

Food Waste Management System

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ABSTRACT

A drastic increase can be seen in food waste. As per data given by Food and Agriculture Organization, 1/3rd of food produced for human consumption is wasted globally, which accounts for almost 1.3 billion tons per year. On the other hand, also as per WHO 20% of the population faces extreme food shortages. Hence there is a need to come up with a solution that can avoid food waste & can help feed the needy. This android-based Food Waste Management system can assist in collecting the leftover food from hotels & restaurants to distribute among those in need. NGOs that are helping poor communities to battle against starvation & malnutrition can raise a request for food supply from restaurants through this application. Once the request is accepted, the NGOs can collect the food from the restaurants for its distribution. In this way this android-based food waste management system will help restaurants to reduce food waste and will help in feeding the poor and needy people. Food waste is something that affects us all. It affects people everywhere like in our homes, at schools, at restaurants, the grocery store, in production and even in transportation. This application use of mobile technology to reduce waste food and allow hotels to donate leftover food to needy people. As per the present reports, it is estimated that 1.3 billion tonnes of food per year are wasted or discarded, causing 750 million Dollars' worth of economic and environmental loss. This wastage has also been linked to the increasing food shortages in developing or underdeveloped countries. When thrown away in the landfills, this waste food causes the release of many toxic gasses that are classified as greenhouse gases, leading to global warming and Air Pollution. Nowadays, when every type of waste is encouraged to be recycled and have a proper management system in place, including plastic waste and e-Waste, Food waste management is ignored due to the misconception surrounding the biodegradable properties of food and the fact that it decomposes itself in spite of the fact that, that process takes a lot of time and causes pollution. Therefore, it is very important to set up a proper Food Waste management system in place.

Keyword- Food Waste Management, Freshness Prediction, Spoilage Detection, Demand Forecasting, Donate Food, Order Food.

1. INTRODUCTION

According to, food waste is a important issue around the world. It is predicted through a survey that more than 58 percent of food that people generated for consumption is wasted every day. Thus, more than 60 percent of people in the third world countries are dying in malnutrition without proper food for a living. Therefore, the technologically developed countries are articulate more on this issue. Therefore, that limited food can be wasted and can be distributed to the needy people. According to in the age of modern era, where we are developed through artificial intelligence, people are more depending on the smartphone. There are different applications, which are developed to control the more wastage of food, and it give the opportunity to send that extra food to the people who need it. There are many applications, which control food waste. A new online-based application that provide a platform for donating leftover food to all or any needy people/organizations. It give details about the motivation to return up with such an application, thereby describing the prevailing donation system and the way the proposed product works for the improvement of society. The recent depression has grow the amount of individuals living in conditions of food poverty, especially in developed regions. At the client side App give facility to donate food to the charity for the assistance of hungry people. The system consists of three primary donor, NGOs and admin modules. The donor completes tasks like registration/login and adds items to the donation request to be contributed and viewed. The recipient does tasks such as requesting items, displaying requested items and declare donations. The manager will track the collection and improve it. The administrator and the donor also look the position of the recipient. The donor-donated items will be displayed to other users as a reminder in the donation tab and the message will be saved in the backend folder [5]. In the base paper, an

automation is built with four modules which focus on accounting the quantity of food being wasted, it is focused on creating an awareness by feeding the live data on how much food is being wasted, it uses a database to store the quantity of food being wasted each day and later the presented data is represented in graphs in order to encourage the students to reduce the wastage of food. The automation elements are connected to the central data store.

1.1. Problem Identification

In this system, we have tried to reduce restaurant food wastage by giving waste food to NGOs. NGOs will raise a request, in case of any leftover food restaurants have. This request is sent to the restaurant manager of that particular restaurant. The NGO Manager then approves the request and assigns it to one of the NGO employees for takeaway and forwards the request to the restaurant. The leftover food at the restaurant can be given to NGOs at the end of the day. The admin can track the history of restaurants and NGOs for the leftover foods. This system can be used by restaurants, and NGOs to donate leftover foods to the needy. In this website we have tried to reduce restaurant food wastage by giving waste food to NGOs. NGOs will add to a request, in case of any leftover food hotels have. This request is sent to the restaurant manager of that specific restaurant. The NGO Manager then accept the request and assigns it to one of the NGO employees for takeaway and forwards the request to the restaurant. The remaining food at the hotel can be given to NGOs at the end of the day. The admin can detect the history of restaurants and NGOs for the leftover foods. orphanages, old age house owner can give a rating of food item which will help other persons to select the food item. Sentiment analysis using scikit_learn library.

1.2. Objectives

The main objective of the Food Waste Management System using Machine Learning is to minimize food wastage by providing a proactive, intelligent, and automated solution. Develop a platform for connecting food donor's and NGOs. Predict surplus food using machine learning. Also reduce food wastage. I our main objective is promote sustainable food management.

2. LITERATURE REVIEW AND SYSTEM ANALYSIS

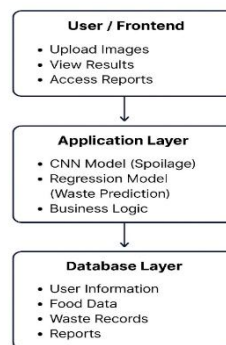
Food waste has become one of the most critical global challenges affecting food security, environmental sustainability, and resource management. According to global studies conducted by organizations such as the Food and Agriculture Organization (FAO), nearly one-third of all food produced worldwide is wasted every year. This results in significant economic loss and environmental damage due to increased greenhouse gas emissions, water wastage, and inefficient use of agricultural resources. In response to this growing concern, researchers and technology developers have proposed various solutions to manage food waste through digital platforms, smart monitoring systems, and predictive analytics. These systems aim to reduce food wastage by improving food redistribution, monitoring consumption patterns, and predicting surplus food generation. However, despite the progress made in this domain, many existing solutions still face limitations in terms of scalability, cost, accessibility, and predictive capability.

One of the earliest approaches to food waste management involved the development of food donation platforms that connect food donors with non-governmental organizations (NGOs) and charities. These platforms allow restaurants, hotels, supermarkets, and households to register surplus food that can be collected and distributed to people in need. Several web-based and mobile applications have been developed to facilitate such donations. These systems primarily focus on communication and logistics by allowing donors to upload food availability details such as type of food, quantity, and location. NGOs can then view this information and arrange pickup or distribution. While such systems have improved coordination between food donors and charities, they largely depend on manual input and real-time communication. They do not incorporate intelligent mechanisms to predict when and where food waste will occur. As a result, food is often reported only after it becomes surplus, which may reduce the available time for redistribution before spoilage.

3. SYSTEM ARCHITECTURE & IMPLEMENTATION

The Food Waste Management System using Machine Learning is designed as an intelligent platform that connects food donors such as restaurants, hotels, event organizers, and households with non-governmental organizations (NGOs) and volunteers who can redistribute surplus food to needy people. The system architecture is structured in multiple layers to ensure efficient data processing, secure storage, user interaction, and machine learning-based prediction. The architecture mainly consists of the User Interface Layer, Application Processing Layer, Database Layer, Machine Learning Layer, and Notification & Analytics Layer. These components work together to create an integrated system that helps in reducing food waste and improving food distribution efficiency.

The Machine Learning Layer is one of the most important components of the system because it provides predictive intelligence that helps reduce food waste before it occurs. Machine learning algorithms analyze historical donation data to identify patterns and predict the likelihood of surplus food generation in different situations. For example, restaurants that regularly host large events may generate predictable amounts of leftover food. By analyzing factors such as event size, food preparation quantity, time of day, and previous donation records, the machine learning model can estimate the expected surplus food quantity. Algorithms such as Decision Tree, Random Forest, and Linear Regression can be used to build predictive models for this purpose. The machine learning model is trained using historical data stored in the database. After training, the model can be deployed through a Flask API that allows the web application to request predictions whenever new data is entered. This integration enables the system to provide intelligent recommendations for food donation and distribution.



System Architecture Diagram

The implementation process of the Food Waste Management System begins with data collection and system design. Initially, the database structure and user interface are designed to support the required functionalities. The backend application is then developed to manage user registration, food donation entries, and request handling. After the basic system functionality is implemented, machine learning models are developed using historical food waste datasets. These models are trained, tested, and optimized to achieve accurate prediction results. Once the models perform satisfactorily, they are integrated with the web application through APIs. The system is then tested using real or simulated data to evaluate its performance and usability.

In conclusion, the system architecture of the Food Waste Management System combines web technologies, database management, and machine learning algorithms to create a comprehensive platform for reducing food waste. By integrating predictive analytics with a user-friendly donation platform, the system enables efficient communication between food donors and NGOs while providing intelligent insights that help prevent unnecessary food wastage. This layered architecture ensures scalability, reliability, and flexibility, making the system suitable for real-world deployment in restaurants, hotels, community kitchens, and urban food distribution networks.

4. PERFORMANCE EVOLUTION PARAMETER

Performance evaluation is a critical part of developing and validating a Machine Learning (ML)-based Food Waste Management System. The objective of evaluation is to measure how accurately and efficiently the model performs in detecting food spoilage and predicting waste quantities. Proper validation ensures that the system's predictions are reliable, accurate, and generalizable to real-world data. Performance evaluation parameters are essential for assessing the effectiveness and reliability of the proposed Food Waste Management System using Machine Learning. These parameters help determine how accurately and efficiently the system predicts food demand, classifies surplus food, and recommends redistribution strategies. One of the primary metrics used is Accuracy, which measures the percentage of correct predictions made by the machine learning model when identifying surplus food or forecasting food demand. Another important parameter is Precision, which evaluates the proportion of correctly predicted positive instances out of all predicted positives, ensuring that the system minimizes incorrect alerts about surplus food. Recall is also significant as it measures the ability of the model to identify all actual surplus food instances, which is critical to prevent food wastage. Additionally, the F1-Score provides a balanced evaluation by combining precision and recall into a single metric. Apart from prediction performance, system-level parameters such as response time, data processing speed, and resource utilization are considered to evaluate the operational efficiency of the platform. Monitoring these parameters ensures that the system performs reliably in real-time environments, allowing restaurants, supermarkets, and NGOs to efficiently track surplus food and redistribute it to those in need, thereby reducing food waste and improving sustainability.

5. EXPERIMENTAL SET UP

The experimental setup for the Food Waste Management System using Machine Learning was designed to evaluate the performance and effectiveness of the proposed model in predicting and managing surplus food. The system was implemented using a machine learning environment that included programming with Python, along with data processing and model development libraries such as NumPy, Pandas, and Scikit-learn. The dataset used in the experiment contained records of food preparation, consumption patterns, and leftover quantities collected from restaurants and food service centers. Before training the model, the dataset underwent preprocessing steps including data cleaning, removal of missing values, normalization, and feature selection to improve the quality of input data. The dataset was then divided into two parts: a training set (approximately 70–80%) used to train the machine learning model, and a testing set (20–30%) used to evaluate its performance. Various machine learning algorithms such as Random Forest and Decision Tree were applied to analyze patterns and predict the likelihood of food surplus. The experiments were conducted on a standard computer system with sufficient processing power and memory to handle data processing tasks. Performance metrics such as accuracy, precision, recall, and F1-score were used to evaluate the results. This experimental setup ensured a controlled environment for validating the proposed system's ability to effectively predict and reduce food waste.

6. SOFTWARE AND HARDWARE SET UP

The implementation of the Food Waste Management System using Machine Learning requires both appropriate software tools and reliable hardware infrastructure. The software environment includes Python for machine learning development and backend processing, along with libraries such as Scikit-learn, NumPy, and Pandas for data analysis and model training. The web interface is developed using HTML, CSS, and JavaScript, with MySQL used for database management. The system runs on hardware consisting of a standard computer with at least an Intel Core i5 processor, 8 GB RAM, and sufficient storage, ensuring efficient data processing, model training, and smooth operation of the web-based platform.

7. CONCLUSION

Our study has look into the problem of food waste that has many serious side effects economically and socially. However, the waste of the food can be prevented or at lowest decreased using political rules and technology. Website technology is helpful for food waste Food waste has serious social and environmental implications, but many of us don't think twice about it. Our hope is that after learning more about this this prevalent problem. The Food Waste Management System using Machine Learning provides an effective solution for reducing food waste and improving food redistribution. By combining predictive analytics with a web-based donation platform, the system enables efficient communication between donors and NGOs. Future work may include mobile applications, GPS tracking, and deep learning models for food freshness detection.

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