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Reducing Food Waste in Restaurants Using Machine Learning

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Abstract

By using machine learning to manage materials based on their expiration dates and recommend new recipes, this initiative seeks to reduce food waste in restaurants. In order to anticipate any waste, the system analyse data on inventory levels and expiration dates in real time. It then makes innovative new dish recommendations using components that are almost out of date based on this information. This method not only minimizes food waste and maximizes inventory, but it also lowers expenses and improves menu diversity. The idea encourages economic efficiency and sustainability in restaurant operations by converting excess ingredients into culinary potential.

Keywords

Food waste · Wasteful behavior · Restaurant waste · Consumer waste ·Restaurant management Out-of-home waste.

Introduction

Restaurants face a big problem with food waste since it affects their profitability and environmental effect. Food expiry is a major source of waste since it can result in the needless disposal of ingredients that are still useful [1][2]. This study suggests a machine learning-based strategy that combines expiration date management with creative cooking to solve this problem. The technology forecasts possible waste and recommends new recipes that make use of ingredients that are about to expire by analysing data on ingredient usage and expiration [5]. This two-pronged approach improves inventory control, lowers food waste, and boosts menu innovation and operational effectiveness. By using this strategy, restaurants may provide a wider variety of tasty eating alternatives at lower costs, increasing sustainability [1][2][3].

Motivation

For restaurants, food waste results in considerable financial losses [1]. Restaurants can save money on the costs of buying, preparing, and discarding extra food by decreasing waste. For restaurants, food waste results in considerable financial losses. Restaurants can save money on the costs of buying, preparing, and discarding extra food by decreasing waste [2][7]. Reducing food waste is the goal of laws and incentives in several areas. Restaurants can abide by these rules and stay out of trouble by putting in place a machine learning solution. By utilizing cutting-edge technology like machine learning, a restaurant can set itself apart from rivals and even draw in a tech-savvy customer base by establishing itself as a leader in innovation.

Existing System

The management of food waste in restaurants has gained significance in India owing to growing worries about environmental impact, food security, and sustainability. These are a few widely utilized systems

and techniques that currently exist. Waste audits are a common practice in restaurants to quantify and examine the different types and quantities of food waste produced. Utilizing software to monitor waste data, certain organizations can pinpoint areas in need of repair. Effective management requires staff to receive sufficient training on trash segregation techniques. Utilizing seasonal ingredients when creating menus helps reduce spoiling loss. To monitor and control food waste and inventory, some restaurants employ smartphone apps. Reduced spoilage and optimal stock levels are two benefits of smart inventory systems.

Literature Survey

According to the **FAO's 2021** report, "Global Food Losses and Food Waste – Extent, Causes and Prevention," around 1.3 billion tons of food are wasted annually, or one-third of all food produced for human use. It looks at the various reasons why food is wasted, such as inefficient methods of production, delivery, and customer behavior. The substantial negative effects of food waste on the environment, the economy, and society are covered in the paper, with special attention to how it increases greenhouse gas emissions and food poverty.

The article by **Talati et al. (2017)** describes a digital platform that links food donors with organizations to make food donations easier. Through the portal's easy donation and tracking features, food waste is to be reduced while hunger is addressed. It addresses problems like logistics and food safety in addition to outlining the advantages of such a system, including social and environmental effects. The site should be put into place, according to the authors, as it will improve food donation efforts and encourage community sharing.

The Food Waste Reduction Management Application's literature review reveals an expanding corpus of studies emphasizing the critical need for creative solutions to address the problem of global food waste. According to studies, almost one-third of all food produced for human use is wasted or lost, which contributes to considerably to losses in the economy and environmental degradation for instance, in, **Vismaya TS*1, Shwethashri KS*2(2024).**

In their **2022 publication**, "Digital Solutions for Food Recovery and Redistribution: A Comprehensive Review," **Anderson and Chabria** investigate how technology might be used to combat food waste by means of recovery and redistribution initiatives. The article covers a number of online resources and applications that are intended to link people in need—such

Problem statement

Food waste is a major problem for restaurants, which has an adverse effect on the environment and profits. The challenge lies in determining and putting into practice efficient tactics and innovations to minimize food waste.

System Architecture

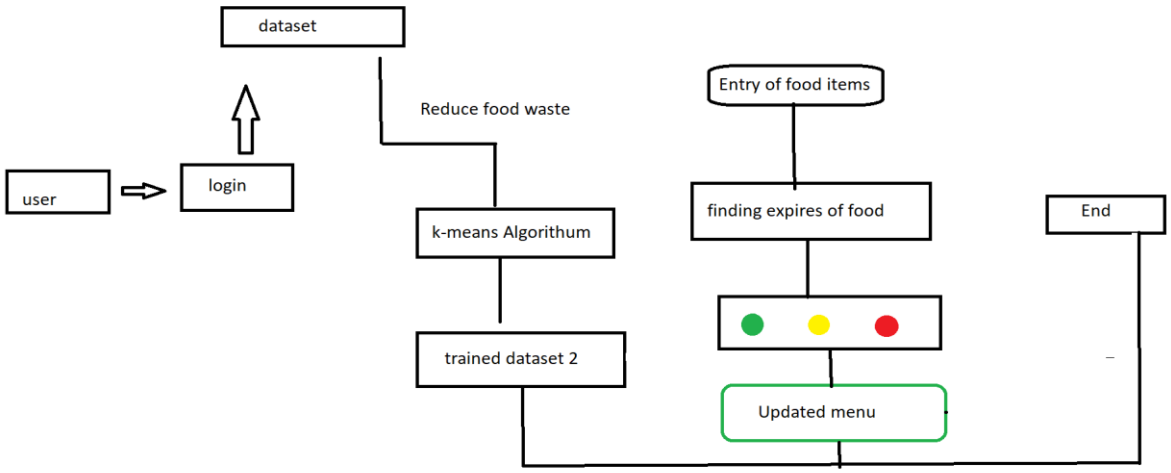

Figure 1. system architecture

Algorithms

Demand Forecasting

Time Series Algorithms: Time series forecasting (e.g., ARIMA, LSTM) to predict future sales based on past trends.

LSTM (Long Short-Term Memory): A type of recurrent neural network (RNN) effective for sequential data like time series sales data.

Inventory Optimization

Q-Learning: its help to decide how much of each ingredient to order, balancing the risk of running out with the goal of minimizing waste.

Menu Engineering:

K-Means Clustering: Clustering to group menu items by popularity or waste levels, helping identify which items to keep, modify or remove.

Waste Monitoring and Anomaly Detection

Isolation Forest: Effective in detecting anomalies

One-Class SVM (Support Vector Machine): Used for identifying data points that deviate significantly from the normal waste levels.

Seasonality and External Factors

Random Forest: Captures complex patterns and interactions between various features like day of the week, weather, and local events.

Gradient Boosting Machines (GBM): Efficient for capturing the impact of multiple external factors on demand.

Conclusion

In today's sustainability-focused market, machine learning is a critical tool for reducing food waste in restaurants. Restaurants may better align inventory with real-time needs and reduce wasteful preparation and spoiling by using analytics to estimate customer demand. It is possible to make well-informed decisions on portion sizes and menu adjustments, improving kitchen efficiency and cutting expenses, by analysing historical sales, seasonal trends, and customer behaviour.

Machine learning's true potential is in promoting long-term sustainability, which will help businesses remain profitable while meeting the growing demand for environmentally beneficial practices. Technology will play a bigger part in the food industry's transformation of waste reduction and resource management as it develops.

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