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A Comprehensive Review on Food Safety Monitoring, Complaint Management, and Food Waste Reduction Systems: Towards an Integrated Foodguard Framework

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I.ABSTRACT

Food safety, food wastage, and complaint management are major issues in today's world. Unsafe practices concerning food can spoil public health, while a lot of food goes wasted every day. Researchers have designed many innovative solutions to these problems, like a food safety monitoring system, a food donation system, a food redistribution application, a hostel grievance system and a complaint management system. However, most of these solutions only solve one of the problems and work independently. This review paper analyses existing works related to food safety monitoring systems, complaint management systems, food donation systems and food waste reduction systems. The reviewed articles have proposed solutions like a food donation system, a complaint management system, a foodborne disease report system, and a smart technology based food safety monitoring system. A comparison between the solutions has been made to identify their strengths and shortcomings. The review suggests the need of an integrated system to improve stakeholder coordination and manage food safety, complaints and donations systematically. The review finds that existing solutions do not offer much in terms of collaborative governance and integrated management of food related issues. The research makes a proposal for a collaborative FoodGuard system that intends to provide an integrated solution to food safety, complaint management, institutional grievance management and food donation platforms to enhance transparency, accountability, stakeholder coordination, food safety and a reduction in food wastage.

Keywords: Food Safety Monitoring, Complaint Management, Food Donation, Food Redistribution, Food Waste Reduction, FoodGuard, FSSAI.

II. INTRODUCTION

Food safety, complaint management, and food waste reduction have become a matter of great importance in the current scenario. Unsafe practices hamper the health of the nation, and a huge amount of food is thrown away every day, even though there are millions of people who go to bed with an empty stomach. Researchers have proposed various solutions for food safety monitoring, complaint management, food donation, and redistribution, to name a few [1], [2], [4], [6], [7]. Food donation and redistribution mechanisms have been discussed in various research works [1], [2], [4], [6], [7]. Various smart systems have been devised to monitor and inspect the food for safety [3], [9], [13]. Grievance management systems have also been implemented in educational institutions to monitor and manage the smooth flow of communication between students and the administration [5], [8], [10]. Though all these systems perform specific tasks very well, most of them fail to amalgamate all the functionalities together resulting in a disjointed mechanism. The current literature reveals that the aforementioned systems are mostly used for isolated purposes. There is still a need for integrated platforms which can handle food-safety monitoring, citizen/students' complaints, inspection, and donation services. Moreover, there is a dearth of effective methodologies to handle the complaints of the college canteen and hostel mess in most of the food-safety systems. This review paper tries to bring out the various research works performed so far in the realm of food-safety monitoring, complaint management, and food donation systems. The research gaps identified in the existing systems will lead to the proposition of FoodGuard: An Integrated Smart Food Safety, Complaint Management and Food Waste Reduction System, by the authors, which can facilitate stakeholders for better collaboration, transparency, food safety governance, and reduction in food waste.

A. Objectives of the Review

1. Conduct a survey of food safety systems and their functioning.
2. Study the systems for processing citizen and student complaints about food safety problems.
3. Conduct a survey of systems for donating food to vulnerable groups and transporting it to them.
4. Formulate the necessity of creating an integrated system of food safety complaint management and food donation distribution among residents.

III. REVIEW METHODOLOGY

Review study was performed by compiling fifteen references including research papers, journals and online sources on the topic of Food Safety Monitoring and Complaint Management and Food Donation and Redistribution Systems. The fifteen references were grouped into three clusters namely, food safety and inspection systems, complaint and grievance management systems and food donation and food waste reduction platforms. Each study was evaluated with respect to the objectives, technologies, key features, benefits and limitations. This study aimed to compare and contrast the objectives, technologies, benefits, and limitations of the fifteen references and identify issues, research gaps, and limitations in the existing systems. The review study results indicated that most of the solutions were focused on a particular field, and there was no system that unified consumers, students, food vendors, authorities, and non-governmental organizations. The results of the review study provided the basis for addressing the research problem and developed FoodGuard as an integrated platform for food safety monitoring, complaint management, and food donation and redistribution system.

IV. LITERATURE REVIEW

A. Food Donation and Redistribution Systems

Shivani and Usha [1] proposed a web based food donation and redistribution system which connects the food donors with the NGOs to minimize the food waste. Shaikh and Rathi [2] emphasized on the importance of the digital system for food redistribution to enhance the food accessibility and develop sustainable strategies for food management.

B. Food Waste Management Systems

Fan and Tyng [6] introduced WeWasteNoMore which is a mobile application that facilitates sharing of surplus food and contributing to community food aid programs. Muzaffar et al. [7] designed FoodLink, a web based food donation and redistribution system. Sanyal et al. [11] proposed a game theoretic approach for optimal distribution of surplus food in smart cities whereas Phillips et al. [12] suggested an optimized method for collection and redistribution of food.

C. Food Safety Monitoring and Inspection Systems

Kirubakaran et al. [3] showed the potential of smart technologies in terms of monitoring, detecting and tracing food products, which are used to ensure food safety. Kim et al. [9] showed how complaint-based restaurant inspection and surveillance strategies could be used for enhanced food safety. Dubrawski et al. [13] displayed how consumer complaints could be mined in order to identify food-safety problems and improve public health.

D. Food Donation Management Systems

Pimple et al. [4] proposed a system for managing food donations with a focus on monitoring and tracking.
The system aims to increase the efficiency and transparency of food donation and records management.

E. Hostel and Student Complaint Management Systems

Heda et al. [5] introduced Digital Hostel Management System (DHMS) with a focus on chatbot, analytics, and live tracking. Mansi et al. [8] designed a Hostel Grievance System that enables students to register and monitor their complaints effectively.

F. Campus Complaint Management Systems

Alifat et al. [10] proposed a Web-Based Campus Complaint Management System for registering and tracking of complaints in educational institutions.

G. Food Safety Standards and Regulatory Framework

The Food Safety and Standards Authority of India (FSSAI) [14] is responsible for developing standards and regulations related to food. The World Health Organization (WHO) [15] emphasizes on the importance of regulatory frameworks and surveillance systems for food safety and controlling food-borne disease

V. COMPARATIVE ANALYSIS

Study	Area	Core Contribution	FoodGuard Relevance	Main Limitation
Shivani and Usha [1]	Food Donation and Redistribution	Developed a web based platform for surplus food donation and NGO based redistribution.	Supports the FoodGuard's food donation and redistribution module.	Does not incorporate the food safety inspection and complaint management.
Shaikh and Rathi [2]	Food Waste Reduction	Studied digital approaches for decreasing the food wastage by way of redistributing the food.	Provides concepts on decreasing the food waste and connecting the donor and beneficiary.	Lacks the monitoring of food safety and grievance handling.
Kirubakaran et al. [3]	Food Safety Monitoring	Introduced smart technologies for detection, monitoring and traceability of food.	Supports the FoodGuard's food safety inspection and monitoring framework.	Does not provide complaint management and food donation services.
Pimple et al. [4]	Food Donation Management	Developed a food donation management system which has real time tracking.	Supports the donor management and tracking of food distribution.	Limited to managing donation activities.
Heda et al. [5]	Digital Hostel Management	Integrated automation and intelligent management for the hostel services.	Supports student complaint and hostel management concepts.	Does not focus on food safety complaints and inspections.
Fan and Tyng [6]	Food Waste Management	Developed a mobile application for the minimization of food waste and food aid distribution.	Provides concepts on food redistribution through mobile.	Does not support regulatory inspection flows.
Muzaffar et al. [7]	Food Donation Application	Developed the FoodLink for connecting food donors and recipients.	Supports the food sharing and redistribution functionalities.	Does not incorporate the food safety verification.
Mansi et al. [8]	Hostel Grievance Management	Developed a system for student grievance registration and tracking.	Supports the FoodGuard's student complaint management module.	Not integrated with food safety authorities.
Kim et al. [9]	Foodborne Illness Monitoring	Demonstrated the efficacy of complaint driven food safety monitoring.	Supports on complaint driven inspection and investigation workflows.	Does not address food donation management.
Alifat et al. [10]	Campus Complaint Management	Developed a web based complaint management platform.	Supports the complaint registration and tracking mechanisms.	Limited only to campus grievances.
Sanyal et al. [11]	Food Distribution Optimization	Proposed a framework for optimizing the distribution of surplus food.	Supports efficient planning of redistributing the food.	Does not incorporate complaint and inspection modules.
Phillips et al. [12]	Food Redistribution Optimization	Applied optimization techniques to the food allocation systems.	Supports efficient strategies for food collection and distribution.	Lacks the components of food safety and complaint management.
Dubrawski et al. [13]	Consumer Complaint Analysis	Used the complaint patterns for identifying the food safety risks.	Supports the complaint analysis and monitoring of food safety.	Does not provide a comprehensive complaint management framework.
FSSAI [14]	Food Safety Regulation	Provides the food safety standards and regulatory guidelines.	Forms the regulatory base for FoodGuard.	Focuses on the regulations and not the implementation.
WHO [15]	Public Health and Food Safety	Provides the world guidelines on food safety and food borne disease prevention.	Supports the public health objectives of the FoodGuard.	Does not provide the implementation mechanisms.

VI. RESEARCH GAP IDENTIFIED

The reviewed literature includes various researches on the topic of food donation and redistribution systems, food safety monitoring technologies, and complaint management platforms. Food donation applications allow reducing food waste and connecting donors with NGOs and beneficiaries [1], [2], [4], [6], [7]. Food safety studies focus on developing approaches for food quality monitoring, traceability, complaint analysis and inspection programs [3], [9], [13]. Complaint management systems offer effective solutions for complaint registration and tracking processes in educational institutions [5], [8], [10]. Most of the systems are designed for a specific purpose and work alone. For example, food donation systems are intended for collecting and distributing food, whereas food safety systems are responsible for monitoring and inspecting. Similarly, complaint management platforms are designed to deal with complaints in isolation and do not have any functions for food safety or food donation services. It is clear that there is a deficiency in integrated solutions that unite food safety monitoring, complaint management and food donation services into one platform. The problem is that current solutions are not addressing the issue of connection and coordination of all parties, such as citizens, students, food safety authorities, schools, non-governmental organizations, volunteers, and food vendors. Thus, there is a research gap that can be addressed through the development of an integrated system that would address multiple purposes, including registering and tracking complaints, conducting food safety inspections, and managing food donation and redistribution processes. The proposed system will enhance transparency, cooperation, food safety control, and reduction of food waste.

VII. PROPOSED FOODGUARD FRAMEWORK

The architecture of the proposed FoodGuard framework is designed around the core functions of the food safety monitoring system, which includes complaint management and food donation services. The system will be used to receive complaints and donation requests from citizens, students, vendors, and donors. The complaint

management component is responsible for handling complaints concerning food safety, college canteens, and messes. The inspection component deals with inspection, sample collection, report upload, and necessary actions by the food safety department. The donation component handles the donation, collection, and redistribution process with NGOs and volunteers. The administrative component deals with the records and status of all the processes involved and is operated through a dashboard. The system aims to guarantee improved management of food safety, transparency, stakeholder collaboration, and efficient management of food donations.

A. Conceptual workflow

Complaint, citizen/students → Verification → Allocation to officer/committee → Inspection and investigation → Correction of violation → Closure and tracking

Food Donation request → NGO/volunteer matching → Collection → Redistribution → Monitoring and reporting

B. Complaint and Inspection

The complaint management component should allow students and citizens to report any violations of food safety and submit complaints about college canteens or messes. The complaint should be assigned to the relevant authority depending on the nature of the violation or location of the canteen or mess. The complaint should be investigated by Food Safety Officers, canteen committee, mess committee, or the relevant authority in case of an institutional canteen. Appropriate action should be taken against the violators. The next component that needs to be developed is the one that will manage, record, and track all the complaints received, inspections conducted, laboratory results, and actions taken.

C. Food Donation and Redistribution

The food donation module should be designed to provide a digital platform for donating, collecting, and redistributing food items. The system should be used to track the donation process by food donors, NGOs, volunteers, and recipients. The complaint management component will also monitor the collection and redistribution of donated food items to ensure that donated food reaches the vulnerable population without being wasted.

VIII. TECHNOLOGY STACK AND IMPLEMENTATION CONSIDERATIONS

FoodGuard is a Food Safety Monitoring Web-Based System that Manages Complaints and Donated Food. The application can be developed using Spring Boot, Thymeleaf, HTML, CSS, JavaScript, and MySQL. The system will be useful to citizens, students, food safety authorities, educational institutions, NGOs, volunteers, and vendors. It is composed of three modules, namely, complaint management, food safety inspection, and food donation and redistribution. The application will offer complaint management services to both citizen and student complaints concerning college canteens and hostel mess. The study is expected to come up with a framework for managing and monitoring food safety, complaints, and donation and redistribution of food in colleges and hostels.

IX. CONCLUSION

The review of existing literature on food safety monitoring, complaint management, and food donation and redistribution was conducted. The study found that most of the previous research has been done on individual aspects of the system. The review also indicated that there is a scarcity of integrated systems that address food safety monitoring, complaint management and food donation and redistribution. Most of the literature reviewed indicates that there is a high level of inadequacy in addressing food safety, citizen complaints, and redistribution of food. The paper presents FoodGuard – a novel system for monitoring food safety with complaint handling and food donation and redistribution management. The proposed system will ensure appropriate complaint management and inspection of food safety in colleges and hostels. Moreover, it will promote partnerships between citizens, students, authorities, NGOs, volunteers and vendors. Future research can focus on developing and testing the proposed framework.

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