, automated notifications, and structured workflows, the system acts as a bridge between donors, NGOs, and beneficiaries. This paper presents the architecture, workflows, and implementation details of the ZeroBin system.

2. REVIEW OF LITERATURE

Several researchers have proposed mobile or web-based solutions for food donation. Django-based and Android applications have shown Sited in terms of scalability, data management, and real-time analytics. Prior works mainly focused on connecting NGOs with donors without advanced forecasting or community engagement features. Comparison with prior works:

Most existing apps rely on SQL databases, which struggle with unstructured donation data. ZeroBin uses MongoDB, allowing more flexibility.

Previous works often lacked role-based workflows, while ZeroBin defines clear donor, admin, NGO, and agent roles. Forecasting and transparency were rarely considered; ZeroBin includes AI/ML and blockchain as future enhancement.

Thus, ZeroBin builds on existing systems but provides an architecture that is more scalable, flexible, and future-proof.

3. SYSTEM ARCHITECTURE

This architecture defines the interaction between donors, NGOs, and admins through backend APIs. MongoDB acts as the database to store food item details, status, and allocation information.

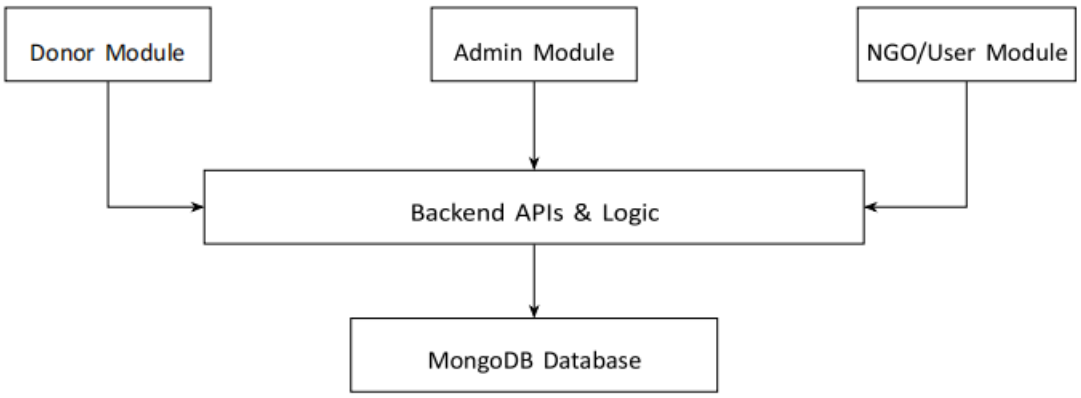

Fig. 1. System Architecture of ZeroBin

4. USE CASE ANALYSIS

The use case diagram captures the responsibilities of each actor. Donors submit food items, admins validate them, and NGOs request and receive food. Notifications ensure all parties remain updated.

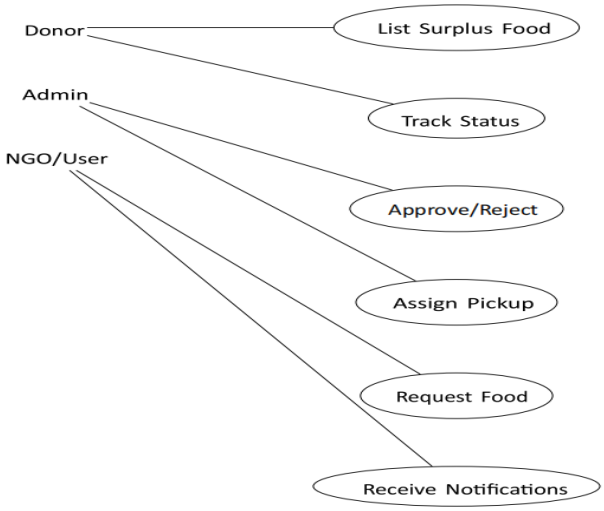

Fig. 2. Use Case Diagram of ZeroBin

5. SEQUENCE FLOW

The sequence diagram models the order of interactions. It ensures traceability from donor submission through admin approval, NGO requests, and final delivery

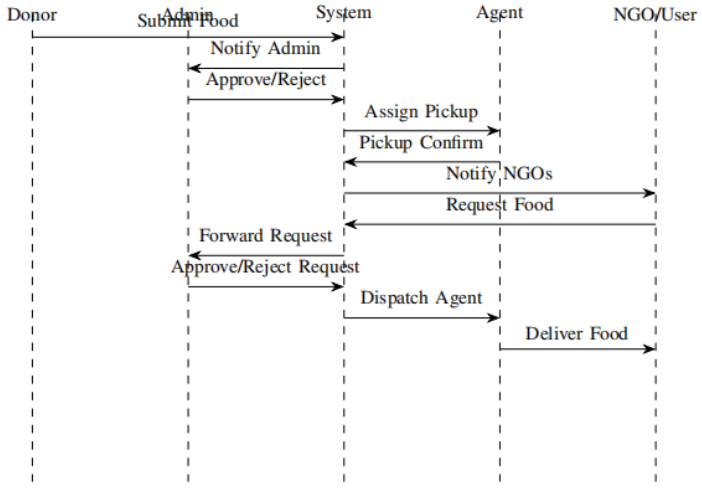

Fig. 3. Sequence Diagram of ZeroBin

6. STATE TRANSITION

The state diagram represents donation states such as initiated, pending, approved, delivered, or rejected. It ensures no donation remains in limbo.

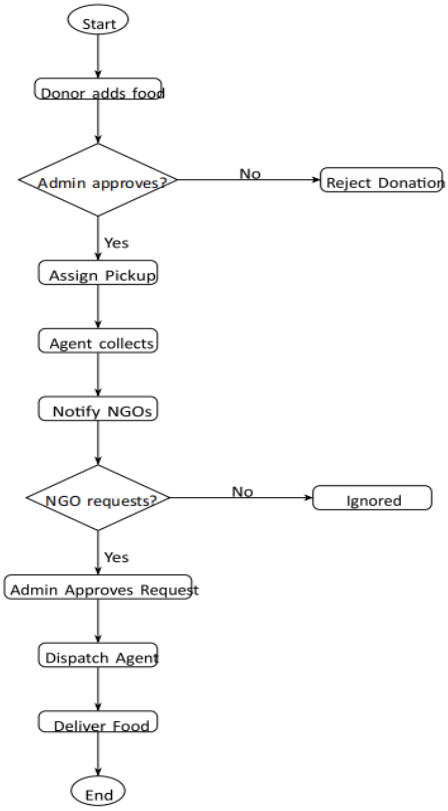

Fig. 4. Activity Diagram of ZeroBin

7. CLASS MODEL

The class diagram defines entities and their responsibilities, enabling modularity and scalability.

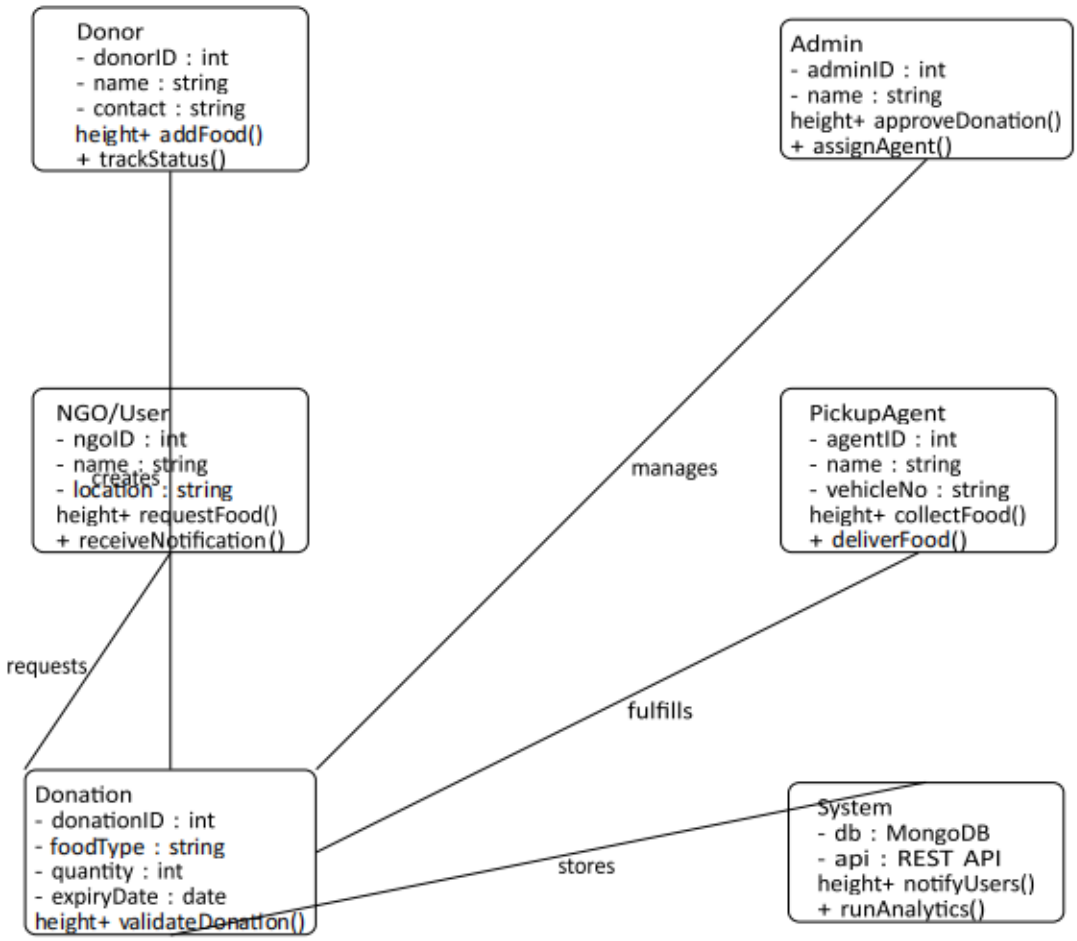

Fig. 6. Class Diagram of ZeroBin

8. RESULTS AND DISCUSSION

The prototype implementation demonstrated promising results. MongoDB efficiently stored and retrieved unstructured donation data, while the HTML/CSS interface ensured accessibility across devices. Role-based workflows streamlined NGO requests and admin approvals, significantly reducing manual delays. Notifications improved coordination between donors, agents, and NGOs.

During testing with sample data, the system successfully managed multiple donation requests simultaneously, ensuring that approval, pickup, and delivery stages were completed with minimal delays.

9. FUTURE SCOPE

Planned improvements include:

• Flutter-based Mobile App: To extend access to mobile first users.

• AI/ML Integration: For predicting surplus patterns and expiry trends.

• Blockchain: To ensure trust, authenticity, and traceability of donations.

• Gamification: Rewarding frequent donors and NGOs with badges and scores.

• Data Analytics: Visual dashboards for admins to monitor trends.

Table 1: COMPARISON OF EXISTING SYSTEMS VS ZEROBIN

Feature Area	Existing Systems	ZeroBin Advantage
Database	Only handles unstructured data	Hybrid database, easy to expand
Scalability	Limited by rigid design	Cloud-based, scalable across modules
Transparency	Blockchain not yet used	Blockchain ensures traceability and auditability
User Engagement	Basic interaction	Gamification with rewards to increase participation
Forecasting & AI	Limited predictive ability	AI predicts surplus for efficient redistribution

10. Conclusion

ZeroBin demonstrates how technology can transform food redistribution from a simple charitable act into essential societal infrastructure. By addressing the critical magnitude of global food loss highlighted by the Food and Agriculture Organization, the platform directly contributes to the United Nations Sustainable Development Goal 12: Responsible Consumption and Production. The project bridges the gap between surplus and scarcity through a user-centric application approach, optimizing how surplus food is managed and ensuring that the donation process is accessible and efficient for all stakeholders.

Technologically, the system is built on a robust foundation using an HTML/CSS and a MongoDBbackend. As detailed in technical literature, this database structure ensures the reliability and scalability required to handle complex data streams. Beyond the current implementation, ZeroBin is designed with a forward-looking roadmap that aligns with the principles of the circular economy. The planned integration ofArtificial Intelligence will allow the system to move beyond simple management to intelligent food waste prediction, making the platform proactive rather than reactive.

REFERENCES

[1] Food and Agriculture Organization (FAO), “Food Loss and Food Waste,” 2022. [Online]. Available: https://www.fao.org/

[2] P. Jones and M. Comfort, “Waste and the Circular Economy,” International Journal of Public Sector Management, vol. 32, no. 5, pp. 450-465, 2021.

[3] S. Bharani et al., “Optimizing Surplus Food Management: A User Centric Application Approach,” in Proc. IEEE ICETITE, 2024, pp. 612–617.

[4] R. Dhir, M. Jain, and S. N. Babu, “AI-Powered Food Waste Prediction for Smart Cities,” IEEE Access, vol. 12, pp. 77521–77534, 2024.

[5] M. Gupta and R. Agrawal, “Blockchain-Enabled Traceability for Food Donation Systems,” in Proc. IEEE Int. Conf. on Blockchain, 2023, pp. 115–122.

[6] A. Chatterjee, P. Singh, and R. Sharma, “Gamification for Social Good: Motivating Sustainable Behaviors,” in Proc. IEEE GHTC, 2022, pp. 301–308.

[7] United Nations, “Sustainable Development Goal 12: Responsible Consumption and Production,” 2022. [Online]. Available: https://sdgs.un.org/goals/goal12

[8] MongoDB Inc., “MongoDB Technical White Paper,” 2023. [Online]. Available: https://www.mongodb.com/whitepap