Reducing Food Waste in RestaurantsUsing 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 It then makes innovative new dish recommendations using components that are almost out of date based on this information.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.

Index Terms—Food waste, Wasteful behavior, Restaurant waste, Consumer waste, Restaurant management Out-of-home waste.

I. 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].

II. 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.

III. LITERATURE SURVEY

1. Vismaya TS*1, Shwethashri KS*2(2024). 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,[2][3]

2. In their 2023 publication, "Digital Solutions for Food Recovery and Redistribution: A Comprehensive Review," Anderson and Chabriainvestigate how technology might beused 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 as food banks and neighborhood associations—with excess food.[3][4][6]

3. According to the FAO's 2022 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.[4][5]

4. The article by Talati et al. (2022) 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.[5][6][7]

5. "Garrone, P., Melacini, M., Perego, A. , The role of food waste management in the food supply chain (2022)" This paper discusses the various stages of the food supply chain where waste occurs and emphasizes the importance of effective waste management practices to minimize food loss.[4][5]

6. "Kumar, P., Singh, D., Food waste generation in households: A review of the literature (2022)" This literature review examines the factors contributing to food waste in households, exploring behavioral, economic, and social aspects that influence waste generation and offering recommendations for reducing household food waste.[7][9]

IV. 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. We have implemented by two system:

1. Support Vector Machines (SVM) for Regression (SVR):

Uses support vectors to find a hyperplane that best represents the data.

2. Decision Trees (Regression Trees):

A tree-like model where decisions are made at each node based on input features.

Screenshot: 6.1. prediction of food waste
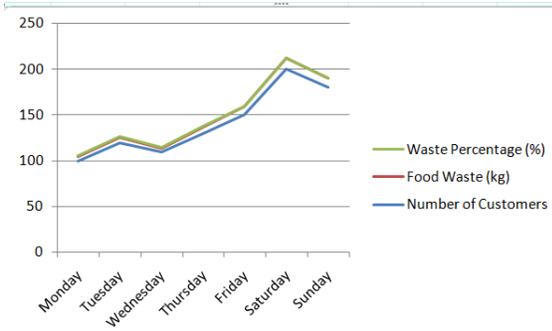
Results:

- Cost Savings: Up to 30% on food procurement.
- Environmental Impact: 100-200 kg CO_2 reduction per year with 10% less waste.
- Operational Efficiency: 15% less spoilage due to improved inventory.
- Customer Satisfaction: 80% prefer eco-friendly restaurants.

Parameters:

- Inventory Management: 10-25% reduction in waste via FIFO and demand forecasting.
- Portion Control: 30% less plate waste with smaller portions.
- Food Preparation: Proper storage and training cut waste by 5-10%.
- Waste Tracking: Automated systems reduce waste by 20-30%.

Accuracy:

- Software & Forecasting: 90-95% accuracy in waste tracking and demand prediction.
- Employee Training: Reduces food waste by 5-15% with correct portioning.
  - Waste Audits: 10-30% waste reduction from identifying key waste areas.

screenshot : 6.2. prediction result of days
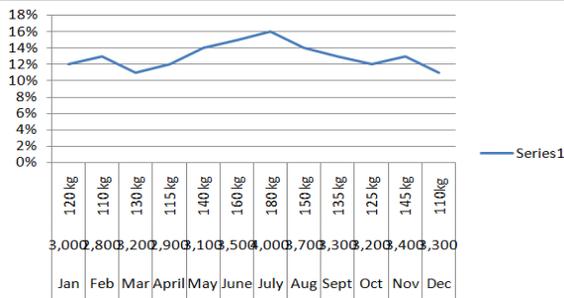


I.   Screenshot: 6.3. prediction results of months

V. PROPOSED SYSTEM

In this system architecture for reducing food waste in restaurants consists of several key components designed to enhance efficiency and sustainability. At the core is the User Interface (UI), which includes a web or mobile application for restaurant staff to input data, access analytics, and receive alerts, along with features that allow customersto provide feedback on portion sizes and food preferences.

1.   K-Nearest Neighbors (KNN) for Classification:
Predicts the class of a sample based on the majority class of its nearest neighbors.

2.   Random Forest (Classification):
An ensemble method combining multiple decision trees to improve prediction accuracy.
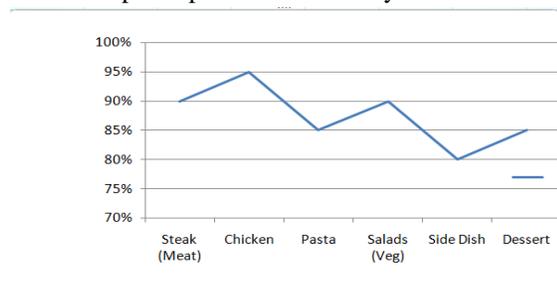
screenshot: 7.1 Dish Recommendation result
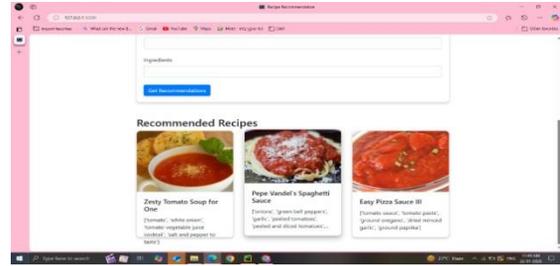
II.   Screenshot:7.2. final output of food recommendation

VI. 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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