Waste Food Management & Donation App

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Abstract

The growing problem of food waste not only results in the loss of valuable resources, but also exacerbates local environmental problems and leads to hunger. To address this pressing issue, we developed a mobile app that bridges the gap between excess food in restaurants, events, and individuals and vulnerable groups in dire need of food. This system will be designed to access the entire population and consider a place closer to the restaurant and selected target users to be restaurant personnel and personnel at non-profit or donation agencies. Then, this system selects android studio as the development tool. To achieve these goals, our application features a user-friendly interface for both donors and recipient organizations. It uses geolocation technology to match leftover food with nearby receiving organizations. Convenient for restaurants and cafes to dispose of excess food. This solves the difficulties of the poor and is a very good start for the international food shortage. It will also improve the quality of the environment and the situation of food shortages from one side

Introduction

We must recognize the importance of food loss and waste and promote global efforts to address it. Therefore, the 74th United Nations General Assembly in 2019 established September 29 as the International Day for Awareness of Food Loss and Waste (Resolution A/RES/74/209), recognizing the important role that sustainable food production plays in promoting food security and nutrition.

Andorra and San Marino played a key role in proposing the establishment of an International Day for Awareness of Food Loss and Waste. The establishment of this International Day provides an opportunity to deepen people's understanding of the need to reduce food loss and waste and how it can promote sustainable development.

Given the growth of the world's population, the United Nations believes that there is an urgent need to address the high level of food loss and waste worldwide, and highlights the risks to climate change, agricultural sustainability, human livelihoods and food supply. The 2030 Agenda for Sustainable Development sets a global target to reduce food loss and waste. Sustainable Development Goal 12.3 calls for halving per capita global food waste at the retail and consumer levels and reducing food losses along the production and supply chains.

FAO and the United Nations Environment Programme (UNEP) are leading the effort to mark the day and are currently assessing progress towards the goal. FAO leads the Food Loss Index and provides guidance for policy interventions to reduce food loss and waste in a profit-incentive way from a commercial and economic perspective, which can then be leveraged to address food insecurity. Meanwhile, UNEP, which produces the Food Waste Index, is committed to accelerating action through its Sustainable Food Systems programme to raise awareness at all levels and spur action at local, regional and

international levels Annually, over 1.3 billion tons of food is wasted globally, equating to approximately one-third of all food produced. This waste occurs at various stages of the food supply chain, including production, transportation, retail, and consumer levels. At the production stage, crops may be left unharvested due to market fluctuations or cosmetic imperfections. During transportation, improper handling and storage can lead to spoilage. In the retail sector, large quantities of food are discarded due to overstocking, expiration dates, and damaged packaging. Consumers also contribute significantly to food waste by buying more than needed, improperly storing food, and discarding leftovers.

Concurrently, nearly 690 million people suffer from hunger worldwide. Many communities and individuals, including the homeless, low-income families, and disaster-affected regions, face daily challenges in accessing nutritious meals. Food insecurity is not limited to developing countries; even in affluent nations, pockets of poverty result in significant portions of the population struggling to obtain enough food. Nutritional deficiencies from lack of access to diverse and healthy foods lead to various health issues, including stunted growth in children and weakened immune systems.

Food waste contributes to environmental issues such as greenhouse gas emissions and resource depletion. Decomposing organic waste in landfills releases methane, a potent greenhouse gas that is 25 times more effective at trapping heat in the atmosphere than carbon dioxide. Additionally, the resources used to produce the wasted food, including water, land, and energy, are squandered. For instance, producing food that is ultimately wasted consumes approximately 250 cubic kilometers of water annually, equivalent to three times the volume of Lake Geneva. Moreover, agricultural practices to grow food, such as deforestation and pesticide use, further strain the environment.

Current food donation systems often suffer from logistical inefficiencies, lack of real-time coordination, and limited outreach, leading to missed opportunities for food

recovery and redistribution. Many food banks and charitable organizations operate with

limited resources and rely on manual processes to match food donations with those in need.

This can result in delays, food spoilage, and unbalanced distribution where some areas

receive an excess while others remain underserved. The lack of a centralized, easily

accessible platform exacerbates these inefficiencies, hindering the potential impact of food

donation efforts

Research Methodology

The project approach aims to design a system that can be used by all, ensuring inclusiveness and wide availability. The system will prioritize locations close to restaurants to optimize food redistribution efficiency and minimize transportation logistics. The main target users are restaurant personnel who will donate surplus food and individuals from non-profit organizations or donor agencies who will receive these donations. To achieve this goal, Android studio was chosen as the development tool, leveraging its powerful features to simplify the development process and ensure the creation of a reliable, efficient, and user-friendly application. By integrating these considerations, the project approach ensures that the system can effectively meet the needs of its diverse user base and achieve the goals of reducing food waste and addressing food insecurity
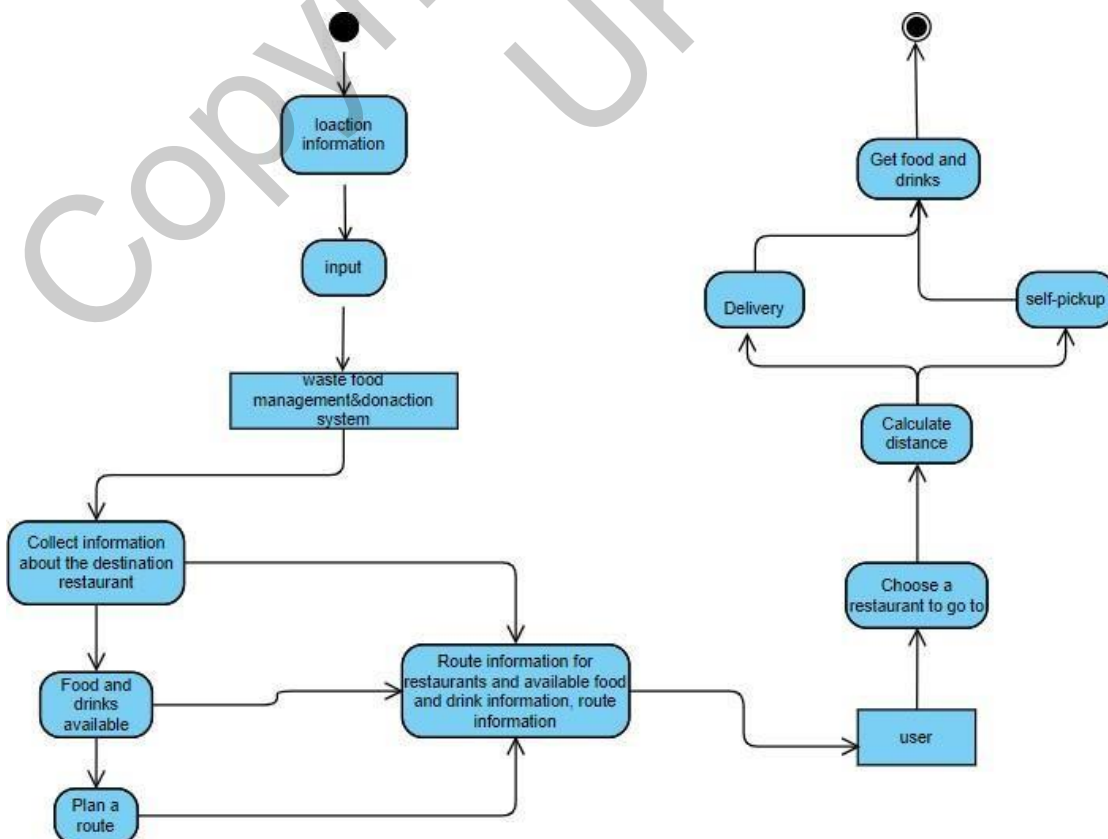
Figure 1: Develop System Flow Chart

In the requirements analysis phase, we need to clearly understand what users need, including the entry of basic resume information, format selection, template selection, and save and export functions. By consulting information and communicating with users, we can better understand their needs and expectations and further improve our requirements list. After the requirements are defined and confirmed, the next step is system design, which requires the formulation of the overall architecture of the system, the definition of the functions of each module, and the interaction between them, including the design of the database, such as deciding what data needs to be stored and the relationship between the data.

In the implementation phase, we will write code according to the design, follow certain programming specifications and best practices to ensure the quality of the code, and also pay attention to the performance of the system to ensure that the system can run smoothly in various situations. Testing plays an indispensable role in the software development life cycle to ensure that the software meets the expected expectations and requirements. It includes several stages: unit testing verifies the various components of the code and finds problems at the earliest stage; integration testing checks the interaction between these units and identifies any interface problems; system testing is an end-to-end process that verifies the entire system under conditions that simulate the real environment; finally, user acceptance testing involves real users of the system to confirm the availability and effectiveness of the system in real scenarios. Through these rigorous testing phases, potential problems can be discovered and resolved, thereby improving the reliability, stability and user satisfaction of the software.

After the system is launched, continuous maintenance work is required, including system

monitoring, problem solving, and the addition of new features to ensure that the system runs healthily and meets user needs. Through the above five stages, we can create an online resume system that meets user needs and runs stably. This process can be repeated. We continuously improve and optimize the system through user feedback to make it closer to user needs and provide better services.

Results and Discussions

Results

1. System Functionality Testing

The system was thoroughly functionally tested covering all key components such as user registration, donation list, matching and notification, pickup and delivery management, and feedback system. The results showed that the system functions as expected and no major bugs were found during the testing phase. All user roles (donors, recipients, and administrators) were able to interact with the system seamlessly, confirming the robustness of the user interface and backend integration.

2. User Interface (UI) Testing

The UI was evaluated for ease of use, intuitiveness, and accessibility. Test users reported that the interface was user-friendly and intuitive with clear navigation paths. UI design principles were followed to ensure a positive user experience on different devices such as desktops, laptops, and mobile phones.

3. Performance Testing

Performance testing was conducted to evaluate the response time and stability of the system under various load conditions. The system exhibited satisfactory performance and could efficiently handle concurrent user activities. The response time remained within acceptable limits, ensuring that users could log in, list donations, and view available donations without noticeable delays.

4. Security Testing

The security assessment confirmed that the system implemented strong authentication and encryption mechanisms to protect user data. Regular security audits revealed no major vulnerabilities, ensuring that the system is secure against potential threats.

Discussion

1. System Efficiency

The results of the functional and performance tests highlighted the efficiency of the system in managing food donations. The geolocation feature effectively matched donors with recipients, optimizing the pickup and delivery process. This efficiency is critical to minimizing food waste and ensuring timely delivery to those in need.

2. User Feedback

User feedback was very positive, with users appreciating the simplicity and functionality of the app. The feedback and rating system can be continuously improved to ensure that any issues are addressed in a timely manner and outstanding contributors are recognized.

3. Impact on Reducing Food Waste

The system has a huge potential to reduce food waste. By connecting donors with recipients in real time, the app ensures that surplus food is redistributed to those who need it most, rather than ending up in landfills. This not only helps alleviate hunger, but also contributes to environmental sustainability.

4. Future Enhancements

Future updates will focus on enhancing the scalability of the system and introducing new features based on user feedback. Potential enhancements include integrating

eco-friendly shipping options for delivery and expanding the system to support more languages and regions.

ID	Requirement	Description	Result
C001	APP compatibility	The system should run on all major android App	Pass
C002	Operating system compatibility	The system should run correctly on different operating systems (e.g,Windows,Mac OS,Linux,Android,iOS)	Pass
C003	Network compatibility	The system should operate correctly in different network environments (e.g,4G,5G,WIFI)	Pass

Compatibility Testing is a type of software testing designed to ensure that software works properly in different environments. Environments can include operating systems, hardware configurations, network environments, browsers, databases, and so on. The purpose of compatibility testing is to ensure that the software is compatible with other systems or components and performs consistently under various conditions, without functional problems or performance degradation due to changes in the environment

ID	Question	Description	Score
U001	Is it easy to navigate?	Whether the operating system is easy for users to use each part of the function?	90/100

U002	Whether these features are easy to use and understand	Whether the viewing and publishing of housing information is convenient for users to use	85/100
U003	Whether the system effectively provides help to users	Whether the user effectively provides help when encountering difficulties	85/100
U004	Is it appropriate in the user interface	This includes the aesthetic aspects of the system, such as typography, layout, color, etc	80/100
U005	Whether the system is efficient and responsive	Includes the response speed of the system, such as page jump, user login speed, etc	90/100

Usability Testing is a method of evaluating the usability of a software product or system by observing the interaction between real users and the system, identifying and solving the problems encountered by users during use, in order to improve the user experience and satisfaction of the product

Conclusion

After a thorough inspection and testing of the food waste donation system, we can conclude that the system performs well in every important parameter.

The system is operating successfully as expected. It provides users with the tools they need to effectively find rental housing.

Although it performed well in testing, there is always room for improvement. Future user feedback and continuous testing should be used to meet the necessary functional requirements detailed in the requirements testing phase to ensure that the development of key features such as housing information creation, editing, saving and sharing can solve any problems, enhance system functionality and continuously improve the user experience.

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