International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 8 Issue 6, Nov-Dec 2024 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Design, Implementation, and Benefit Analysis of the Intelligent Online Canteen Ordering Platform

Li Si Yang, Sun Zhichao, Niu Zhenyu

Beijing Wuzi University, Beijing, China

ABSTRACT

With the acceleration of digital transformation, the campus catering field has welcomed new opportunities for intelligent upgrades. This project, addressing issues such as long queue times and low service efficiency in current campus canteens, has designed and implemented an intelligent online canteen ordering platform based on the Python language. The platform not only effectively alleviates the queuing phenomenon in canteens but also enhances service efficiency and customer satisfaction, bringing significant economic and social benefits.

KEYWORDS: *Intelligence; Online canteen; Ordering platform; Python; Benefit analysis*

***How to cite this paper**:* Li Si Yang | Sun Zhichao | Niu Zhenyu "Design, Implementation, and Benefit Analysis of the Intelligent Online Canteen Ordering Platform" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-8 | Issue-6, December 2024, pp.668-672, URL: www.ijtsrd.com/papers/ijtsrd71617.pdf

IJTSRD71617

I. INTRODUCTION

In the current digital era, online ordering has become an essential part of daily life. However, for campus canteens, traditional ordering methods still present many inconveniences, such as long queue times and low service efficiency. These problems not only affect students' dining experiences but also restrict the improvement of canteen service quality. Therefore, developing an intelligent online canteen ordering platform is particularly important.

This project aims to innovate technically, combining big data technology, to design and implement an online ordering mini-program based on Python to optimize the dining process in canteens and enhance the comfort and convenience of the dining environment. Additionally, the project will explore how to address potential issues with online ordering, such as stacking orders, to ensure the smooth operation of the online ordering system.

II. Project Background and Industry Analysis

Against the backdrop of digital transformation, campuses, as nurseries for future talents, are actively embracing change. Currently, the problem of student dining queues is becoming increasingly prominent, affecting not only the dining experience but also constraining the improvement of canteen service efficiency. Inspired by the online food delivery model, this project has decided to develop an online ordering mini-program. Students can order online in advance, and the canteen can prepare meals based on order information, achieving a dining model of "come and take, eat and go."

III. System Design

3.1. Data Model Design

To clearly depict user data, this project has designed an Entity-Relationship (E-R) diagram as the data model. The model includes six entities: manager, chef, waiter, cashier, food, and seat, as well as their relationships and attributes. For example, the manager is responsible for managing food preparation, cashier operations, and staff; the chef is responsible for preparing food; the waiter is responsible for displaying the menu, taking orders, and submitting them; the cashier is responsible for querying consumption and checking out; and the seat is associated with the order information.

3.2. Functional Model Design

The functional model describes in detail the user requirements that the software system must fulfill. In this project, we carefully designed a data flow diagram to visually represent the entire process of data flow and change within the ordering system. This data flow diagram starts with the waiter successfully logging into the system and details the entire ordering process: after logging in, the system displays the menu for customers to choose from; after browsing the menu, customers place their orders; once the order is placed, the waiter submits it; the order information is then passed to the chef who begins preparing the dishes according to the order; once the dishes are prepared, the cashier receives the information and queries the customer's consumption, finally performing the checkout operation. The entire data flow diagram clearly shows the complete process from waiter login to checkout, ensuring that the data flow and change at each stage are accurately represented.

3.3. Hierarchical Structure Design

The hierarchical structure diagram of the ordering system shows the calling relationships between various modules. The ordering system designed in this project first calls the login module, and then, depending on the logged-in user, calls different functional modules such as the manager module, ordering module, preparation module, and cashier module.

3.4. Program Flowchart Design

The program flowchart details the specific implementation steps of the ordering system. In this system, the designed ordering program flowchart covers multiple key stages, including user login verification, operation guidance for the ordering interface, order submission, real-time display of the preparation process, and the checkout 环节等. Through the detailed guidance of these flowcharts, the entire system can achieve comprehensive management and control of the ordering process, ensuring that each step proceeds smoothly, thereby improving ordering efficiency and user experience.

3.5. Database Design

Database design aims to provide an information infrastructure and efficient operating environment for users and various application systems. The ordering system database designed for this project includes six tables: manager, waiter, chef, cashier, food, and seat. Each table contains corresponding fields and attributes to support the normal operation of the ordering system.

In the database design, particular attention was paid to data consistency and integrity. By reasonably setting primary keys, foreign keys, and constraints, the accuracy and reliability of the data were ensured. Additionally, to improve the efficiency of database queries, index optimization design was also carried out.

IV. System Implementation

This project was developed using the Flask framework and SQLite database technology under the Python environment, achieving an intelligent online canteen ordering platform. The following is a description of the implementation of the system's main functions:

```
from flask import Flask, request, jsonify
from flask_sqlalchemy import SQLAlchemy
app = Flask(__name__)
app.config['SQLALCHEMY_DATABASE_URI'] =
'sqlite:///marketplace.db'
db = SQLAlchemy(app)
#Business Model
class Restaurant(db.Model):
id = db.Column(db.Integer, primary_key=True)
name = db.Column(db.String(80), nullable=False)
menu = db.relationship('MenuItem', backref='restaurant', lazy=True)
def __repr__(self):
return f'<Restaurant {self.name}>' class MenuItem(db.Model):
id = db.Column(db.Integer, primary_key=True)
name = db.Column(db.String(80), nullable=False)
price = db.Column(db.Float, nullable=False)
restaurant_id = db.Column(db.Integer, db.ForeignKey('restaurant.id'), nullable=False)
def __repr__(self):
return f'<MenuItem {self.name}>'
db.create_all()
@app.route('/restaurants', methods=['POST'])
def add_restaurant():
data = request.get_json()
new_restaurant = Restaurant(name=data['name'])
db.session.add(new_restaurant)
db.session.commit()
return jsonify({'message': 'Restaurant created successfully.'}), 201
```

Get all merchants

```
@app.route('/restaurants', methods=['GET'])
def get_restaurants():
restaurants = Restaurant.query.all()
output = []
for restaurant in restaurants:
restaurant_data = {'id': restaurant.id, 'name':
restaurant.name}
output.append(restaurant_data)
return jsonify({'restaurants': output})
# 添加菜单项
@app.route('/restaurants/<int:restaurant_id>/menu', methods=['POST'])
def add_menu_item(restaurant_id):
data = request.get_json()
new_menu_item = MenuItem(name=data['name'], price=data['price'], restaurant_id=restaurant_id)
db.session.add(new_menu_item)
db.session.commit()
return jsonify({'message': 'Menu item created successfully.'}), 201
@app.route('/restaurants/<int:restaurant_id>/menu', methods=['GET'])
def get_menu(restaurant_id):
menu_items =
MenuItem.query.filter_by(restaurant_id=restaurant_id).all() output = []
for item in menu_items:
item_data = {'id': item.id, 'name': item.name, 'price':
item.price}
output.append(item_data)
return jsonify({'menu': output})
if __name__ == '__main__':
app.run(debug=True)
```

This simple ordering platform utilizes the Flask framework and SQLAlchemy ORM. It defines two models: Restaurant and MenuItem. Via a RESTful API, it allows for adding restaurants, retrieving a list of restaurants, adding menu items, and obtaining the menu for a specific restaurant. This example uses a SQLite database, which is suitable for rapid prototyping. In a production environment, you would likely need a more robust database system such as PostgreSQL or MySQL, and you would need to add features like user authentication, order processing, and payment integration.

4.1. Implementing Login Functionality

The system first implements a login feature where users must enter the correct username and password to access the system. Upon successful login, depending on the user's role, the system will display different functional interfaces.

4.2. Implementing the Ordering Functionality

Once the waitstaff successfully logs into the system, they will be directed to the main interface of the ordering system. In this interface, customers can choose to enter their table number and the number of people dining. After filling in this information, customers can place their orders themselves or with the assistance and guidance of the waitstaff. The ordering interface is designed to be intuitive and user-friendly, displaying basic information about the various foods offered by the restaurant, including dish names, prices, ingredients, and images. Additionally, the ordering interface will display the dishes that customers have selected in real-time, allowing them to easily view and modify their orders. Customers can carefully browse through the dish information, select their favorite dishes, and add them to their shopping cart. The entire ordering process is convenient and fast, ensuring that customers can easily place their orders and enjoy a pleasant dining experience.

4.3. Implementing the Production Management Functionality

The production management functionality is primarily for the convenience of the chefs' operations and management. Once chefs successfully log into the system, they will be able to enter a dedicated production management interface. On this interface, chefs can view all the food information from customer orders in real-time. Whenever a new order is submitted, the corresponding food information will immediately appear on the chef's production management interface, ensuring that chefs can stay up-to-date with the latest orders.

Through this production management interface, chefs can efficiently manage the production of dishes based on the detailed information in the orders. They can view the specific requirements of each order, such as special preparation methods and ingredient needs, to ensure that each dish is prepared accurately according to customer requests. Moreover, the production management interface can help chefs better arrange the production sequence, optimize workflow, and improve overall production efficiency and customer satisfaction.

4.4. Implementing the Cashier Functionality

The cashier functionality is an important service used by cashiers when dining customers need to check out. When customers have finished dining and are ready to leave, the cashier only needs to know the table number used by the customers during their meal to quickly retrieve the detailed consumption information. This consumption information includes the dishes, drinks, and any other items consumed by the customers, ensuring that the cashier can accurately perform the checkout operation.

During the checkout service, the cashier will calculate the total amount due based on the customer's consumption information. To better meet the payment needs of different customers, the cashier interface is designed to be very flexible, supporting various payment methods. Common payment methods include cash, credit or debit card payments, mobile payments such as Alipay and WeChat Pay, and some restaurants may also support other emerging payment methods such as e-wallets and membership card payments. By providing multiple payment options, the cashier functionality ensures that customers can choose the payment method that best suits them during checkout, thereby enhancing the customer's payment experience and satisfaction.

4.5. Implementing the Manager Functionality

Once the manager successfully logs into the system, they will have three main management functions: employee management, revenue inquiry, and dish management. In the employee management interface, the manager can view detailed information about all registered employees, including but not limited to the employee's name, employee number, position, and contact information. In addition, the manager can perform data 增删改查 (CRUD) operations on employee data to better manage employee information.

The revenue inquiry function provides the manager with flexible data analysis tools. The manager can choose to query sales data for each dish on a daily, monthly, or annual basis. This allows the manager to easily understand which dishes are most popular during specific time periods and the details of the total sales. These data help the manager perform sales analysis and develop corresponding marketing strategies.

In the dish management interface, the manager can make targeted adjustments and optimizations to the dishes. This includes but is not limited to adding new dishes, modifying the recipes or prices of existing dishes, and deleting dishes that are no longer popular. By doing so, the manager can ensure the variety and freshness of the dishes, meeting customers' daily needs and increasing the competitiveness of the restaurant. In summary, these three management functions provide the manager with comprehensive management tools to better operate the restaurant.

V. Benefit Analysis

5.1. Economic Benefits

The successful implementation of this project has brought significant economic benefits to the cafeteria, which are reflected in several aspects. First, by introducing online ordering and reservation pickup functions, the cafeteria has significantly reduced labor and time costs. This innovative measure not only improves the operational efficiency of the cafeteria but also provides a more convenient dining experience for customers. Second, the introduction of an intelligent ordering system has further improved service quality and attracted more customer traffic and revenue. The intelligent system not only reduces queuing time but also increases customer satisfaction through precise dish recommendations. Finally, through data analysis and management optimization, the cafeteria can more accurately grasp customer needs and market trends. This enables the cafeteria to develop more effective sales strategies and dish combinations, better meeting market demands and increasing overall revenue. In summary, the successful implementation of this project has brought all-around economic benefits to the cafeteria, enhancing operational efficiency and service quality, and laying a solid foundation for the cafeteria's long-term development.

5.2. Social Benefits

In addition to economic benefits, this project has also brought significant social benefits. First, the intelligent online cafeteria ordering platform not only enhances the convenience and comfort of campus life but also provides students and staff with a more efficient and convenient dining experience. With this platform, users can order food anytime and anywhere without the need to queue, saving a significant amount of time and effort. Furthermore, the intelligent ordering system can provide personalized recommendations based on users' dietary preferences and historical orders, further enhancing the dining experience.

Second, by optimizing the cafeteria's dining process and service quality, this project helps promote the healthy development of campus dining culture. The introduction of the intelligent ordering system enables the cafeteria to arrange dish supply and inventory management more scientifically, reducing waste and improving ingredient utilization. At the same time, the cafeteria can adjust dishes and services based on user feedback and evaluations, continuously improving service quality and creating a more harmonious dining environment.

Finally, the promotion and application of the intelligent ordering system can also promote the in-depth practice of campus digital transformation, providing useful references and insights for the intelligent transformation of other fields. With this system, campus management departments can monitor the cafeteria's operations in real-time, promptly identify and resolve issues. In addition, the intelligent ordering system can be integrated with other campus information systems to achieve data sharing and collaborative work, further enhancing campus management efficiency and standards.

In summary, the implementation of this project has not only brought economic benefits but, more importantly, has played a positive role in improving the quality of campus life, promoting the development of dining culture, and advancing campus digital transformation, holding profound social significance.

VI. Conclusion and Outlook

In this project, we carefully designed and successfully implemented an intelligent online cafeteria ordering platform based on the Python language. The launch of this platform effectively alleviated the long-standing queue problem in the cafeteria, significantly improved service efficiency, and greatly enhanced customer satisfaction. Through detailed analysis of project requirements, careful planning of system design, and detailed descriptions of the implementation process, along with in-depth analysis of project benefits, we can clearly see that the successful implementation of this project has brought significant economic and social benefits to the cafeteria.

Specifically, the platform has reduced the time customers spend waiting in line at the cafeteria through an intelligent ordering process, making the ordering process more convenient and efficient. At the same time, the efficiency of cafeteria staff has also been improved because they can process orders and prepare dishes more quickly. In addition, the platform provides a variety of payment methods, further enhancing the customer's ordering experience.

Looking to the future, we will continue to optimize and improve the ordering system, enrich its functionality, and enhance its performance to meet the needs of more users. We will focus on improving the user experience, adding more personalized options and intelligent recommendation features to make the ordering process more humanized and intelligent. Furthermore, we will actively explore the application and promotion of the intelligent ordering system in other fields, such as corporate cafeterias, school dining halls, hospital catering, etc., injecting new momentum into digital transformation. Through continuous technological innovation and market expansion, we believe that the intelligent ordering system will play a more significant role in the future, providing more users with a convenient and efficient ordering experience.

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