Restaurant management database system design and implement

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Abstract. At present, the growth rate of the information age, various industries have begun to integrate with the Internet, the catering industry is no exception. This article is based on the current information age of restaurant management problems, for the current existence of restaurant management efficiency and personnel management and other research. The current manual management will still appear many drawbacks, such as difficult statistics. This paper through demand analysis, draw ER diagram after analyzing the relationship model using Mysql to build a restaurant project database, with convenient query turnover, understand the functions of best-selling products, employee information and other functions. Test whether the function of the system is normal through several common daily needs, and check whether it can pass the system analysis through some daily actual data. The test shows that the restaurant management database not only solves the needs of the daily operation of the business, but also provides the ability to analyze data.

Keywords: restaurant management, database, data analysis, ER diagram.

1. Introduction

At present, the level of network technology is improving day by day, and people have entered the information age. Nowadays, many traditional commerce, entertainment and other industries have gradually joined the team of electronic information technology with the influence of the continuous development of the network. At the same time, with the popularization of computers and mobilephones, the continuous development of computer technology and the huge growth of the amount of various information, the traditional restaurant manage by human has been overwhelmed, it is necessary to find a new management model to adapt to needs. At present, there are still a few restaurants in the catering industry that use information management systems to assist in operation, and most restaurants are still in the stage of manpower to deal with restaurant affairs. It is difficult for operators to quickly and accurately obtain information such as turnover, labor costs, and sales volume. The use of management systems to obtain information more efficiently is the future. Therefore, the market for promoting information management systems in the catering industry is very wide. The fierce competition in the catering market will require the catering enterprises to continuously refine the management technology, accumulate the brand value, integrate the resources, and expand the financing channels [1]. So use an restaurant management system is necessary.

The traditional management may cause many problems like calculate wrong, write wrong item, can't find which waiter manage which table and some special ask may not being solve. When customer ask for bills, is not easy to find what item that customer ordered. So use the restaurant manage system to manage the restaurant is necessary. The system has good generality that can be used in most restaurants.

Design an accurate and efficient restaurant information management solution for the traditional catering industry. The general catering platform can only achieve restaurant consumption [2]. This system can improve the efficiency and quality of food and beverage services and reduce operations Cost, save human resources, but also facilitate the daily management of the restaurant.

2. Requirements analysis

2.1. Daily operation
The daily operation needs are mainly to record customer reservations, information records of arriving guests, order management of guests, payment information viewing, as well as store status observation and staff information. These needs associate with the create table and insert message in database, is the basic but important part [3].

2.2. Detail of dishes
The details of the dishes are mainly related to the order and the staff, and it is necessary to record the production materials, unit price, and production personnel of different meals, and it is necessary to classify different meals and assign them to the corresponding production chef, so that the division of labor can be clear, and customers who come to the store can easily choose the dishes they order. These requirements are mainly the connection between tables in the database, and the need to set primary and foreign keys to help data calls between tables is an important part of making the database complete.

2.3. Data analyze
After a day, month, quarter or even a year of operation, it is necessary to count the turnover of the restaurant, etc., and find out the better dishes sold in the restaurant to recommend guests, or find out the right meals to promote consumption when there are fewer customers. These requirements require the use of SQL statements for data analysis, and SQL statements to query and calculate the required data, so that operators can better understand the operation of the restaurant and formulate countermeasures. Queries require data support, so the usual maintenance of the database is essential.

3. Database design

3.1. Conceptual structural design
Conceptual structure design is the process of abstracting the analyzed requirements into a conceptual model, that is, on the basis of requirements analysis, a model that can meet the needs of users and the interrelationships between them is designed. The conceptual model can reflect the requirements of the system well, which is easy for people to understand, and can also be well changed. The conceptual model is mainly described by ER diagrams, according to this system can create the complete ER diagram for entire restaurant manage (Figure 1) [4][5].

Figure 1. Restaurant ER diagram.

3.2. Logical structure design

Logical structure design is the second stage of database design, which needs to be based on the above conceptual database design and ER diagram, the conceptual structure is transformed, and the concept of the database is converted into specific logic and verification.

Prove the rationality of the above relationship design and the correctness of model establishment. As the picture of system ER diagram, anlyaize the diagram, it can find the Staff (include waiter, chef, mananger), Customer, Order, item, Drink, Transaction, TableTop, reserve, item_Type these main entities. And analysed their property and describe the relationship between the entities. These entities include the Restaurant System's multi subsystem's main point.These are the explain to the relationship between the entities [6][7].

3.2.1. Staff.
Staff have waiter, manager, chef and cleaner, buyer such job Restaurant can have.

They have same property like staffNo, staffName, salary, workyears, job which are the main property in picture.They also have something different like chef have cooktype [8-9].

3.2.2. Customer.
Customer is created to manager all the customer who visit the restaurant. Every customer has their unique CustomerID, and in the System, every customer only has one main waiter to service. Customer is an important entity because it will cause muti associate to others. One group of

customer will only use one customerID, and can choose muti transaction way and create one to many order.

3.2.3. TableTop. TableTop have the property like tableID, table_Code, status,capacity, Content. TableID is used by the system to identify each table. Table_Code represents the code or number assigned to each table, such as A1 or B2. The status have three different status: Empty,Full, reserved. These status can clearly show to users to lead the customer. Content is use to some special customer who maybe take baby or use discount.

3.2.4. Reserve. Reserve have reserveID, reserveTime, customerName, tableType and will use tableID as a foreign key. When restaurant receive the reserverTime, customer Name and the tableType, the waiter will register to system and find the empty table to change the status to reserved. The reseveID will auto increase when the data update. The customer in the reserve will not create customerID, Because sometime the customer who reserved table but won't come.So the Customer Data will create in the customer comes to the restaurant.

3.2.5. Item. Item have itemID, itemName, ItemDetail, product-Min, itemPrice, Calories and have staffID to find which chef will cook them. And it have item_type to classify. Item mainly use to let the chef and buyer to prepare the material of the dishes, and customers can know which they want to order by see the Calories and Detail.

3.2.6. Item_Type. Item_Type have Type_ID, typeName, StaffID. In the system, One chef cook for one Type, it's most large restaurant will use.It help to share out the work and cooperate with the other chef easily.

3.2.7. Drink. Drink like item.Because sometimes drink can classify to many different so can't put it in item,Customer can choose what they want easily.

3.2.8. Order. Order is the most important entity in the system. It connects many entities like customer, table, item, drink and it will decide the total price. The associate with item and drink that is many to many, so will have two extra table use to list the detail like Name, quantity and unitprice.

3.2.9. Transaction. Transaction have transactionID, transaction type, Create At, status, content, and use the orderID and customerID to identify who paid the order. Status have Complete, pending, failed. These will help manager and waiter to check the Bill whether have been paid.

3.3. Physical database design
The physical database design aims to implement the logic of the above model at the physical level Features. First analyse the relationship and find the table the system need. In this system final relation model will have twelve table in the system, include two subclass table, and to extra table in many to many relationships. Second create the database called restaurant system, create tables (Staff,staff_chef,customer,tabletop,reserve,item,item_type,order,item_ordered,drink,order_drink,transaction) List like figure 2
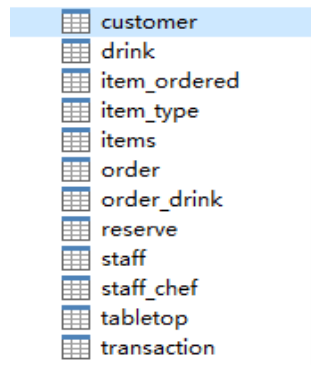
Figure 2. System table.

And design the necessary fields and words that used in the inspection work.
Here are some created table (Table 1-table 5)

Table 1. Customer table.

Field name	Type	length	Key
Customer_ID	int	11	PK
First_Name	varchar	255	
Last_Name	varchar	255	
Phone	varchar	255	
staffID	int	2	FK

Table 2. Order table.

Field name	Type	length	Key
Order_ID	int	11	PK
Customer_ID	int	11	FK
Order_Date	datetime	0	
TotalPrice	decimal	19	
Content	varchar	255	
TransactionID	int	11	FK
TableID	int	10	FK

Table 3. Items.

Field name	Type	length	Key
Item_ID	int	11	PK
Chef_ID	int	11	FK
Item_Name	varchar	255	

Table 3. (continued).

Item_Detail	varchar	255	
itemPrice	decimal	10	
Calories	int	20	
Production_Min	int	10	
Item_Type	int	11	FK

And one of the many to many caused extra table

Table 4. Item-ordered table.

Field name	Type	length	Key
Order_ID	int	11	PK,FK
Items_ID	int	11	PK,FK
OrderedItem	varchar	255	
Quantity	varchar	255	
Unit_Price	decimal	10	

This table can know which items in one order.
And another table called order_drink can know the drinks in one order

Table 5. Order_drink table.

Field name	Type	length	Key
Order_ID	int	20	PK, FK
DrinkID	int	11	PK, FK
DrinkName	varchar	255	
DrinkQuantity	varchar	255	
Unit_Price	decimal	10	

4. System application

(1) Example of database table creation process: Create a table 'customer' under the database 'restaurant system', and add the data type and constraint of each field, and execute the SQL code as follows :
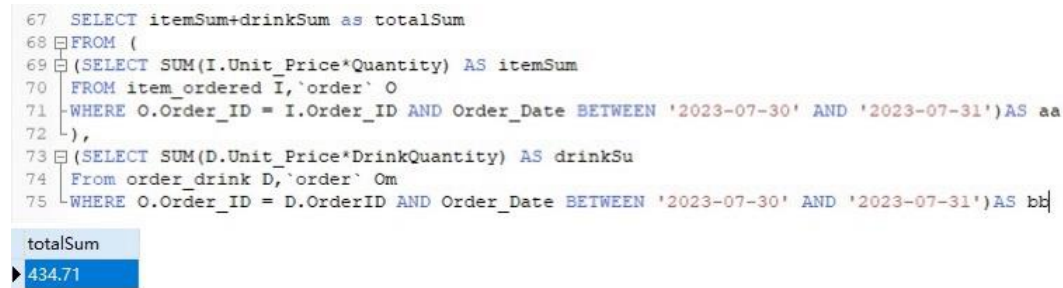
```
CREATE TABLE `customer` (
`Customer_ID`  int(11) NOT NULL ,
`First_Name`  varchar(255) NULL DEFAULT NULL ,
`Last_Name`  varchar(255) NULL DEFAULT NULL ,
`Phone`  varchar(255) NULL DEFAULT NULL ,
`staffID`  int(11) NULL DEFAULT NULL ,
PRIMARY KEY (`Customer_ID`),
```

FOREIGN KEY (`staffID`) REFERENCES `staff` (`staffID`) ON DELETE NO ACTION ON UPDATE CASCADE,
INDEX `waiterID` (`staffID`) USING BTREE)
ENGINE=InnoDB
DEFAULT CHARACTER SET=utf8 COLLATE=utf8_general_ci
ROW_FORMAT=COMPACT;

(2) Calculation of daily turnover:Find the turnover at July 30 ,calculated the item turnover and drink turnover, execute the SQL code as follows:

SELECT itemSum+drinkSum as totalSum
FROM (
(SELECT SUM(I.Unit_Price*Quantity) AS itemSum
FROM item_ordered I,`order` O
WHERE O.Order_ID = I.Order_ID AND Order_Date BETWEEN '2023-07-30' AND '2023-07-31')AS aa),
(SELECT SUM(D.Unit_Price*DrinkQuantity) AS drinkSu
From order_drink D,`order` Om
WHERE O.Order_ID = D.OrderID AND Order_Date BETWEEN '2023-07-30' AND '2023-07-31')AS bb

The result showed in Figure 3

```
67   SELECT itemSum+drinkSum as totalSum
68 ⊟FROM (
69 ⊟(SELECT SUM(I.Unit_Price*Quantity) AS itemSum
70 | FROM item_ordered I,`order` O
71 ⊢WHERE O.Order_ID = I.Order_ID AND Order_Date BETWEEN '2023-07-30' AND '2023-07-31')AS aa
72 └),
73 ⊟(SELECT SUM(D.Unit_Price*DrinkQuantity) AS drinkSu
74 | From order_drink D,`order` Om
75 └WHERE O.Order_ID = D.OrderID AND Order_Date BETWEEN '2023-07-30' AND '2023-07-31')AS bb
```

totalSum
434.71

Figure 3. Turnover calculates.

It's a necessary function in the System, users can efficiently know the daily or weekly even yearly turnover.

(3) Choose the items to combine with Drink to a set: Find the item can combine with mango smoothie and the price lower than 30, include the itemName, exculate the SQL code as follow:

SELECT Item_Name,DrinkName
From items,Drink
WHERE DrinkName = 'Mango smoothie' AND itemPrice + DrinkPrice <30
The result showed in figure 4

Item_Name	DrinkName
BONELESS WINGS	Mango Smoothie
MOZZARELLA STICKS	Mango Smoothie
8 OZ. TOP SIRLOIN	Mango Smoothie
CHICKEN TENDERS PLATTER	Mango Smoothie
BOURBON STREET CHICKEN & SHRIMP	Mango Smoothie
DOUBLE CRUNCH SHRIMP	Mango Smoothie
NEW BOURBON STREET MUSHROOM SWISS BURGER	Mango Smoothie
STRAWBERRY BALSAMIC CHICKEN SALAD	Mango Smoothie
JUST SALAD	Mango Smoothie
CINNABON MINI SWIRLS	Mango Smoothie
TRIPLE CHOCOLATE MELTDOWN	Mango Smoothie

Figure 4. Set choose.

This function can help the Restaurant operators easily to find the set to Stimulate consumption, it is a helpful way to make more profit to restaurant [10].

(4) Increase the most sales finding function:It can use in everytime the restaurant operators want to know the most popular dishes, the information include the OrderedName, count of Quantity and the times of order, exculate the SQL as follow:

SELECT OrderedItem,sum(Quantity)AS totalQuantity,count(Items_ID) AS Ordered_times
From item_ordered
GROUP BY OrderedItem
ORDER BY sum (Quantity) desc

The result showed in figure 5

OrderedItem	totalQuantity	Ordered_times
SIDE TOMATO BASIL SOUP	10	2
HAND-BATTERED FISH & CHIPS	9	2
SPINACH & ARTICHOKE DIP	9	2
CHICKEN TENDERS PLATTER	8	3
SIDE CHICKEN TORTILLA SOUP	7	1
STRAWBERRY BALSAMIC CHICKEN SALAD	6	2
CRISPY CHICKEN TENDER SALAD	6	4
BONELESS WINGS	4	1
JUST SALAD	3	2
SHRIMP 'N PARMESAN SIRLOIN	3	2
8 OZ. TOP SIRLOIN	3	1
BOURBON STREET STEAK	2	1
SIDE FRENCH ONION SOUP	2	1
CINNABON MINI SWIRLS	2	1
DOUBLE CRUNCH SHRIMP	2	1
GRILLED CHICKEN BREAST	2	1
BREW PUB PRETZELS & BEER CHEESE DIP	2	1
NEW BOURBON STREET MUSHROOM SWISS BURGER	2	2
MOZZARELLA STICKS	1	1

Figure 5. Find.

This function can find which dishes are the customer like most, it helps to analyse the change of dishes, manager can reserve the popular dishes can remove the dishes which customer doesn't like. Restaurant can control the cost in this way.

5. Conclusion

The use of database is more and more widely used in the industry, in view of the current problems in restaurant data management and maintenance, this article mainly focuses on the daily necessary content of the restaurant, from the daily operation, meal management, business analysis and other aspects of managing the information in the restaurant, around the needs of the restaurant work, to design the MYSQL-based restaurant information management system. The system can effectively manage the information of restaurant personnel and customers, the information details of meals, convenient storage and view of each record about each order, and can query the total turnover within a certain period of time, the items sold, and the status of popular meals. It significantly reduces the manpower consumption in the analysis of restaurant operating conditions and completes the digital management of restaurants. The use of database management is an inevitable trend in the future industry, database management can avoid judgment errors or calculation errors such as human management, can accurately obtain the required data, and simplify complex work. However, the use of database management is also a process that needs to be continuously improved to add more functions and improve the applicability and reliability of the system in different scenarios.

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