

SMART FOOD DISTRIBUTION SYSTEM

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ABSTRACT

Food waste has emerged as one of the most critical global challenges, with millions of tons of edible food being discarded every year while a significant portion of the population continues to suffer from hunger and malnutrition. Conventional food donation and redistribution processes rely heavily on manual coordination, which often results in delays, inefficiencies, and food spoilage.

The Smart Food Distribution System is designed to address this issue by providing a centralized digital platform that connects food donors, volunteers, and non-governmental organizations (NGOs). The system enables restaurants, hotels, event organizers, and households to register surplus food through a web or mobile interface. Volunteers receive real-time notifications for food pickup and delivery, ensuring timely redistribution to people in need.

Keywords: Food Waste Management, Smart Distribution System, IoT, Machine Learning, NGO Collaboration, Sustainability.

I. INTRODUCTION

Food wastage has become a major global concern, with a significant amount of edible food being wasted every day while millions of people struggle to meet their basic nutritional needs. In developing countries such as India, food wastage occurs frequently in restaurants, hotels, hostels, social events, and households due to over-preparation, poor planning, and lack of effective redistribution mechanisms. At the same time, underprivileged communities face hunger, malnutrition, and poor health conditions.

This imbalance between food surplus and food scarcity highlights the need for an efficient and structured solution. Traditional food donation practices are mostly informal and rely on manual communication through phone calls or messaging applications, which leads to delayed responses and food spoilage.

The Smart Food Distribution System aims to overcome these challenges by providing a technology-driven solution that connects donors and beneficiaries through a centralized platform. The system ensures quick identification of surplus food and timely delivery to needy individuals using real-time notifications and GPS-based routing. Cloud-based storage allows efficient data management, transparency, and scalability. By integrating digital technologies, the system improves decision-making, reduces waste, and supports sustainable food management.

II. LITERATURE SURVEY

Global Food Waste Studies

According to reports published by the Food and Agriculture Organization (FAO), nearly one-third of the food produced globally, approximately 1.3 billion tons per year, is wasted. This wastage contributes significantly to environmental issues, accounting for nearly 8–10% of global greenhouse gas emission.

Food Collection and Logistics Management

Research highlights that inefficient logistics and lack of coordination are major challenges in food redistribution. Delays in food pickup and delivery often result in spoilage, reducing the effectiveness of donation efforts.

IoT-Based Food Monitoring

IoT technologies such as temperature and gas sensors are increasingly used to monitor food quality during storage and transportation. These sensors help detect spoilage early and ensure that only safe food is distributed.

Machine Learning in Demand Prediction

Machine learning algorithms like Decision Trees and regression models are used to predict food demand and identify high-need locations. These techniques help optimize delivery routes and improve resource allocation.

Real-Time Notification Systems

Real-time notification and alert systems play a crucial role in time-sensitive applications such as food redistribution. Studies show that instant updates improve coordination and reduce communication gaps between stakeholders.

Existing Food Redistribution System

Several non-governmental organizations such as the Robin Hood Army actively work toward food redistribution. However, these systems rely largely on manual coordination and volunteer availability, which limits their efficiency and scalability.

Security and Future Trends

Security and data privacy are essential in digital platforms involving multiple users. Literature emphasizes secure authentication, data encryption, and role-based access control. Future systems are expected to integrate AI-driven analytics and automation for improved efficiency.

III. PROPOSED METHODOLOGY

The Smart Food Distribution System follows a web-based client-server architecture that integrates donors, volunteers, and administrators through a centralized platform. The system consists of a frontend interface, backend processing logic, and a centralized database to manage food donation and distribution activities efficiently.

Food donors use the system to register surplus food details such as quantity, location, and expiry time. Once the food is registered, the system automatically identifies nearby volunteers using GPS-based location tracking and sends real-time notifications for pickup. Volunteers confirm pickup and delivery status through the system, ensuring transparency and accountability.

The backend handles authentication, data validation, notification services, and record management. All data is securely stored in a centralized database, and real-time synchronization ensures that updates are instantly reflected across the system. Security measures such as encrypted communication and role-based access

control protect sensitive data.

IV. SYSTEM IMPLEMENTATION

The Smart Food Distribution System is implemented as a web-based application that enables efficient coordination between food donors, volunteers, and administrators. The system is designed to automate the food donation and redistribution process while ensuring transparency, reliability, and ease of use. The implementation integrates frontend interfaces, backend services, and a centralized database to support real-time communication and decision-making.

The frontend of the system is developed using web technologies such as HTML, CSS, and JavaScript, along with responsive frameworks like Bootstrap. This ensures that the application is accessible across various devices, including desktops, tablets, and mobile phones. Donors can easily enter surplus food details such as food type, quantity, preparation time, and location through intuitive forms. Volunteers can view available pickup requests and update delivery status through a simple dashboard.

User authentication and role-based access control are implemented to differentiate between donors, volunteers, and administrators. Each user is required to register and log in using secure credentials. This approach prevents unauthorized access and ensures that users can only perform actions relevant to their roles, thereby improving system security and reliability.

The backend implementation is responsible for handling all business logic and data processing. It is developed using Python-based frameworks such as Flask or Django, which provide scalability and secure request handling. The backend processes donor submissions, verifies food availability details, assigns volunteers, and manages notifications. RESTful APIs are used to enable smooth communication between the frontend and backend components.

A key feature of the system implementation is the real-time notification mechanism. Once a donor submits food details, the backend identifies nearby volunteers using location data and sends instant alerts. This real-time communication reduces response time and ensures that food is collected before spoilage. Volunteers can confirm pickup and delivery through the system, allowing continuous tracking of the redistribution process.

The centralized database plays a critical role in system implementation. It stores information related to users, food donations, volunteer assignments, and delivery records. Cloud-based databases ensure data availability, consistency, and scalability. Real-time synchronization allows updates made by one user to be immediately reflected across the system, enhancing transparency and coordination.

Security measures are integrated throughout the implementation to protect sensitive data. Encrypted data transmission, secure authentication mechanisms, and controlled access policies are employed to ensure data privacy. Regular validation checks are performed on user inputs to prevent incorrect or malicious data entry.

Extensive testing is carried out to validate the functionality and performance of the system. Unit testing, integration testing, and performance testing ensure that all modules operate correctly under different conditions. The system demonstrates stable performance with multiple users, confirming its readiness for real-world deployment.

Overall, the system implementation successfully delivers an automated, scalable, and secure platform for food redistribution. By combining responsive interfaces, efficient backend logic, and real-time data management, the Smart Food Distribution System effectively addresses the challenges of food waste and hunger.

V. ADVANTAGES

1. Reduction of Food Waste

The Smart Food Distribution System significantly reduces food wastage by enabling timely identification and redistribution of surplus food. Through real-time reporting and automated volunteer assignment, excess food from restaurants, events, and households is collected before spoilage. This systematic approach minimizes unnecessary disposal of edible food and promotes efficient resource utilization.

2. Improved Accessibility for Needy Communities

The system improves access to food for underprivileged and vulnerable communities by creating a reliable distribution network. By connecting donors with volunteers and NGOs through a centralized platform, food reaches beneficiaries in a structured and timely manner. This helps address hunger, malnutrition, and food insecurity in an effective way.

3. Real-Time Coordination and Faster Response

Real-time notifications and GPS-based volunteer allocation enable faster response to food availability. Volunteers receive instant alerts and can quickly reach pickup locations, reducing delays. This real-time coordination ensures efficient communication among stakeholders and improves the overall speed of food redistribution.

4. Reduced Manual Effort and Operational Efficiency

Automation of food reporting, volunteer assignment, and delivery tracking reduces the need for manual coordination. This minimizes human errors and lowers the workload for NGOs and administrators. As a result, the system improves operational efficiency and allows organizations to focus more on service delivery rather than logistics management.

5. Transparency and Accountability

The centralized database maintains complete records of food donations, volunteer actions, and delivery confirmations. This ensures traceability from donor to beneficiary, increasing transparency and accountability. Stakeholders can monitor activities and verify that food reaches the intended recipients, which builds trust in the system.

6. Data-Driven Decision Making

The system collects and stores valuable data related to

donation patterns, high-demand locations, and volunteer activity. This data can be analyzed to identify trends and optimize resource allocation. Data-driven insights help administrators improve planning, enhance coverage, and make informed decisions for future operations.

7. Scalable and Sustainable Design

The Smart Food Distribution System is designed to be scalable and adaptable for future expansion. Features such as IoT-based food quality monitoring, machine learning-based demand prediction, and mobile application integration can be added easily. This scalable design ensures long-term sustainability and makes the system suitable for large-scale real-world deployment.

VI. RESULTS AND ANALYSIS

The Smart Food Distribution System was successfully implemented and evaluated to assess its functionality, reliability, and efficiency. All core modules, including donor registration, surplus food reporting, volunteer assignment, and delivery confirmation, operated as expected without system failures. The integration between the frontend interface, backend services, and centralized database was smooth, ensuring accurate data flow and consistent system behavior. These results demonstrate that the system effectively meets its functional requirements and supports real-time food redistribution operations.

Analysis of the real-time coordination features showed a significant improvement in response time compared to manual food donation methods. Automated notifications and GPS-based volunteer allocation enabled faster pickup and delivery of surplus food, reducing the chances of food spoilage. Volunteers were able to receive alerts instantly, confirm pickup locations, and update delivery status in real time. This improved communication and coordination among donors, volunteers, and administrators, resulting in more efficient and timely food distribution.

```

C:\xampp\htdocs> cd Project2 > cd login.php
1 {
2 require 'db.php';
3 $error = '';
4 if ($SERVER['REQUEST_METHOD'] === 'POST') {
5     $email = isset($_POST['email']) ? trim($_POST['email']) : '';
6     $password = isset($_POST['password']) ? $_POST['password'] : '';
7     if (empty($email) || empty($password)) {
8         $error = "Please fill in all fields!";
9     } else {
10        $sql = "SELECT * FROM users WHERE email = ?";
11        $stmt = $conn->prepare($sql);
12        $stmt->bind_param('s', $email);
13        $stmt->execute();
14        $result = $stmt->get_result();
15        if ($result->num_rows === 1) {
16            $row = $result->fetch_assoc();
17            if (password_verify($password, $row['password'])) {
18                session_start();
19                $_SESSION['user_id'] = $row['id'];
20                $_SESSION['user_name'] = $row['full_name'];
21                header("Location: index.php");
22                exit();
23            } else {
24                $error = "Invalid password!";
25            }
26        } else {
27            $error = "No account found with that email!";
28        }
29        $stmt->close();
30    }
31    $conn->close();
32 }
33 }

```

Back

Manage Donations

Welcome, Kabir!

ID	Donor Name	Phone	Food Item	Quantity	Location	Account No	IFSC	UPI	Payment Ref	Image	Actions
2	Madhu	9876507896	FriedRice	5	safur	KYB015637	234564789247382		Madhu004@chdtc		Edit Delete
1	Harish	9994758940	Noodles	9	Chinniyampalayam	BOBS455	Balappaerthan	harishpbk2007@chdtc	Rajapalayamyappan1972@chdtc		Edit Delete

VII. CONCLUSION

The Smart Food Distribution System provides an effective digital solution to reduce food waste and address hunger. By automating food donation and redistribution, the system bridges the gap between surplus food providers and needy individual.

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Overall, the project achieves its objectives by delivering a scalable, user-friendly, and socially impactful solution that supports sustainability and community welfare.

VIII. FUTURE WORK

Future enhancements may include IoT-based food quality monitoring to ensure food safety during storage and transportation. Temperature and spoilage sensors can improve decision-making.

Machine learning models can be integrated to predict food availability and demand patterns based on historical data. This would further optimize volunteer allocation and delivery routes

The system can be expanded with a mobile application, multilingual support, and integration with government and NGO databases, enabling large-scale deployment and wider impact.

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