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The application of backend database systems in precision marketing: A case study of Nike official online store

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Abstract. In the era of big data, databases have become a powerful tool for enterprises to gain insight into consumer behavior and market dynamics. However, some enterprises, especially small and medium-sized ones, focus too much on data volume growth while ignoring the importance of data relevance, resulting in unsatisfactory marketing outcomes. Based on this, this paper provides an example of Nike official online store. With the assistance of structured query language (SQL), a backend database system is created under the Oracle11g R2 environment, and its functions are simulated and demonstrated. The system is capable of managing user, product, and order transaction information through basic functions such as adding, querying, modifying, and deleting. In addition, it serves as a foundation for Nike's precision marketing efforts through user profile construction, user behavior analysis, and demand forecasting based on basic statistical methods of counting, proportioning, and sorting.

Keywords: backend database, precision marketing, online shopping, SQL.

1. Introduction

In recent years, the popularity of online shopping has increased due to the rapid development of information technology and the internet economy. By 2022, the worldwide number of internet users had exceeded 5 billion, and global retail e-commerce sales had reached around $5.7 trillion. It is expected that this figure will continue to increase in the coming years [1]. According to recent data from the U.S. Census Bureau of the Department of Commerce, retail e-commerce sales in the United States rose by 3% year-over-year to $272.6 billion during the first quarter of 2023 [2]. Additionally, the application of big data in the context of “Internet Plus” has had a significant impact on all aspects of society. Through the implementation of a robust database marketing system, a more reliable source of data is accessible for marketing activities, thereby allowing for more precise targeting [3].

With the rise in online shopping platforms, scholars have proposed various design ideas to implement the frontend and backend systems for online shopping. The backend management functions primarily focus on “management,” which involves fundamental insertion, querying, deletion, and modification commands [4, 5, 6]. In addition, many scholars concentrate solely on the role of “big data” from third parties in promoting personalized marketing, emphasizing data growth excessively and neglecting the most concrete and genuine first-party data from the enterprise itself [7]. Especially some small and medium-sized enterprises face the risk of weak data relevance due to limitations in their user scale and their dependency on third-party data management platforms. Thus, unlocking the potential of their databases and breaking free from this reliance has become essential to driving digital marketing [8].

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Based on the user registration and login process, the purchase process, and the specific information of the official website, this paper takes Nike U.S. official online store as an example, designs and builds the backend database system for it, writes the command code, and conducts the simulation demonstration of the function, to provide the data basis for formulating the marketing strategy of Nike.

2. Requirements analysis

This system aims to provide a convenient, efficient, and friendly management and analysis environment. The primary users of the backend management system are Nike merchants who sell goods online and Nike digital strategists. Therefore, the system can be divided into two types of roles: merchants and strategists.

Regarding Nike merchants, the database system needs to perform the essential functions of user information management, product information management, and order transaction management. Through the system's add, query, modify, and delete functions, the merchant can manage information about users, products, types of products, sub-brands of products, and orders. Merchants can obtain user information through the process of user registration and login, and order submission: each online user can register for a free Nike membership, and the information that the registered member must fill in includes name, email address, shopping preferences, and date of birth. Consumers can also purchase products directly as ordinary users, and the information required includes name, email address, mobile phone number, and shipping address. Nike's commodity information is categorized and archived by types and sub-brands. Types include shoes, clothing, and accessories; sub-brands include Nike Sportswear, Jordan, Nikelab, and All Conditions Gear (ACG). Product information stored in the backend system includes product styles, names, prices, discounts, sales and inventory counts. Order information includes basic information about the user and the item, together with the total price, payment time, arrival time, and order status.

As far as Nike digital marketing strategist is concerned, the database system should have the basic mathematical and statistical functions to realize the user profile analysis, user behavior analysis, and demand forecasting for database marketing [9]. In the user information module, user profile metadata can be generated by counting, proportioning, sorting, and other statistical methods. The user table, product table, and order table can be linked together, and then through basic statistical operations to obtain multi-segment relational data, such as the changes in sales of products under certain circumstances or the characteristics of the consumption behavior of certain types of users.

3. Database design

Based on the requirements analysis, the author designs the backend database for the online shopping system of Nike in the United States, and the storage objects mainly consist of three entities, including customers, products, and transaction. The database can be used for more than just its core functions, such as user information management, product management, and order management; it can also be employed for precision marketing by gathering and analyzing information about customers from the enterprise's backend, enabling the brand to gain an understanding of their target consumer's preferences and buying habits, ultimately leading to a higher conversion rate and greater customer satisfaction.

3.1. Database conceptual design

Database conceptual design is the process of abstracting user requirements obtained from requirements analysis into a conceptual model [10]. Figure 1 illustrates that the system comprises five entity types: customers, products, product categories, product brands, and order transactions. This paper also defines the relevant attributes of each entity. The relationship between the functional modules is that each category and sub-brand contains different products; users can create multiple orders at different times, and each order can contain multiple product details; merchants receive orders and fulfill them accordingly.

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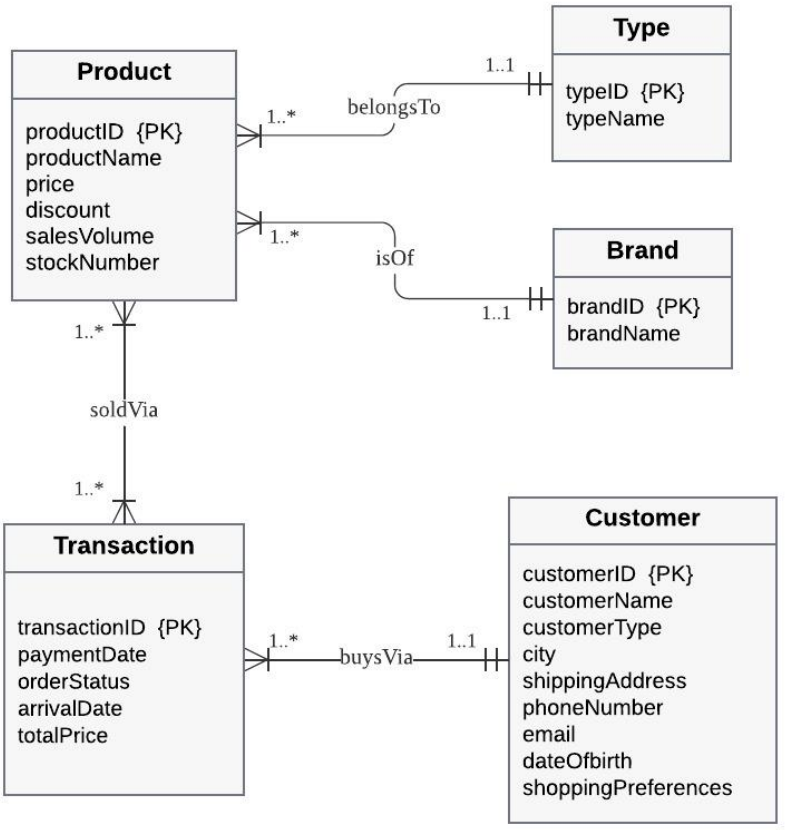

Figure 1. Entity relational diagram.

3.2. Database logical design

By analyzing and organizing the database conceptual design, the author derives the following relationship models:

(1) Customer (customerID, customerName, type, city, shipping Address, phone Number, email, date Of birth, shopping Preferences).

This relationship model corresponds to the Customer entity, with the primary key of customer ID.

(2) Transaction (transactionID, paymentDate, orderStatus, arrivalDate, totalPrice, customerID).

This is the relationship model for the Transaction entity. The transaction ID is the primary key, while the customer ID is the foreign key.

(3) Product (productID, productName, price, discount, salesVolume, stockNumber, typeID, brandID)

This relationship model corresponds to the Product entity. The product ID serves as the primary key in the relationship, while the type ID and brand ID act as the foreign keys.

(4) Type(typeID,typeName)

This is the relationship model for the Type entity. The type ID is the primary key.

(5) Brand(brandID,brandName)

This relationship model corresponds to the Brand entity. The brand ID serves as the primary key.

(6) Product Information In The Order (transactionID, productID)

This relationship model corresponds to the Product Information In The Order entity. The transaction ID and product ID are both the primary key and the foreign key of the relationship.

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Convert the relational models above into database tables, including tables for the customer, transaction, product, type, brand, and product information in the order. The customer table is shown in Table 1.

Table 1. Customer table.

Column name	Data type	Data length	Explain
CUSTOMER_ID	VARCHAR	4	Primary key Not null
CUSTOMER_NAME	VARCHAR	25	
CUSTOMER_TYPE	VARCHAR	10	Not null
CUSTOMER_CITY	VARCHAR	20	
CUSTOMER_SHIPPING ADDRESS	VARCHAR	50	
CUSTOMER_PHONENUM	VARCHAR	15	
CUSTOMER_EMAIL	VARCHAR	30	
CUSTOMER_ DATEOFBIRTH	DATE		
CUSTOMER_SHOPPING PREFERENCES	VARCHAR	8	

3.3. The fundamental structure and functions of the backend database system

The backend database system consists of three primary modules: user information management, product information management, and transaction order management. Each module involves fundamental operations on data, such as insertion, query, deletion, and modification. In addition, the merchants or digital strategists can associate the information among the tables of consumers, orders, and products, and conduct a multi-dimensional portrait analysis of the target consumers utilizing statistical functions, which helps to gain insights into users' needs, providing personalized services for distinct consumer groups, and facilitating precision marketing.

A functional module diagram (see Figure 2) is included in this paper to present the backend system's functions objectively. The detailed information about functions is described as follows:

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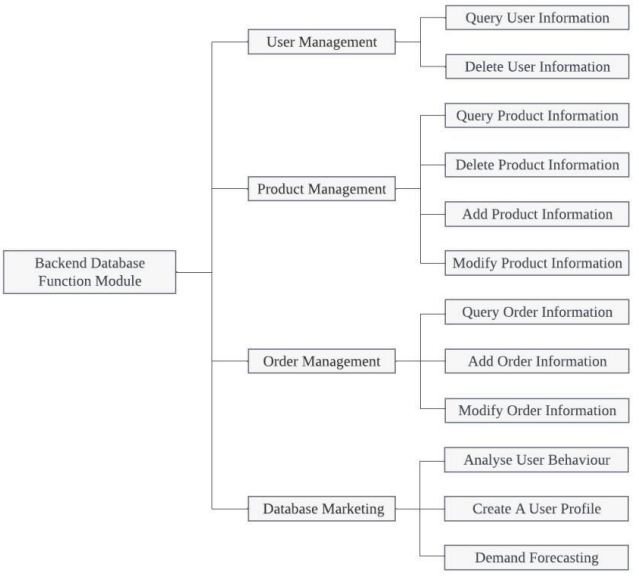

Figure 2. Backend database system function module.

3.3.1. Customer information management. The administrator can manage user information, including querying user information and deleting user information. The following specific functions are described: (1) Query user information: The administrator can retrieve all pertinent user information by entering condition statements related to user attributes. (2) Delete user information: The administrator can utilize the "DELETE... FROM... WHERE..." SQL statement to remove user information.

3.3.2. Product information management. The administrator can manage the product information of the online store, including querying product information, deleting product information, adding product information, and modifying product information. Specific functions are described as follows: (1) Query product information: Administrators can retrieve all the corresponding commodity information by entering the product ID or name. (2) Delete product information: The administrator can remove the remaining products according to the sales of the goods and delete the relevant product data in the database. (3) Add product information: Merchants can shelve new products, and the administrator can add relevant information through the "insert" SQL command. (4) Modify product information: Sales of goods and inventory number are constantly changing, and the administrators can also use the "update" SQL command to modify accordingly.

3.3.3. Order transaction processing. The order transaction information module retains details of each online transaction, with functions for querying, adding, and modifying order information. Specific functions are described as follows: (1) Query order information: The administrator can enter a specific transaction ID to retrieve the target transaction records or search for all transaction information on a particular date. (2) Add order information: The database system will save information for each new order. (3) Modify order information: The transaction status changes from "Paid" to "In transit" and then to "Completed". Modifying the order information updates the status for real-time tracking of the transaction process.

3.3.4. Statistics. The statistical function of the database realizes user profile analysis, user behavior analysis, and analysis of sales characteristics of products with specific conditions by using the sorting

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function, counting function, and percentage function through all the tables. Specific functions include but are not limited to: (1) Order statistics: Administrators can select particular criteria, such as "the first quarter of 2022" and "consumers from New York," and then order the product by "sales volume" to analyze the sales variations under different conditions and develop future marketing strategies based on the results. (2) Data filtering: Based on the customer table, administrators can create conditional commands to obtain information about the age distribution, city distribution, and shopping preferences of the target consumers, which can be used to develop user profiles for precision marketing.

4. Database construction

This paper uses the SQL language in the Oracle11g R2 environment to build the backend database system [11]. The main task of the system construction is the code implementation and description of all the functions. The commands used to create the customer table and the transaction table using SQL statements are shown in Figure 3.

```
CREATE TABLE CUSTOMER
(CUSTOMER_ID VARCHAR(4) PRIMARY KEY,
CUSTOMER_NAME VARCHAR(25),
CUSTOMER_TYPE VARCHAR(10),
CUSTOMER_CITY VARCHAR(20),
CUSTOMER_SHIPPINGADDRESS VARCHAR(50),
CUSTOMER_PHONENUM VARCHAR(15),
CUSTOMER_EMAIL VARCHAR(30),
CUSTOMER_DATEOFBIRTH DATE,
CUSTOMER_SHOPPINGPREFERENCES VARCHAR(8));

CREATE TABLE TRANSACTION
(TRANSACTION_ID VARCHAR(10) PRIMARY KEY,
TRANSACTION_PAYMENTDATE DATE ,
TRANSACTION_ORDERSTATUS VARCHAR(15) ,
TRANSACTION_ARRIVALDATE DATE,
TRANSACTION_TOTALPRICE DECIMAL(6,2),
CUSTOMER_ID VARCHAR(4),
FOREIGN KEY (CUSTOMER_ID) REFERENCES CUSTOMER(CUSTOMER_ID));
```

Figure 3. SQL commands for creating customer and transaction tables.

5. Database implementation examples

A demonstration of the statistical function of the database is conducted to give a clear comprehension of Nike backend database design, with data being inserted into the database to simulate the function and assess the database's positive effects on the marketing strategy and the data association.

Case 1: Suppose a digital strategist at Nike wants to understand the characteristics of the target consumer group - age distribution, city distribution, preference characteristics, and membership share - through a backend database system.

Upon entering the conditional statement in Oracle and reviewing the results presented in Table 2-5, it becomes evident that member users are predominantly aged between 18 and 34, which represents 50% of the demographic. The older group, 65 years and older, has the lowest percentage at only 8.33%. Regarding location, most users are from New York, USA, accounting for approximately 30%. Male member users are the primary consumption group, with a percentage of 58.33%. In addition, it is

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noticeable that many users have registered for Nike membership on the official website, and the percent of member users is six times that of ordinary users.

The output data is used to create the pie chart shown in Figure 4.

Table 2. SQL output of age distribution of online shoppers.

AGE	COUNT(*)	PERCENT
55-64	2	16.67%
35-54	3	25%
18-34	6	50%
65 and older	1	8.33%

Table 3. SQL output of city distribution of online shoppers.

CITY	COUNT_CITY	PERCENT
Atlanta	2	14.29%
New York	4	28.57%
Chicago	1	7.14%
Washington D.C.	2	14.29%
Boston	2	14.59%
Miami	1	7.14%
Florida	2	14.29%

Table 4. SQL output of share of online shoppers' shopping preferences.

SHOPPING_PREFERENCES	COUNT_PREFERENCE	PERCENT
men's	7	58.33%
women's	5	41.67%

Table 5. SQL output of share of online members.

CUSTOMER_TYPE	COUNT_TYPE	PERCENT
member	12	85.71%
non-member	2	14.29%

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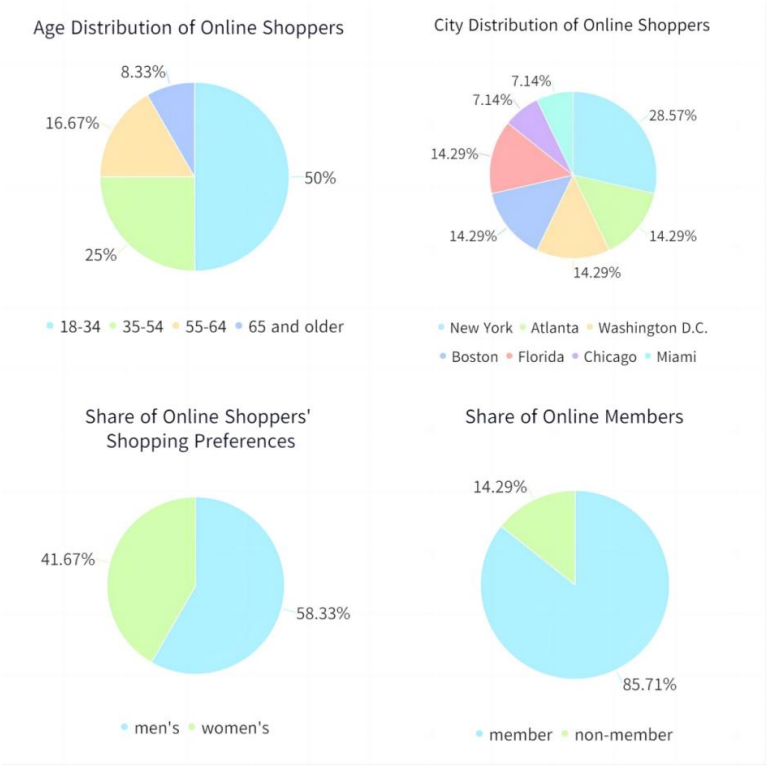

Figure 4. Online customers' data.

Case 2: Suppose digital strategists are going to develop a marketing strategy for the 18-34 age group and need information on the top-selling and preferred sub-brands within that demographic.

The SQL output is visualized, and Figure 5 displays the corresponding bar chart. The bar chart below shows that sub-brand B2 (Jordan) is purchased most frequently by the 18-34 age group. Therefore, Jordan becomes a potential focus for future marketing strategies that target this demographic.

Based on the results of Case 1 and Case 2, a simulated user profile of Nike online consumers is generated, as shown in Figure 6.

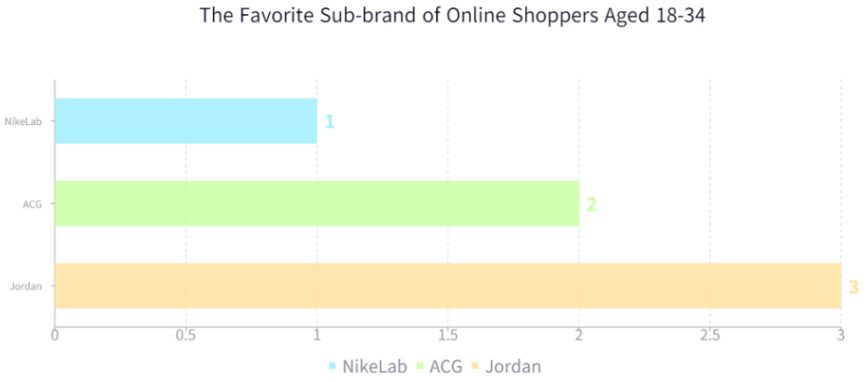

Figure 5. The favorite sub-brand of online shoppers aged 18-34.

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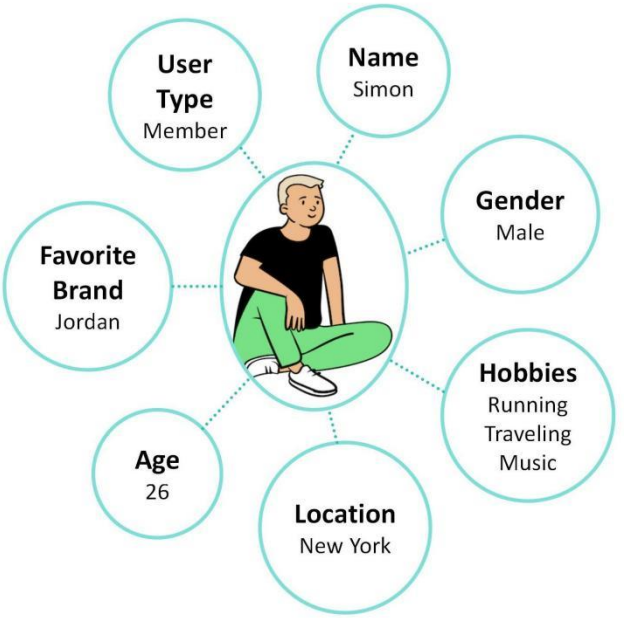

Figure 6. The simulated user profile of Nike online consumers.

Case 3: Suppose Nike wants to identify the top-selling product categories for the second quarter of 2022 to develop a marketing strategy for the same period next year.

The SQL output is visualized, and the corresponding bar chart is shown in Figure 7. The figure illustrates the number of transactions for various product categories in the second quarter of 2022. Specifically, category C1 (shoes and sneakers) has the highest number of transactions, with four pairs sold. The brand can utilize this data to predict the sales volume of different categories for the corresponding period in 2023. For example, the brand can select category C1 (shoes and sneakers) as the basis for its marketing campaign.

Figure 7. Sales volume of different types in the second quarter of 2022 (partial).

6. Conclusion

This paper explores how enterprises can extract valuable user information from internal databases, emphasizing the importance of "small data" from first parties and promoting the competitive advantage

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of small and medium enterprises during the era of big data. The author takes the Nike USA official online store as a case study and builds a backend database system using the SQL language in the Oracle 11g R2 environment. The system is able to offer not only user information, product information, and order information management to Nike retailers, but also provide support for constructing user profiles, assessing user behavior, and forecasting commodity demand. This paper contends that, in the age of the big data epoch, companies should prioritize not just the increase of the data volume, but also the construction and maintenance of their backend database system with particular emphasis on analyzing and applying the data collected from the system.

The main goal of the current study is to simulate fundamental user behavior analysis using a backend database. It would be a fruitful area for further work for more complex analyses, such as behavioral path analysis, consumer life cycle, user repurchase rate, and other functional applications.

References

[1] Statista.E-commerce worldwide-statistics&facts. Feb 27, 2023.: https://www.statista.com/topics/871/online-shopping/#topicOverview
[2] PracticalEcommerce. Charts:U.S. Retail Ecommerce Sales Q1 2023.May 24, https://www.practicalecommerce.com/charts-u-s-retail-ecommerce-sales-q1-2023
[3] Li L L, Hu Y Q 2022 *J. Science & Technology Economy Market* 157-160
[4] Wang Y J 2015 *J. Modern Electronics Technique* **38** 119-122
[5] Lee Z J, Su Z Y, Cheng X, et al 2020 *J. Artificial Intelligence Evolution* **1** 1-7
[6] Wei F, Zhang Q 2018 *C. MATEC Web of Conferences* **246** 03033
[7] Yang T 2017 *J.Voice & Screen World* 104
[8] Desai V, Vidyapeeth B. 2019 *J. Inter. J. Trend Sci. Res. Devel.* **5** 196-200
[9] Blattberg R C, Kim B D, Neslin S A, et al 2008 *Why database marketing?* Springer New York 18 13
[10] Zeng Y M 2022 *J. Auto. Appl.* 67-70
[11] Curley C 2000 *J.Linux J.***2000** 17-es