

# **EatTrackUKM - Application of Web Technology in Campus Restaurant Food Tracking System**

WUWENPO

ASSOC. PROF. DR. ZALINDA OTHMA

*Fakulti Teknologi & Sains Maklumat, Universiti Kebangsaan Malaysia, 43600 UKM Bangi,  
Selangor Darul Ehsan, Malaysia*

## **ABSTRACT**

This project aims to develop a "EatTrackUKM-Campus Restaurant Food Tracking System" for a specific restaurant at Universiti Kebangsaan Malaysia (UKM) to address the growing need for transparency in meal origins, composition, and safety. Leveraging a cloud-based database, the system will generate personalized meal recommendations for customers and provide nutrition and ingredient traceability information. For restaurant staff/managers, it offers convenient management tools. The project will enhance food supply chain transparency, strengthen food safety measures, protect consumer rights, and improve restaurant operations on the UKM campus.

## **INTRODUCTION**

In an era marked by globalization and escalating food safety concerns, the demand for robust food traceability systems is growing. This is particularly relevant to the campus restaurants of Universiti Kebangsaan Malaysia, where issues related to the opacity of food ingredients and

their sources have been identified as a significant problem. The Campus Food Tracking System was born to solve these problems and provide a comprehensive solution that benefits both diners and restaurant operators.

The proposed system integrates detailed dish information, open ingredient tracking, and strict authenticity supervision, allowing diners to make informed decisions based on their dietary needs and preferences. Through the provision of a traceability log for main ingredients, transparency is enhanced by including data such as the country of origin, descriptions of the ingredients, and their validity period.

Additionally, the system offers personalized recommendations to help users identify their preferences and make informed choices. To further support restaurant operators, it includes convenient tools that simplify the usage of the system, making it easier to manage and maintain.

Moreover, the system incorporates measures for authenticity supervision by enabling customers to view real pictures associated with each ingredient's tracking information. This feature ensures that restaurants cannot upload false data, thereby establishing a robust monitoring mechanism. By leveraging software technology, this food tracking system aims to enhance the dining experience on campus, build trust and satisfaction among customers, uphold food safety standards in campus restaurants, and ultimately improve restaurant operations.

## **RESEARCH METHODOLOGY**

In the "EatTrackUKM" project, we adopted the waterfall model to systematically address development phases, ensuring each stage was meticulously planned and executed. Our goals were refined through thorough research, leading to a user-friendly prototype. The sequential approach allowed for comprehensive testing and validation at each stage, ensuring a robust system ready for market deployment.

# Waterfall model

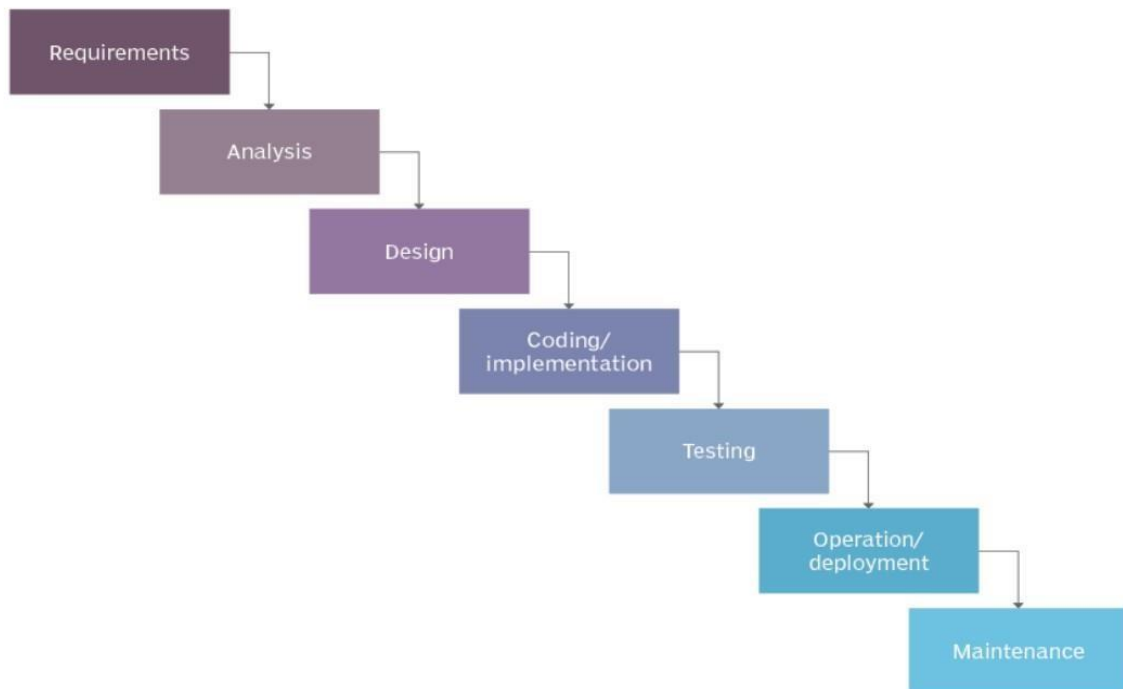


Figure 1 Waterfall Model Diagram

## Clear Stage Division

One of the primary benefits of the waterfall model is its clear division of stages. Each development phase has a distinct start and end point, ensuring that all necessary tasks for each stage are completed before moving on to the next. This approach helps avoid overlapping tasks, reducing confusion and errors.

## Rigorous Planning and Time Management

The waterfall model requires detailed planning at the project's outset. This comprehensive planning includes not only each stage of the project but also the allocation of time and resources. This method ensures predictability in project progress, allowing for systematic advancement according to a predetermined schedule.

## Phased Testing and Validation

The waterfall model allows for thorough testing and validation at the end of each stage. This ensures that each functional module works correctly before proceeding to the next development phase, reducing the likelihood of integration issues. By conducting phased testing, problems can be identified and resolved early, enhancing the system's stability and reliability.

### **Clear Documentation**

Documentation is a crucial component of the waterfall model. Each stage's output requires detailed documentation, which not only helps in better understanding the project's progress but also provides valuable references for future maintenance and upgrades. This clear documentation improves the project's maintainability and portability.

### **Comprehensive Understanding of User Requirements**

The waterfall model emphasizes detailed analysis and understanding of user requirements at the project's outset. Through thorough requirement analysis, the developed system can truly meet user needs. In the "EatTrackUKM" project, through extensive research and user surveys, I was able to design a user-friendly prototype and make adjustments throughout the development process to align with user requirements.

In conclusion, adopting the waterfall model enabled me to systematically and effectively develop the "EatTrackUKM" project, ensuring that each phase's tasks were thoroughly considered and executed, ultimately delivering a high-quality and reliable system.

## **RESULTS AND DISCUSSION**

The development of a campus restaurant food tracking system (EatTrackUKM) for campus restaurant customers and operators has been successfully completed, with all documentation finalized. During the development process, EatTrackUKM was created using the PHP front-end framework, its scripting language JavaScript, and the styling language CSS. The MySQL database was utilized to ensure data integrity and reliability, adhering to the MVC design

architecture. Python Flask was used to create all backend services for the system, including but not limited to personalized recommendation features, auto-highlight map functionality, and ingredient calorie lookup features.

Providing detailed dish information, including ingredients and sources, allows diners to make informed choices based on their dietary needs and preferences. Personalized menu recommendations help customers quickly find dishes they enjoy, reducing decision fatigue. Tracking the sources of main ingredients ensures freshness and quality, boosting customer confidence in food safety. Transparent ingredient information and traceability increase customer trust and satisfaction, leading to higher retention rates and positive word-of-mouth. Personalized recommendations reduce menu overwhelm, making the dining experience more enjoyable and efficient. A management data dashboard helps collect and analyze customer preferences, allowing timely adjustments to menus and procurement strategies. Efficient feedback mechanisms enable restaurants to respond quickly to customer needs, improving satisfaction. Simplified system usability through a simple user interface and convenient tools, such as auto-generated origin country images and one-click calorie lookup, makes system functions easy to use for managers and staff, reducing the learning curve and improving overall efficiency.

After entering the EatTrackUKM system, you will first see the homepage including promotional images and personalized recommendation functions. The user is not logged in here, so this function cannot be used.

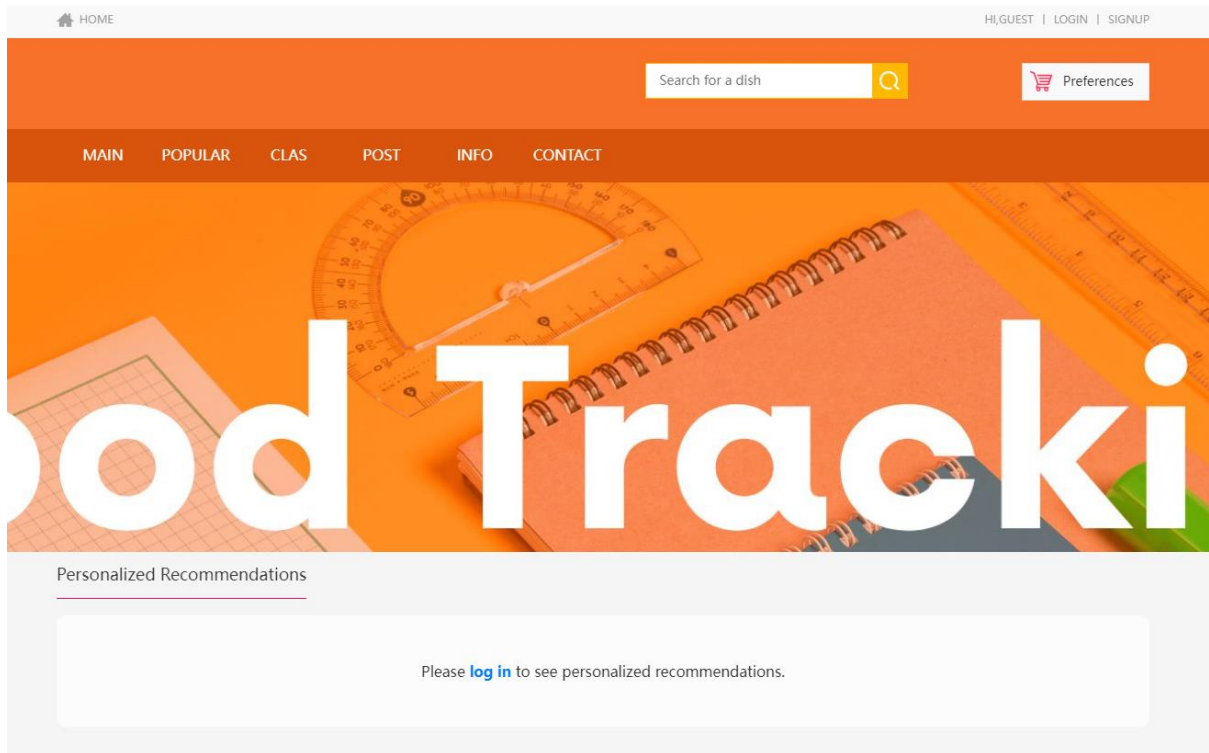


Figure 2 Homepage 1

In Figure 2, users can see all the dish data managed by the restaurant.

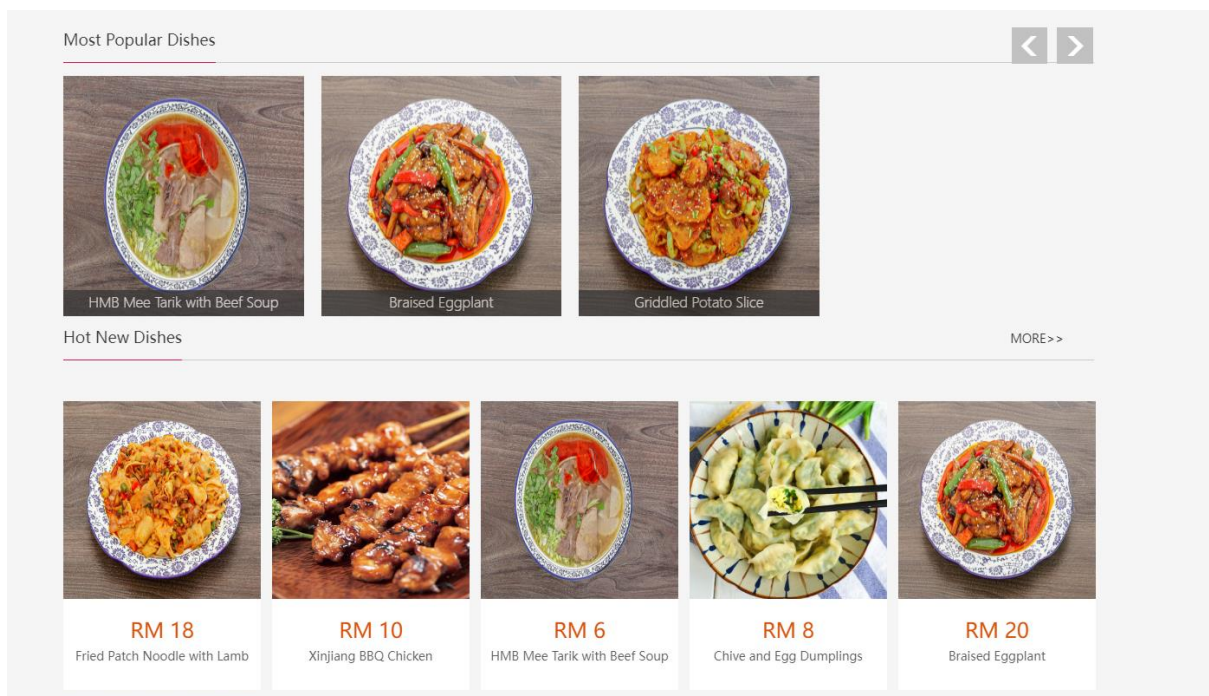


Figure 3 Homepage 2

In Figure 3, users can see the category search labels and search bar for all dishes. Users can also manually search for dishes based on keywords.

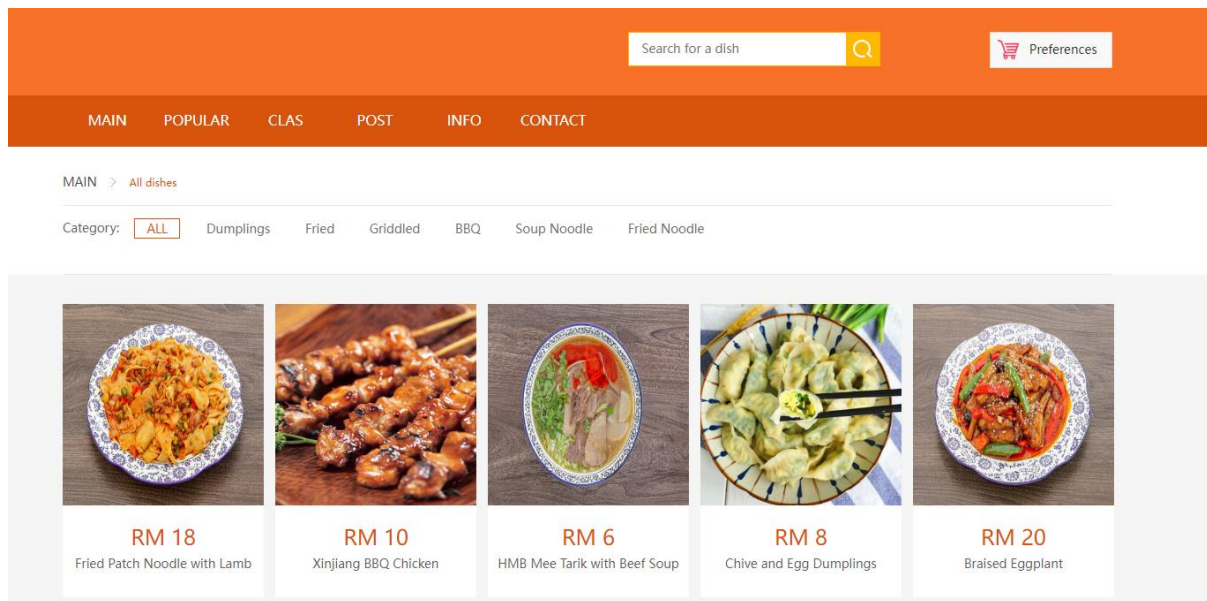


Figure 4 Food classification and search

In Figure 5, users can see the announcements posted by the restaurant and can also view the announcement categories.

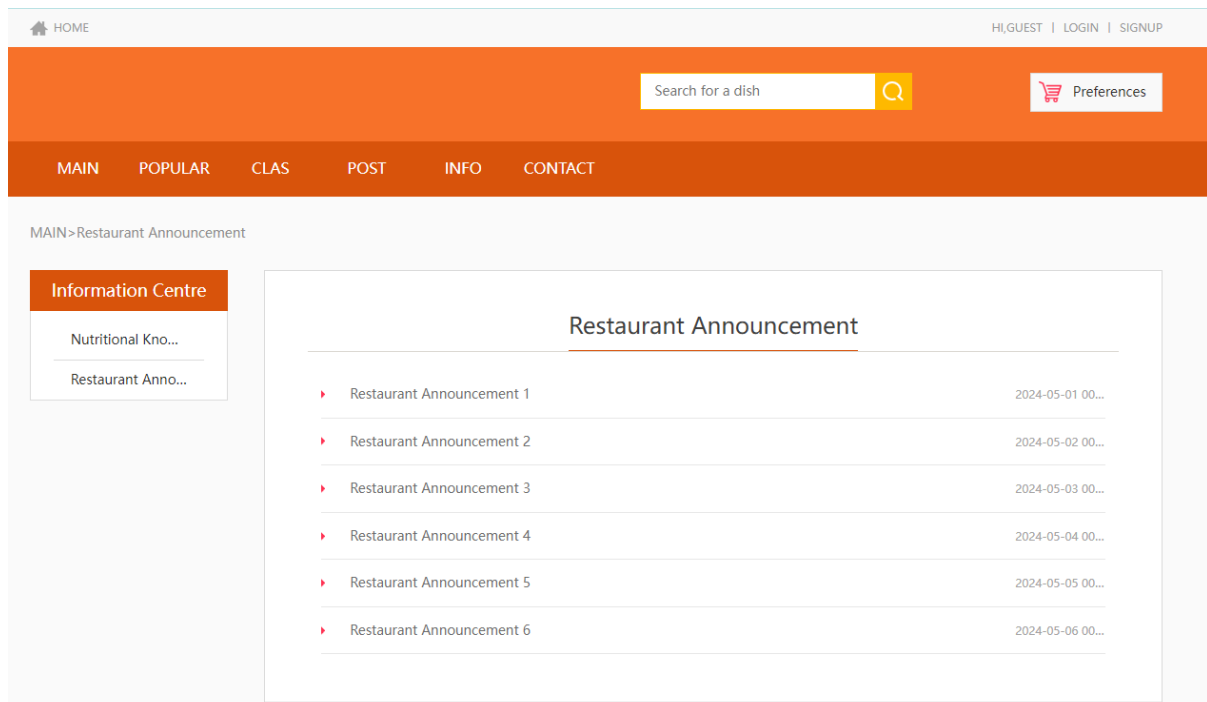
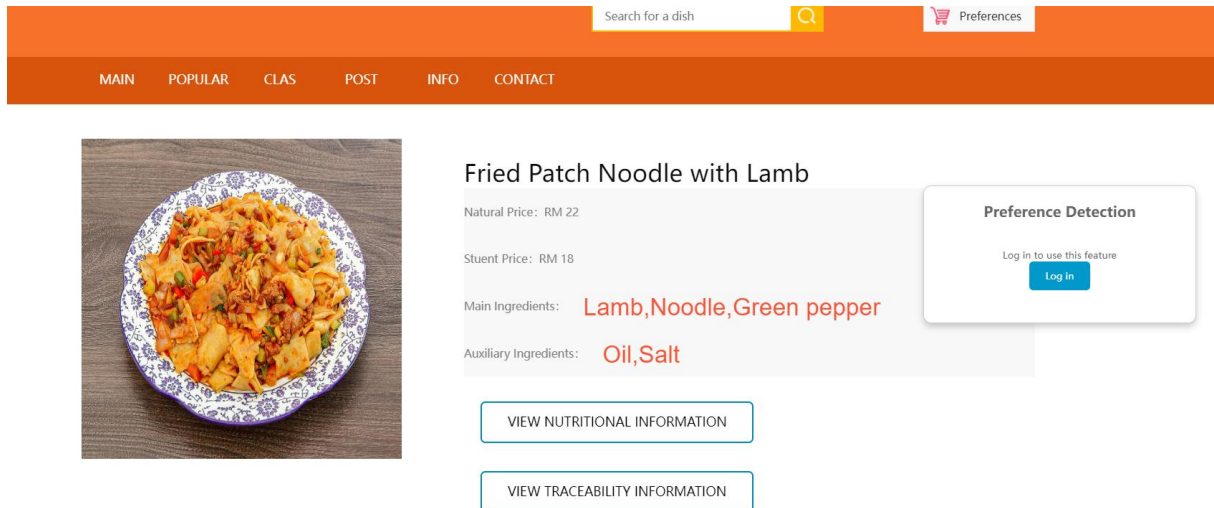


Figure 5 Restaurant Announcements and Classifieds

Click on any dish and the dish details will be displayed, as shown in Figure 6. You can see the dish price, ingredients and other data, as well as two buttons. The preference detection area is temporarily unavailable because the user has not logged in and generated recommendation data.



The screenshot shows a web interface for a dish. At the top, there is an orange navigation bar with a search bar labeled 'Search for a dish', a magnifying glass icon, and a 'Preferences' link with a shopping cart icon. Below the navigation bar, there are menu items: MAIN, POPULAR, CLAS, POST, INFO, and CONTACT. The main content area features a photograph of a plate of 'Fried Patch Noodle with Lamb'. To the right of the image, the dish name is displayed in bold. Below the name, the 'Natural Price' is listed as RM 22 and the 'Stuent Price' as RM 18. The 'Main Ingredients' are listed as 'Lamb, Noodle, Green pepper' and the 'Auxiliary Ingredients' as 'Oil, Salt'. There are two buttons: 'VIEW NUTRITIONAL INFORMATION' and 'VIEW TRACEABILITY INFORMATION'. A 'Preference Detection' box is present, containing the text 'Log in to use this feature' and a 'Log in' button.

Figure 6 - Dish details page

Click the View Nutritional Information button, as shown in Figure 7, which has three sections: Calorie Calculator, Calorie Information for this Dish, and Nutrition and Energy Tips.



## Calorie Calculator ×

Male  
 Female

Height (cm):

Weight (kg):

Age (years):

**Calculate**

### Nutritional Information

Beef (50g) -- 145.00 kcal  
Noodle (300g) -- 414.00 kcal  
Total Calories: 559.00 kcal

### Nutrition and Energy Tips

Generally speaking, adults need at least 1,500 calories a day to maintain body functions, because even if you lie still, your body still needs energy to maintain body temperature, cardiopulmonary function, and brain function. Basal metabolic consumption varies depending on individual height, weight, age, and gender.

Figure 7 View Nutrition Information Page

After the user enters their information in the calorie calculator section and clicks the Calculate button, as shown in Figure 8, the system calculates the user's daily calorie information based on the international calorie standard, and also makes corresponding changes based on the user's input in the Nutrition and Energy Tips.

## Calorie Calculator ✕

Male  
 Female

Height (cm):

Weight (kg):

Age (years):

**Calculate**

Your daily calorie needs: 1917 kcal

### Nutritional Information

Beef (50g) -- 145.00 kcal  
Noodle (300g) -- 414.00 kcal  
Total Calories: 559.00 kcal

### Nutrition and Energy Tips

You are 22 years old, male, 181 cm, and 80 kg. According to the system calculation, you need 1917 kcal per day, and the total calories of this meal are 559 kcal. After eating this meal, you need to consume at least 1358 kcal today. Please keep exercising to achieve the best physical condition.

Figure 8 View Nutritional Information Page (Enter Information)

When the user clicks the View Traceability Log button on the dish details page, as shown in Figure 9, a selection box pops up, prompting the user to select an ingredient to track its information.

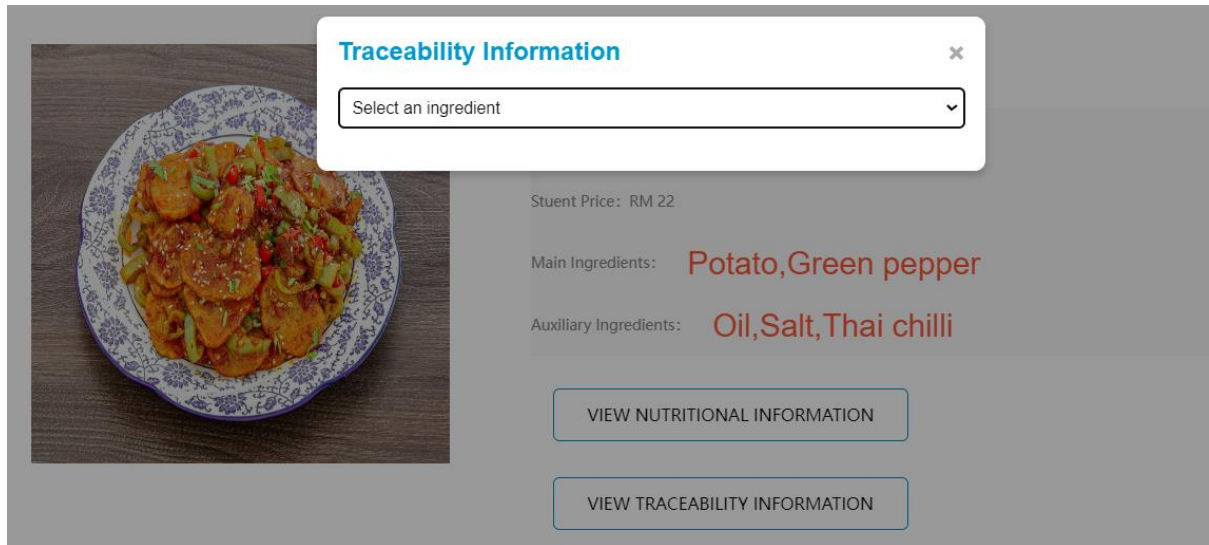


Figure 9 Trace log selection box

When the user selects an ingredient, as shown in Figure 10, information such as the country of origin and description of the ingredient selected by the user will be displayed.

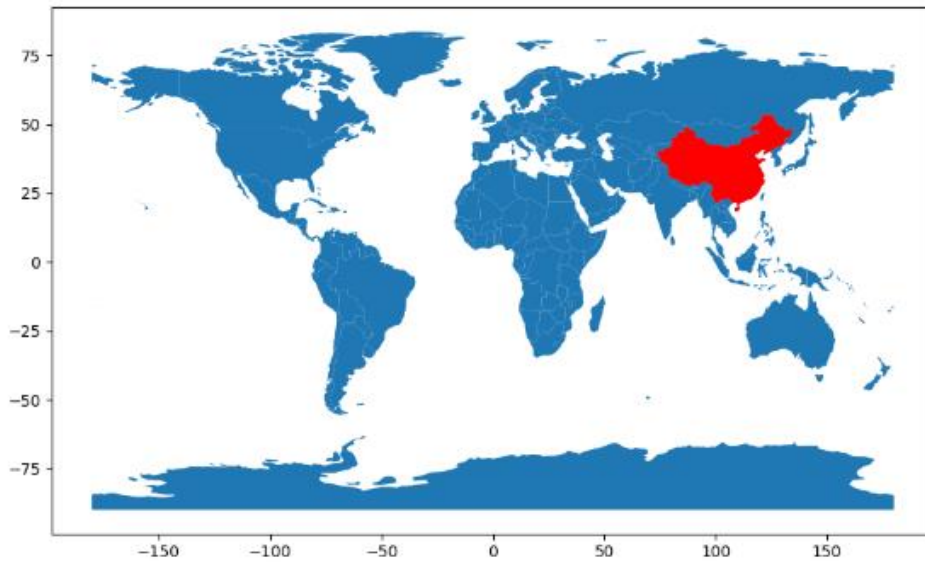
## Traceability Information



Rice



Rice



**Country of Origin:** China

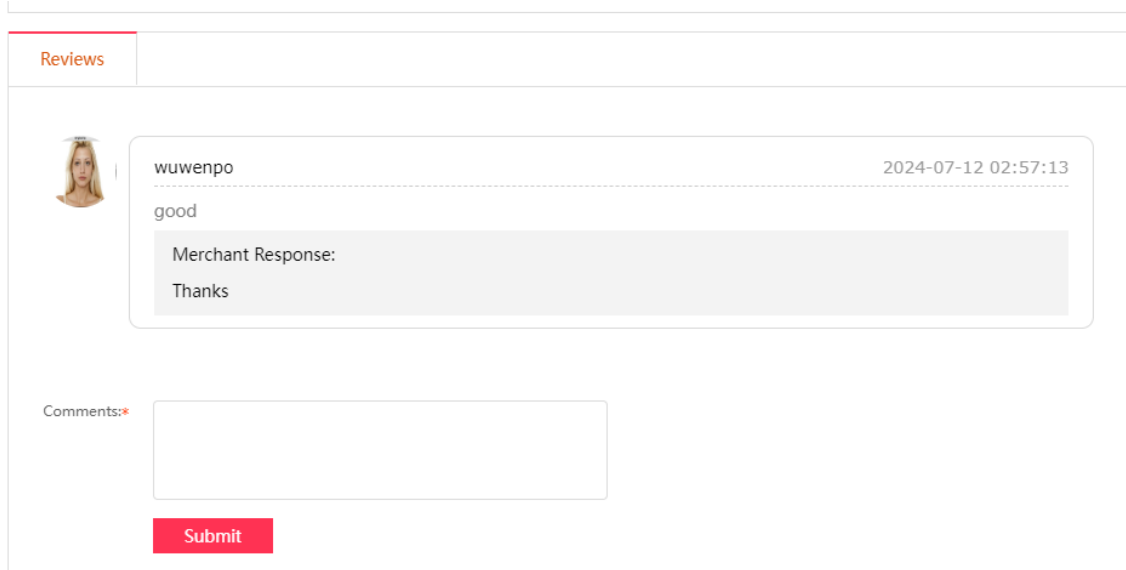
**Product Name:** Fragrant rice from Northeast China

**Validity:** Validity

**Description:** Sweet, rich in protein and vitamins

Figure 10 Trace log display

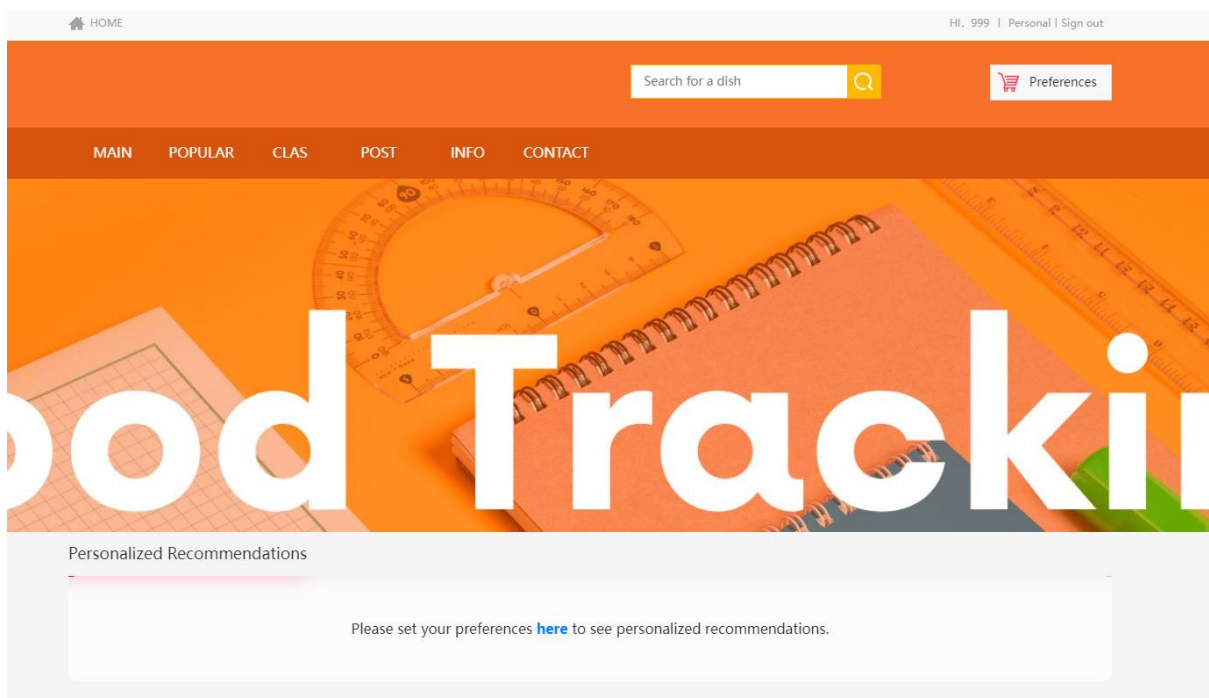
When the user scrolls down to the comments on the dish details page, as shown in Figure 11, comments from other users and the manager's response will be displayed.



The screenshot shows a 'Reviews' section. At the top left, there is a 'Reviews' tab. Below it, a user profile picture is shown next to the name 'wuwenpo' and the timestamp '2024-07-12 02:57:13'. The user's comment is 'good'. Below the comment, a 'Merchant Response' box contains the text 'Thanks'. At the bottom, there is a 'Comments:\*' label, a text input field, and a red 'Submit' button.

Figure 11 Comments display

After the user registers and logs in, as shown in Figure 12, the personalized recommendation area prompts that food preferences need to be set first, and we click it.



The screenshot shows the home page of the 'Food Trackin'' website. The top navigation bar includes 'HOME', 'Hi, 999 | Personal | Sign out', a search bar with 'Search for a dish' and a magnifying glass icon, and a 'Preferences' button with a shopping cart icon. Below the navigation bar, there are menu items: 'MAIN', 'POPULAR', 'CLAS', 'POST', 'INFO', and 'CONTACT'. The main content area features a large orange banner with the text 'Food Trackin'' overlaid on a background of school supplies like a ruler, a protractor, and a spiral notebook. Below the banner, there is a section titled 'Personalized Recommendations' with a white box containing the text: 'Please set your preferences [here](#) to see personalized recommendations.'

Figure 12 Personalized recommended area prompts after registering an account

As mentioned in Figure 11, when the user clicks Set Preferences, as shown in Figure 12, the user needs to fill in all the information and confirm it.

HOME Hi, 999 | Personal | Sign out

Search for a dish

MAIN POPULAR CLAS POST INFO CONTACT

**System Hint**

The system will make recommendations and alerts based on the customer's selected preferences or alert ingredients to optimize the customer's dining experience.

**Choose your preferred ingredients**

Preferred staple food:

Preferred meat:

Preferred vegetables:

Other preferences:

**Choose ingredients you don't like or are allergic to**

Dislikes/Allergies:

Figure 13 Set food preferences for new accounts.

**Confirm your preferences**

Please confirm the following information. If there is any error, please return to modify it.

**Choose your preferred ingredients**

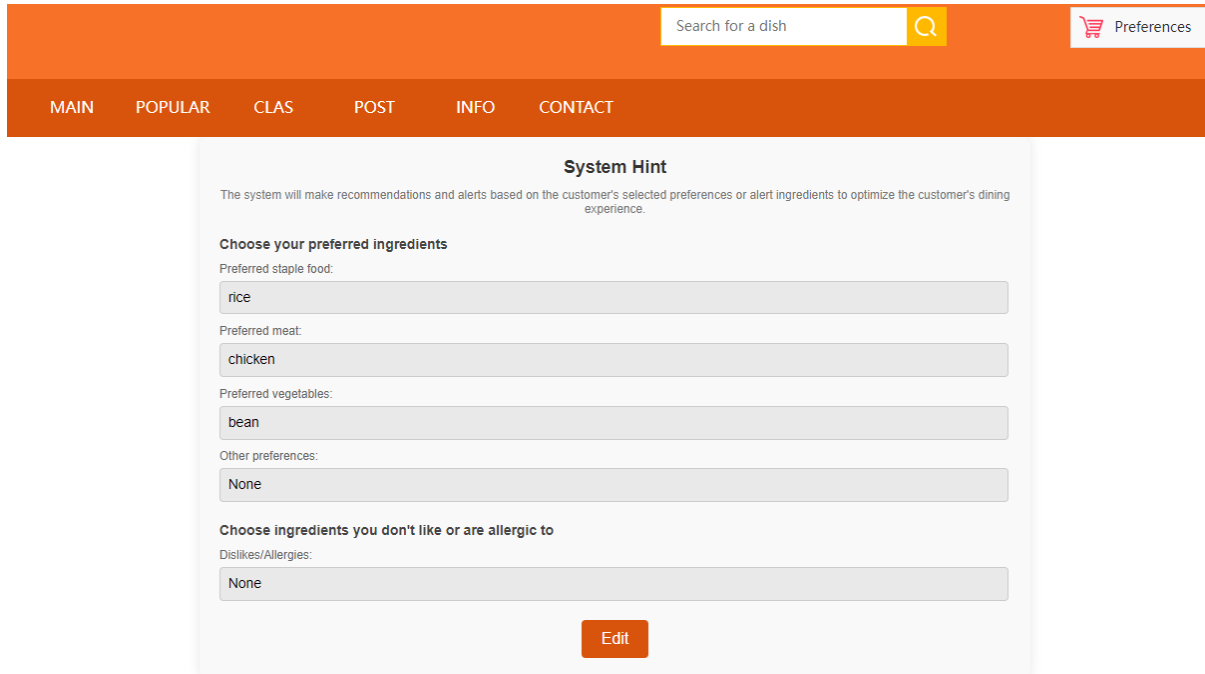
Preferred staple food: rice  
 Preferred meat: chicken  
 Preferred vegetables: bean  
 Other preferences: None

**Choose ingredients you don't like or are allergic to**

Dislikes/Allergies: None

Figure 14 Food Preference Confirmation Form

After the user completes the operations in Figure 13 and Figure 13 , when the user clicks Set Preference, as shown in Figure 15 , the food preference has been confirmed and recorded, and the user can modify it again.



The screenshot shows a web interface with an orange header. The header contains a search bar with the text "Search for a dish" and a magnifying glass icon, and a "Preferences" link with a shopping cart icon. Below the header is a navigation menu with links: MAIN, POPULAR, CLAS, POST, INFO, CONTACT. The main content area is titled "System Hint" and contains the following text: "The system will make recommendations and alerts based on the customer's selected preferences or alert ingredients to optimize the customer's dining experience." Below this is a section titled "Choose your preferred ingredients" with four input fields: "Preferred staple food:" (value: rice), "Preferred meat:" (value: chicken), "Preferred vegetables:" (value: bean), and "Other preferences:" (value: None). Below this is a section titled "Choose ingredients you don't like or are allergic to" with one input field: "Dislikes/Allergies:" (value: None). At the bottom of the form is an "Edit" button.

Figure 15 Food preference form set up

When the user returns to the home page, they can see the display shown in Figure 16. The user is prompted to click a button to generate a recommendation.

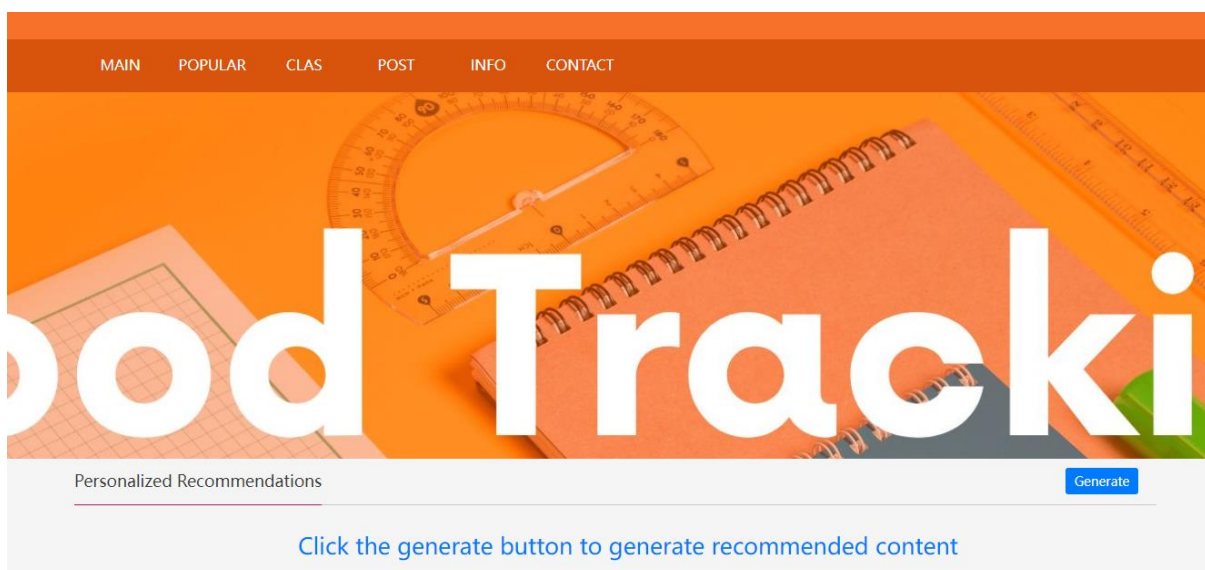


Figure 16 Prompt users to generate recommendations

When the user completes the generation operation in Figure 16, wait a few seconds and you can view the generated food recommendations, which are predictions made by the AI model running on the server backend based on the set food preferences. At the same time, the user can also click the Regenerate button to regenerate the results.

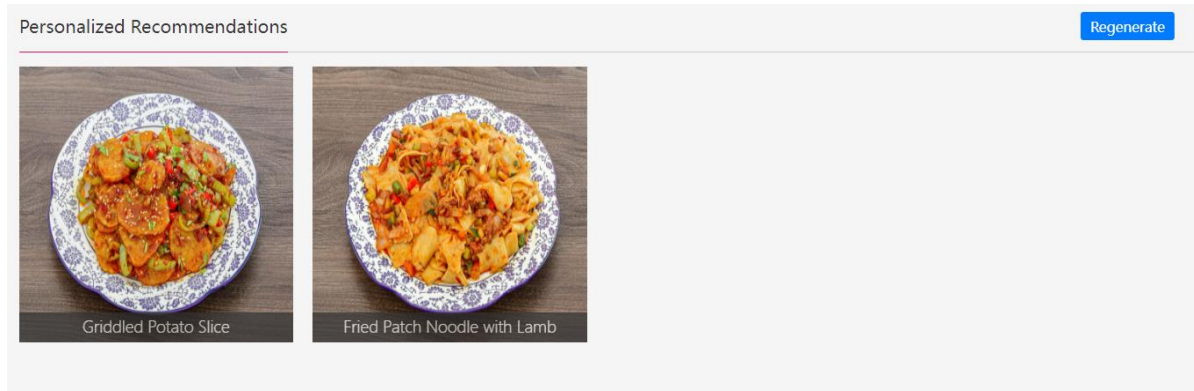


Figure 17 Personalized recommendation display after generation

After the user generates a recommendation, he clicks on any dish, as shown in Figure 18. Preference detection is already available, and prompts the user whether he may like this dish to help the user make a judgment.

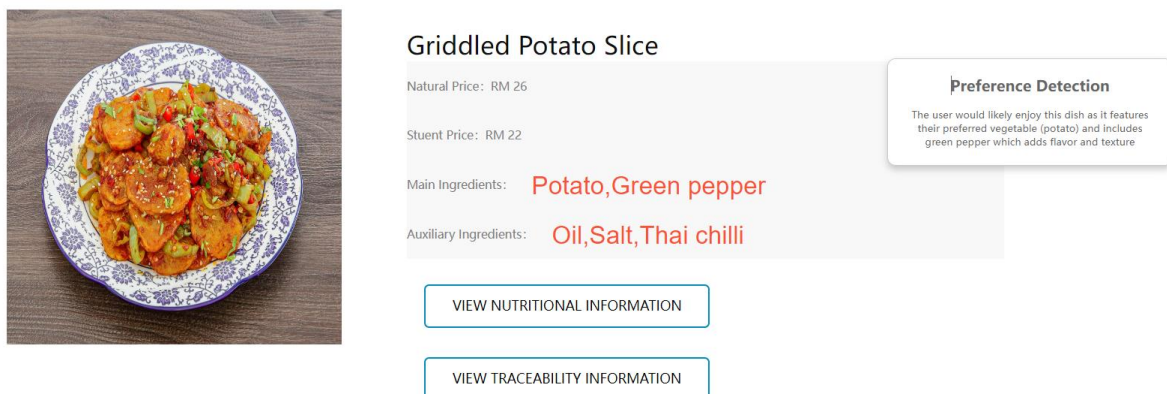


Figure 18 Generated dish preference detection



The administrator can log in to the management page using the correct account and password. After logging in, the display shown in Figure 19 is displayed.



Figure 19 Administrator Interface Home Page

The administrator clicks Dashboard under the System Settings column to display Figure 20. This dashboard clearly and intuitively displays the analysis of some key data.

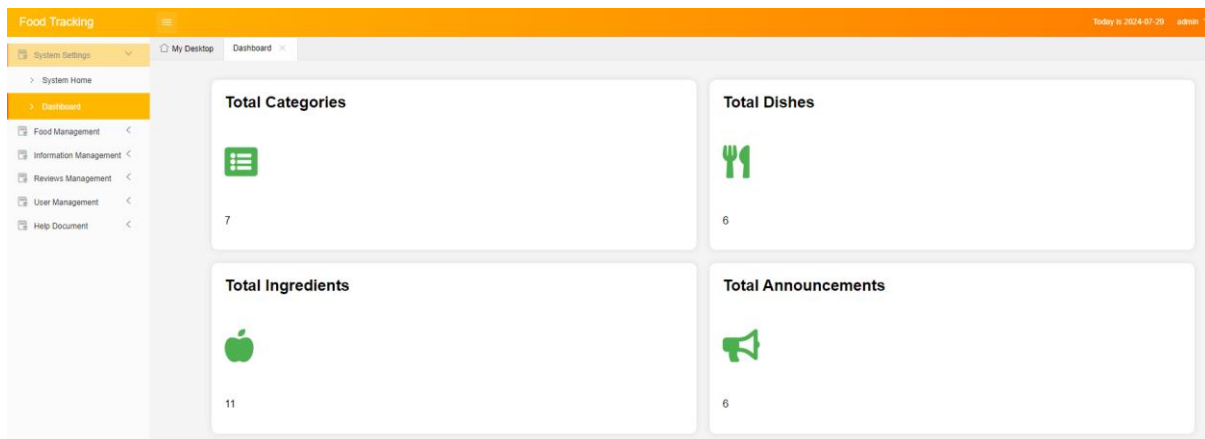
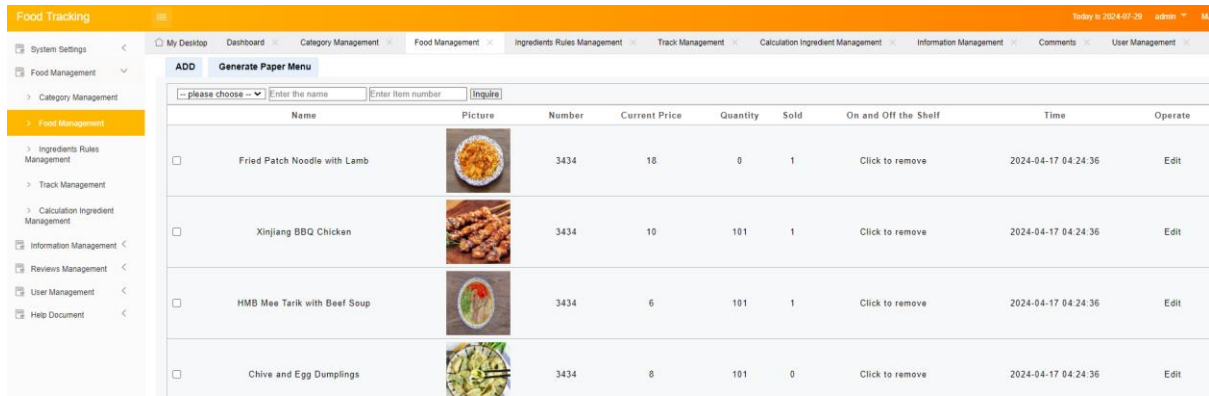


Figure 20 Administrator dashboard page

When the administrator clicks Food Management under the Food Management column, Figure 21 is displayed. This page provides functions such as menu management and can generate paper menus.







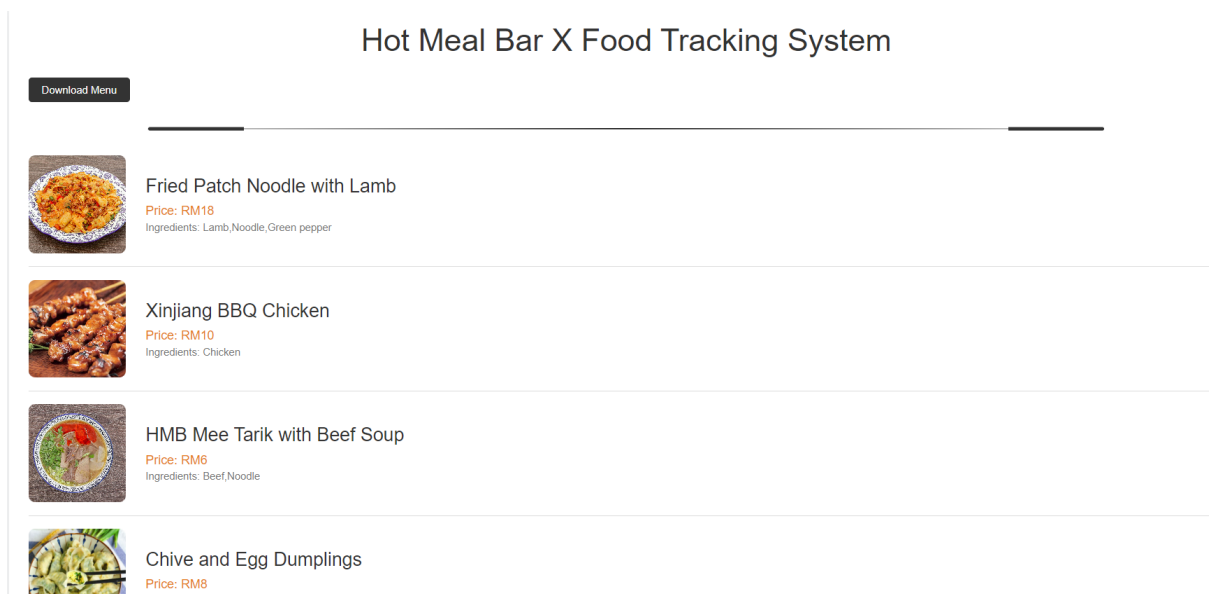
	Name	Picture	Number	Current Price	Quantity	Sold	On and Off the Shelf	Time	Operate
<input type="checkbox"/>	Fried Patch Noodle with Lamb		3434	18	0	1	Click to remove	2024-04-17 04:24:36	Edit
<input type="checkbox"/>	Xinjiang BBQ Chicken		3434	10	101	1	Click to remove	2024-04-17 04:24:36	Edit
<input type="checkbox"/>	HMB Mee Tarik with Beef Soup		3434	6	101	1	Click to remove	2024-04-17 04:24:36	Edit
<input type="checkbox"/>	Chive and Egg Dumplings		3434	8	101	0	Click to remove	2024-04-17 04:24:36	Edit

Figure 21 Admin Food Management Page


As shown in Figure 21, when the administrator clicks on the "Generate Paper Menu" button, the system will automatically generate a paper menu based on the dish information in the database and make it printable.




### Hot Meal Bar X Food Tracking System

[Download Menu](#)


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**Fried Patch Noodle with Lamb**  
Price: RM18  
Ingredients: Lamb, Noodle, Green pepper



**Xinjiang BBQ Chicken**  
Price: RM10  
Ingredients: Chicken



**HMB Mee Tarik with Beef Soup**  
Price: RM6  
Ingredients: Beef, Noodle



**Chive and Egg Dumplings**  
Price: RM8

Figure 22 Paper menu generation page

Click Ingredients Rule Management under the Food Management column, as shown in Figure 23, and the administrator can manage the ingredient calorie calculation rules. Several convenient functions are provided here: 1. Check Match: You can check the missing ingredient rules. 2. Query: You can query the calories of the ingredients with one click (here,

the flask application running on the backend server links to the third-party API to achieve this).

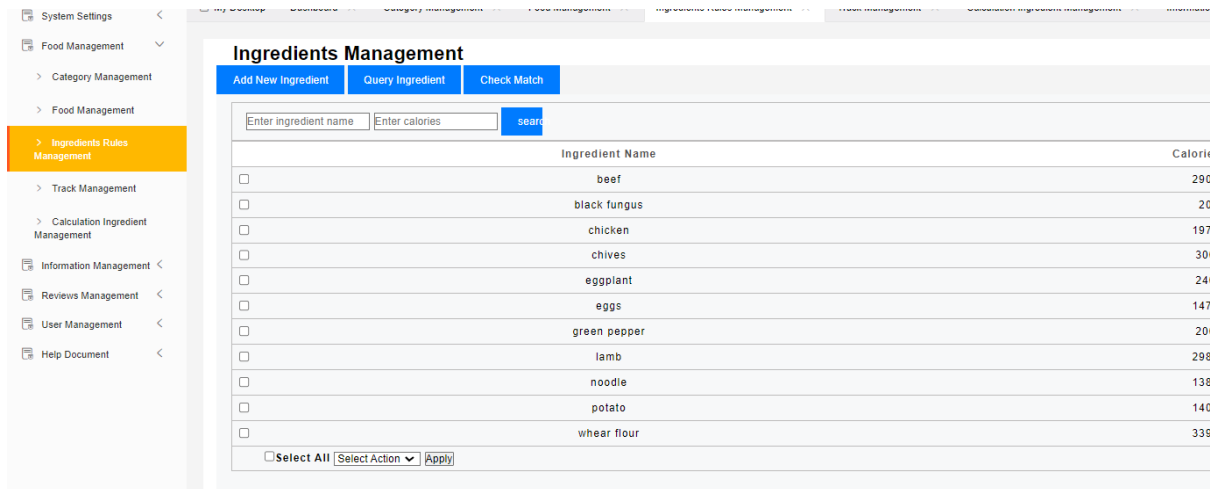


Figure 23 Administrator ingredient management interface

The administrator clicks the help document, as shown in Figure 24, and the administrator can easily see which button belongs to which function.

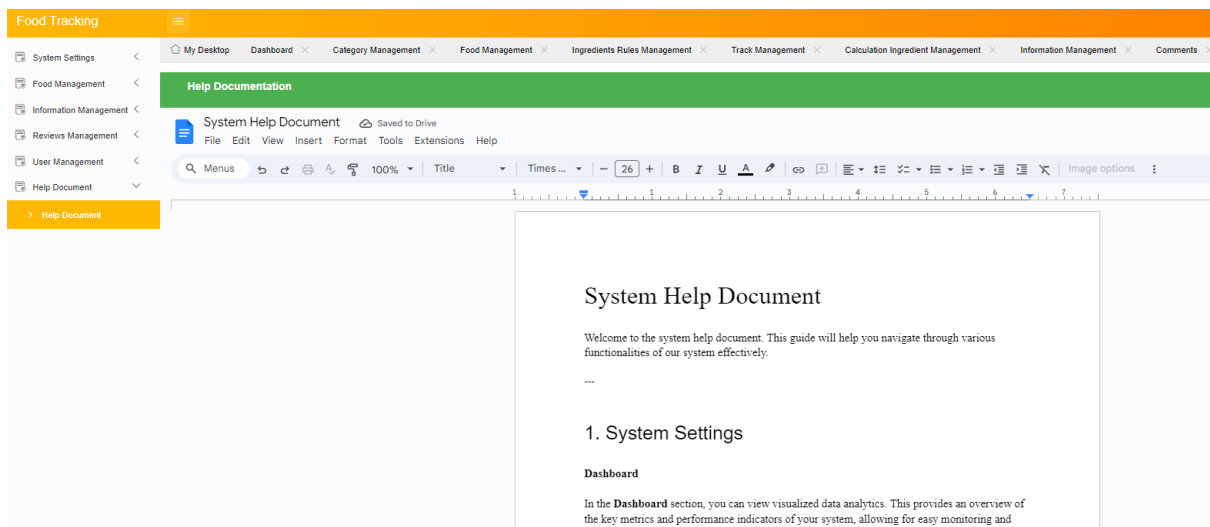


Figure 24 help document

## Usability Testing

This usability testing report outlines the evaluation of various features of a web application designed for user interaction, including registration, login, logout, and other user-specific functionalities. The primary objective of this testing is to ensure that the application meets its intended usability standards and provides a seamless user experience.

The main goal of this usability testing is to verify that each feature functions as expected from a user's perspective, ensuring ease of use, efficiency, and satisfaction.

Usability testing was conducted by a group of testers who simulated real-world usage scenarios. Each test case was executed according to predefined steps, and testers recorded their findings and any issues encountered. The effectiveness of each feature was evaluated based on success rate, error rate, and user satisfaction.

Test Case ID	Test Case Description	Objective	Result	Score	Comments
TC-001-001	User Registration (Customer)	Verify that a user can successfully register.	Passed	95/100	Registration process is streamlined and user-friendly.
TC-002-001	User Login (Customer)	Verify that the user can successfully log in as a customer.	Passed	92/100	Login is efficient; minor delays noted in loading user profile.
TC-002-002	User Login (Administrator)	Verify that the user can successfully log in as an administrator.	Passed	90/100	Admin login functional with all privileges accessible.

<b>Test Case ID</b>	<b>Test Case Description</b>	<b>Objective</b>	<b>Result</b>	<b>Score</b>	<b>Comments</b>
TC-003-001	User Logout	Verify that a user can successfully log out.	Passed	98/100	Logout process is quick and confirms user has exited securely.
TC-004-001	Modify Personal Information	Verify that a user can successfully modify personal information.	Passed	93/100	Modification options are clear but could include more detailed instructions.
TC-005-001	Search and Filter Menu	Verify that a user can successfully search and filter menu.	Passed	89/100	Effective search functionality; filters need more intuitive labels.
TC-006-001	View Menu Details	Verify that a user can successfully view menu details.	Passed	94/100	Detailed information available; images load slowly on slower connections.
TC-007-001	Nutritional Information & Calorie Calc	Verify viewing nutritional info and perform calorie calculations.	Passed	91/100	Nutritional information is accurate; calculator could be more prominent.

Test Case ID	Test Case Description	Objective	Result	Score	Comments
TC-008-001	Main Ingredient Traceability Info	Verify selecting/viewing main ingredient traceability information.	Passed	88/100	Traceability data comprehensive; interface could be simplified.
TC-009-001	View And Publish Dish Reviews	Verify that a user can view and publish dish reviews.	Passed	85/100	Review system works well; some users reported occasional lags.
TC-010-001	Set Food Preferences	Verify that users can set and view food preferences.	Passed	87/100	Preferences are easy to set; more customization options suggested.
TC-011-001	Generate Personalized Recommendations	Verify users can generate/view personalized recommendations.	Passed	90/100	Recommendations are relevant; algorithm delay affects immediacy.

Table 1 Usability Testing

The usability testing has demonstrated that the application performs well across most tested features with minor areas for improvement. Continuous enhancements based on user feedback will further refine the experience, ensuring higher satisfaction and usability scores in future assessments.

## **Suggestions for improvement**

Suggested improvements to strengthen the system in the future:

- i. Enhanced security protocols: Implement stronger encryption and security audits to protect user data.
- ii. Improve third-party integration: Ensure smoother integration with payment gateways and other services to enhance user experience.

## **CONCLUSION**

This section discusses the overall conclusions of the development process of the campus restaurant food tracking system "EatTrackUKM". The project was designed to enhance the dining experience of customers in campus restaurants and restaurant managers' perception of customer feedback, providing traceable staple food ingredient information and transparent food ingredient and nutritional information. Key requirements and key information were identified before the development process to ensure that the project could be successfully executed and meet user needs.

## **Strengths of System**

The developed system has several recognized advantages that enhance functionality and user experience:

- i. User-friendly interface: The platform is easy to navigate and can be used by customers of all ages, whether they are customers, restaurant staff or managers.
- ii. Personalized dish recommendations based on personal food preferences: This feature allows customers to upload their own food preferences and the system generates personalized recipe recommendations.
- iii. Traceable ingredient log: This feature allows customers to view the ingredient traceability log of each dish uploaded by the restaurant manager , which covers the specific information of the ingredients and the country of origin.

- iv. Automated highlight map system: This feature automatically matches the highlighted country of origin map when the restaurant manager or employee uploads the country of origin, which is more professional and efficient , while reducing the workload of restaurant managers and employees.

### **Limitations of System**

The system also has some limitations during development:

- i. Security challenges: The handling of sensitive user data requires stronger security measures to ensure privacy and trust.
- ii. Integration with third-party services: Third-party integrations occasionally have problems, which may affect overall system performance.

### **ACKNOWLEDGEMENTS**

The author of this study would like to express the highest appreciation and a million thanks to Assoc. Prof. Dr. Zalinda Othman, the supervisor of this study, who has provided guidance and support in completing this project successfully.

I would also like to extend gratitude to all parties who have assisted directly or indirectly in completing this project. All the help extended is greatly appreciated, as without their assistance, this project could not have been carried out effectively. May God bless and reward them abundantly.



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