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Reminding Food Expiry Dates and Sending Timely Alerts

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ABSTRACT

Product wastage due to expiration is a common issue and is evident in almost every household and we need to keep track of it. The aim of this research is to propose a system which reminds the food expiry date to prevent food wastage and to remind the frequently used items by the user. In this proposed system, users create profiles with purchased food items, it also involves time series forecasting model to send the reminders. Our system employs with machine learning algorithms like K-Nearest Neighbour, Naïve Bayes and Decision tree for classifying the personalized food items that are consumed before the food expiration and K-means clustering to group the frequently used items. This project keeps track of food expiration dates and sends an automatic notification to the user before the purchased food expires and also generates the frequently used items for future purchase.

Keywords: User profiles, Notification system, Timely alerts, Personalised food Classification, Clustering, Predictive analytics, Machine learning.

1. Introduction

In contemporary households, the issue of food wastage due to expiration is a pervasive concern, leading to both economic losses and environmental impact. The main feature of this system is to reduce the household food wastage. So a solution has been proposed to the people who are looking to avoid consequence of expired products which may cause food poisoning. The primary goal is to develop a user-centric system that not only tracks the expiration dates of purchased food items but also proactively reminds users in advance, thereby preventing unnecessary waste. It can also be useful at wholesale shops, grocery shops, bakeries etc as they purchase items on a heavy load. The goal of this project is to send timely alerts to the user before the item get expires and to recommend the future purchase list to the user. By observing the need for efficient systems to mitigate this problem, our research focuses on proposing a comprehensive solution that leverages advanced technologies. To enhance the accuracy and personalization of the system, machine learning algorithms such as K-Nearest Neighbour, Naïve Bayes, and Decision Tree are employed for classifying individualized food items that are likely to be consumed before reaching their expiration dates. Recognizing the importance of anticipating users' needs, the system incorporates K-means clustering to group frequently used items. This feature aims to streamline the user experience by providing timely notifications about replenishing commonly consumed items, thereby optimizing future purchases.

2. Literature Survey

[1] Food Waste and Expiration Management: Previous studies have highlighted the significant environmental and economic impact of food wastage due to expiration. Research in this area provides insights into the challenges associated with food expiration management and the need for effective solutions to mitigate wastage.

[2] Technological Solutions for Food Expiry Tracking: Several technological solutions have been proposed to address the issue of food expiration tracking, including mobile applications, smart devices, and IoT-enabled systems. Literature in this domain explores the effectiveness of various approaches in reducing food wastage and improving consumer awareness.

[3] Machine Learning Applications in Food Management: There is a growing body of research focusing on the application of machine learning algorithms in food management systems. Studies have investigated the use of algorithms such as K-Nearest Neighbours, Naive Bayes and Decision tree for classification and prediction tasks related to food expiration and consumption patterns.

[4] Time Series Forecasting Models: Time series forecasting models have been widely used in various domains, including inventory management and demand forecasting. Research in this area discusses the applicability of time series forecasting techniques in predicting food expiration dates and sending timely reminders to consumers.

[5] Personalized Recommendation Systems: Personalized recommendation systems plays a crucial role in enhancing user experience and engagement. Literature on personalized recommendation systems explores different approaches, including collaborative filtering, content-based filtering, and hybrid methods, and their application in recommending food items based on individual preferences and consumption patterns.

[6] Evaluation Metrics and User Studies: Evaluating the effectiveness of food expiry reminder systems requires the use of appropriate metrics and user studies. Previous research has proposed various evaluation metrics, such as food wastage reduction rate, user satisfaction, and system accuracy, and conducted user studies to assess the usability and acceptance of such systems.

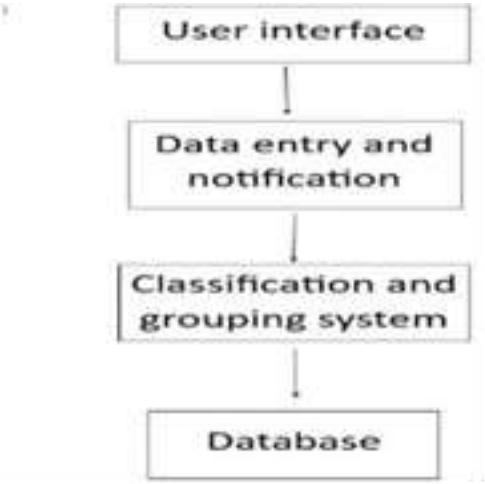
3.1 Existing System

The existing project is a android application named “Desired Before Expired.” This application is created for people who want s to get notified when the food item is ready to expire. The application contains expiring notifications, definition of an expirati on time to products and other features. We can save a significant amount of money if we use all products before their expiring dates which preven ts food wastage, and even we can donate it to food rescue organizations when we have excess food.

3.2 Proposed System:

The proposed system is a Grocery Item Management System aimed at assisting users in tracking their grocery purchases. It feat ures a notification system to alert users about items nearing expiry and utilizes machine learning algorithms (KNN, Naive Bayes, Decision Tree) to classify items into consumed and not consumed lists. The system provides accurate notifications and classifications, enhan cing user experience and ensuring efficient grocery management.

3.3 Work flow of proposed system:



3.4 Data set and preprocessing:

The dataset includes grocery item details such as item name, purchase date, expiry date, frequency count, and consumption status. It facilitates monitoring purchase patterns, expiration dates, and consumption behaviour within the system for effective management and notification purposes. This dataset is collected from Kaggle (www.kaggle.com).

3.5 K-Nearest Neighbor algorithm:

KNN is a supervised machine learning algorithm which is used for classification of food items. For classification, it assigns the class that occurs most frequently among the neighbors. KNN can be applied to find similar food items based on some related features. Using the scikit-learn library it implements the KNN classifier. The `KNearestNeighbors Classifier` class is instantiated, and the model is trained on the training data (`X_train` for features, `y_train` for labels). Predictions are then made on the same training data to evaluate the accuracy of the KNN classifier. The `accuracy_score` function is used to calculate the accuracy by comparing the predicted labels (`pred_knn`) with the actual labels from the training set (`y_train`). Additionally, a classification report is printed, displaying precision, recall, and F1-score metrics for each class. The accuracy and classification report are printed to provide a comprehensive summary of the KNN classifier's performance on the training data.

3.6 Decision Tree algorithm:

It is hierarchical structure that makes decisions by splitting the data based on features. It is capable of handling both numerical and categorical data. The decision tree can provide a clear decision-making process to users about the expired food, it may even decide to send an alert if a item has been stored for a long time without being consumed. Scikit-learn library is used to implement the Decision Tree classifier with the Gini impurity criterion. The model is then trained using the training data (X_train for features, y_train for labels). Subsequently, predictions are made on the test data (X_test), and the accuracy of the model is computed by comparing the predicted labels with the actual labels from the test set. This provides a clear summary of the Decision Tree model's performance on the given dataset.

3.7 Naïve Bayes algorithm:

Naive Bayes algorithm is a classification technique which is used for classifying the food items that are consumed before the expiry date. It assumes that the features follow a Gaussian distribution i. e normal distribution. This algorithm requires a small amount of training data and performs well on high-dimensional datasets. The Gaussian NB class is instantiated, and the model is trained on the training data. The predictions are then made on the same training data to evaluate the accuracy of the model, and the results are printed to the console. The accuracy is calculated using the accuracy_score function, comparing the predicted labels (pred_nb) with the actual labels from the training set (y_train).

3.8 K-means clustering:

K-means is a unsupervised machine learning algorithm used for partitioning into subgroups or clusters. The goal of K-means is to group similar data points together and assign them to clusters based on their feature similarity. The number of clusters must be specified before running the algorithm. The clustering process help to organize and categorize items, making it easier to provide timely and relevant reminders to users

4. Results and Discussions

KNN:

4.1.1 METRIC RESULTS:

Metric	Class 1	Class 2	Class 3	Class 4	Class 5	Overall
Accuracy	-	-	-	-	-	99.73%
Precision	0.99	0.99	1	1	1	1.00 (weighted avg)
Recall	1	0.98	0.99	1	1	1.00 (weighted avg)
F1-Score	0.99	0.99	0.99	1	1	1.00 (weighted avg)
Support	96298	46871	62736	156292	424235	786432

Decision Tree:

4.1.2 METRIC RESULTS:

Metric	Class 1	Class 2	Class 3	Class 4	Class 5	Overall
Accuracy	-	-	-	-	-	93.98%
Precision	1	0	0.57	1	1	0.91 (weighted avg)

Recall	1	0	1	1	1	0.94 (weighted avg)
F1-Score	1	0	0.72	1	1	0.92 (weighted avg)
Support	31953	15773	20773	52243	141402	262144

Naive Bayes:

4.1.3 METRIC RESULTS:

Metric	Class 1	Class 2	Class 3	Class 4	Class 5	Overall
Accuracy	-	-	-	-	-	53.94%
Precision	0	0	0	0	0.54	0.29 (weighted avg)
Recall	0	0	0	0	1	0.54 (weighted avg)
F1-Score	0	0	0	0	0.7	0.38 (weighted avg)
Support	96298	46871	62736	156292	424235	786432

5. Conclusion

In conclusion, the system offers a comprehensive solution for users to track and manage their grocery purchases effectively. The proposed system has the potential to be an effective tool in reducing household food waste. By integrating features such as notification alerts for items nearing expiry date the system aims to encourage timely consumption and prevent food from expiring before it can be used. By utilizing the machine learning algorithms (K-Nearest Neighbor, Naïve Bayes, Decision tree) for classification, it enhances the user experiences, promotes the efficient food usage and suggestions for frequently used items.Additionally, the use of K-means clustering to identify frequently used items can streamline shopping habits and minimize the purchase of items that may ultimately go to waste. This integrated approach aims to enhance awareness and efficiency in managing household food resources, ultimately contributing to a reduction in unnecessary waste and improved sustainability. The project demonstrates the feasibility and benefits of employing technology to streamline everyday tasks, ultimately contributing to improved organization and decision-making in grocery shopping.

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