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RESEARCH ARTICLE

Dialogflow-based Robot Customer Service in Online Shopping Malls

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Abstract

With the rapid development of e-commerce, consumers encounter more and more frequent customer service problems in the shopping process, especially during peak periods, the burden of manual customer service is heavy, and it is difficult to provide timely and effective service. In addition, enterprises are faced with high labor costs and low service efficiency. However, existing customer service systems are still deficient in user experience and intelligence level. In order to solve these problems, I designed a mall system and integrated Google's Dialogflow robot service in it, which realizes intelligent customer service functions through natural language processing technology to help users get real-time and accurate responses during the shopping process. This system can significantly improve the customer experience and reduce the customer service cost of enterprises, and has a wide range of application prospects.

Keywords: online customer service, dialogflow, mall system.

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1 Introduction

With the rapid development of the Internet, users face more and more customer service needs in their daily lives, especially when shopping on e-commerce platforms (e.g. Taobao). These customer service issues are usually repetitive and high-frequency, which brings enormous work pressure to the enterprise's manual customer service. For enterprises with huge business volume, if they continue to increase manual customer service, not only will bring high operating costs, but also difficult to realize 24/7 service. At the same time, the conversation between customers and customer service generates a large amount of valuable data, however, this data has not been fully utilized [1].

Therefore, how to utilize intelligent technology to effectively respond to repetitive customer service needs has become an important topic worthy of in-depth exploration. In the field of intelligent customer service, foreign countries started earlier, the first chatbot ELIZA was born in the 1960s [2] and the technology was then rapidly developed and widely used in various industries.

In contrast, the domestic start a little later, but by virtue of the reference to foreign advanced demand surge, accelerating the popularization of intelligent customer service and innovation. A new generation of intelligent customer service system must keep up with the trend of the times, it has the characteristics of intelligence, mobility, socialization, cloud, etc., not only has the functions of the traditional customer service system, but also a good solution

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to the problems brought about by the traditional customer service, and therefore will be more and more welcomed by the enterprises [3]. The improved model based on Seq2Seq architecture by [4–7] can be used to develop robots with deep learning capabilities by classifying user messages through recurrent convolutional neural networks, which can further enhance intelligence and humanization. However, although many intelligent customer service systems have been put into commercial application [8, 9], there is still a gap between its user experience and the level of intelligence, and it is still deficient in understanding complex semantics and providing personalized solutions, and the user experience is often not ideal. In addition, system integration is more difficult, and the flexibility of functions needs to be improved.

To address these shortcomings, this paper adopts Google's Dialogflow platform to train intelligent customer service robots and seamlessly integrate them into the mall system. Dialogflow provides powerful natural language processing capabilities, supports complex dialogue processes, and continuously optimizes the user's interaction experience through deep learning models. With Dialogflow, the intelligent customer service robot is able to accurately understand the user's intent and provide effective responses, thus significantly improving the response speed and accuracy of customer service. In addition, the system supports multi-channel integration, ensuring that users enjoy a consistent service experience on different platforms. Combining the intelligent customer service system with the shopping process of the mall effectively reduces the pressure of manual customer service and improves the shopping experience of users.

2 System Design

This paper introduces the design of this system in three parts, firstly, the design and implementation of the mall system, next, the training of the robot customer service will be shown, and finally, the integration of the mall system with the robot customer service will be introduced.

2.1 Design and implementation of mall system

This mall system is designed to integrate robot customer service with all the regular features of the mall. The system utilizes a front-end and back-end separation architecture, where the front-end page is rendered through the browser and built using the Vue.js framework. The front-end and back-end communicate via HTTP, using axios to realize the sending and receiving of data, and using JSON format for interaction [10]. The back-end is built based on Spring Boot technology and is divided into several layers, such as view layer (View), control layer (Controller), service layer (Service), data access layer (DAO), and model layer (Model), and each layer communicates with each other through well-defined interfaces, and the DAO layer is responsible for connecting with the database. The database stores the basic data of the system and realizes the functions of data storage, modification and deletion. The architecture of the mall system is shown in Figure 1.

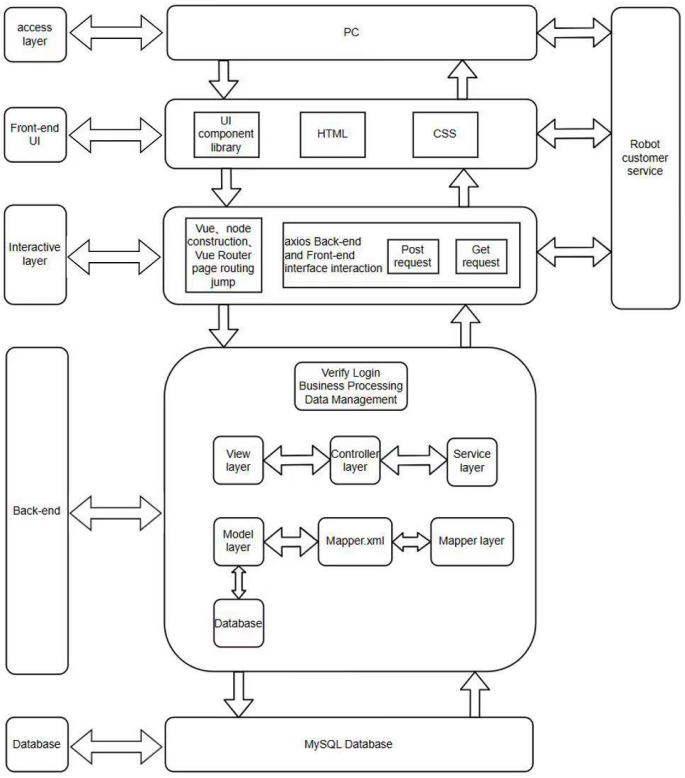

Figure 1. Mall system architecture diagram.

2.1.1 *Requirement analysis of all functions*

After analyzing the functional requirements of the system, it can be seen that the mall system is designed from two parts, which are administrator and user. In the administrator interface, it includes user management, order management, product management, customer service management and other functions. In the user interface, it includes default homepage, personal center, payment, order management, shopping cart management and so on. The system also sets up the login function of administrator and user, both of which are logged in each page respectively. System Requirements Analysis

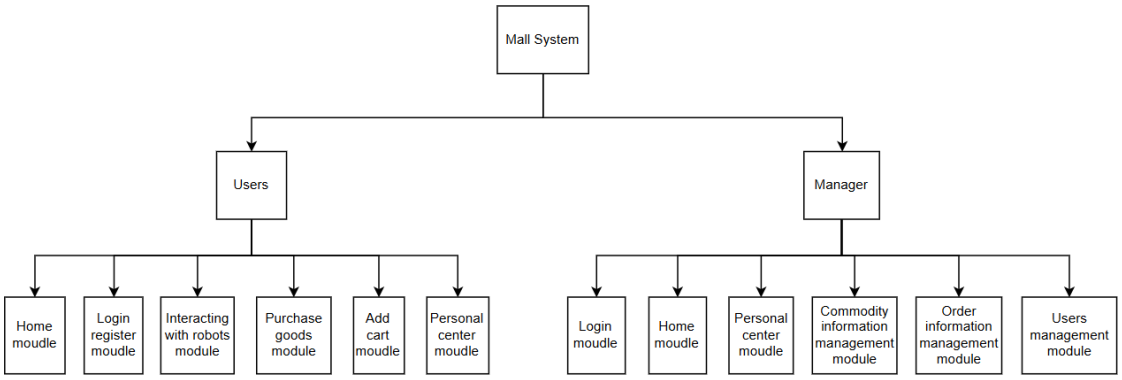

Figure 2. Analysis diagram of system requirements.

Figure 2 is shown.

2.1.2 *System database design*

The system database contains six entities, including goods, administrators, customers, customer information, order information, and product information. Next, we introduce the relationships between the entities: a product category can contain multiple goods, which is a one-to-many relationship. An administrator can manage multiple commodities, a one-to-many relationship. An administrator can manage multiple customer information, a one-to-many relationship. Multiple products can be associated with multiple order information, a many-to-many relationship. A customer can place multiple orders, so the customer-order relationship is a one-to-many relationship. The E-R diagram of the database system is shown in Figure 3.

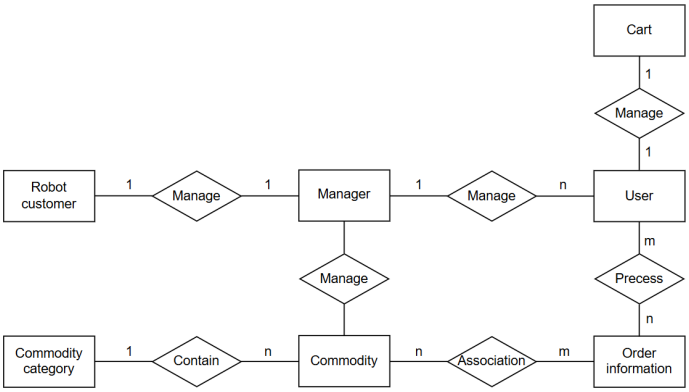

Figure 3. Database E-R diagram.

2.2 Robot customer service training

In order to create a smart robot that can truly serve their customers, merchants, as the best managers of their malls, must have a deep understanding of all aspects of their products. For example, merchants not only need to be familiar with the inventory quantity of products, sales, and preference data of popular products, but also need to grasp the common questions and feedback of customers during the purchase process. This data is the key to the effective operation of the robot customer service, which can help it respond quickly and accurately to customer needs during the service process. Therefore, merchants need to be personally involved in training their bot services so as to ensure that the bots can truly replace human customer service and provide timely and accurate answers.

In this regard, Google's Dialogflow platform provides an easy and powerful tool for merchants, allowing them to train and customize their bots with great efficiency through its intuitive interface and rich functionality. The core functionality of the platform includes the setting of Entities and Intents, the configurations that determine a bot's ability to understand and respond when talking to customers. By defining Entities, merchants can enable bots to understand specific information such as products and quantities mentioned by customers, while by configuring Intents, bots are able to automatically recognize the needs of customers based on their questions and provide solutions accordingly.

Additionally, Dialogflow supports multiple rounds of dialog, allowing bots to interact more deeply with customers. For example, if a customer asks about the stock status of an item, the bot can not only answer directly, accurately understand the consumer's questions and needs and provide targeted solutions in a timely manner, but also provide recommendations, comparisons, or promotional information based on the customer's follow-up questions [2]. Merchants can also update and optimize the robot's training data regularly to ensure that it is always up-to-date with the latest product information and customer needs.

Through this training process, merchants can create a robot customer service that truly meets their business needs, which not only reduces the workload of

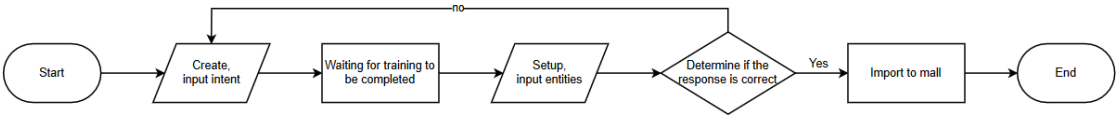

Figure 4. Robot customer service training flowchart.

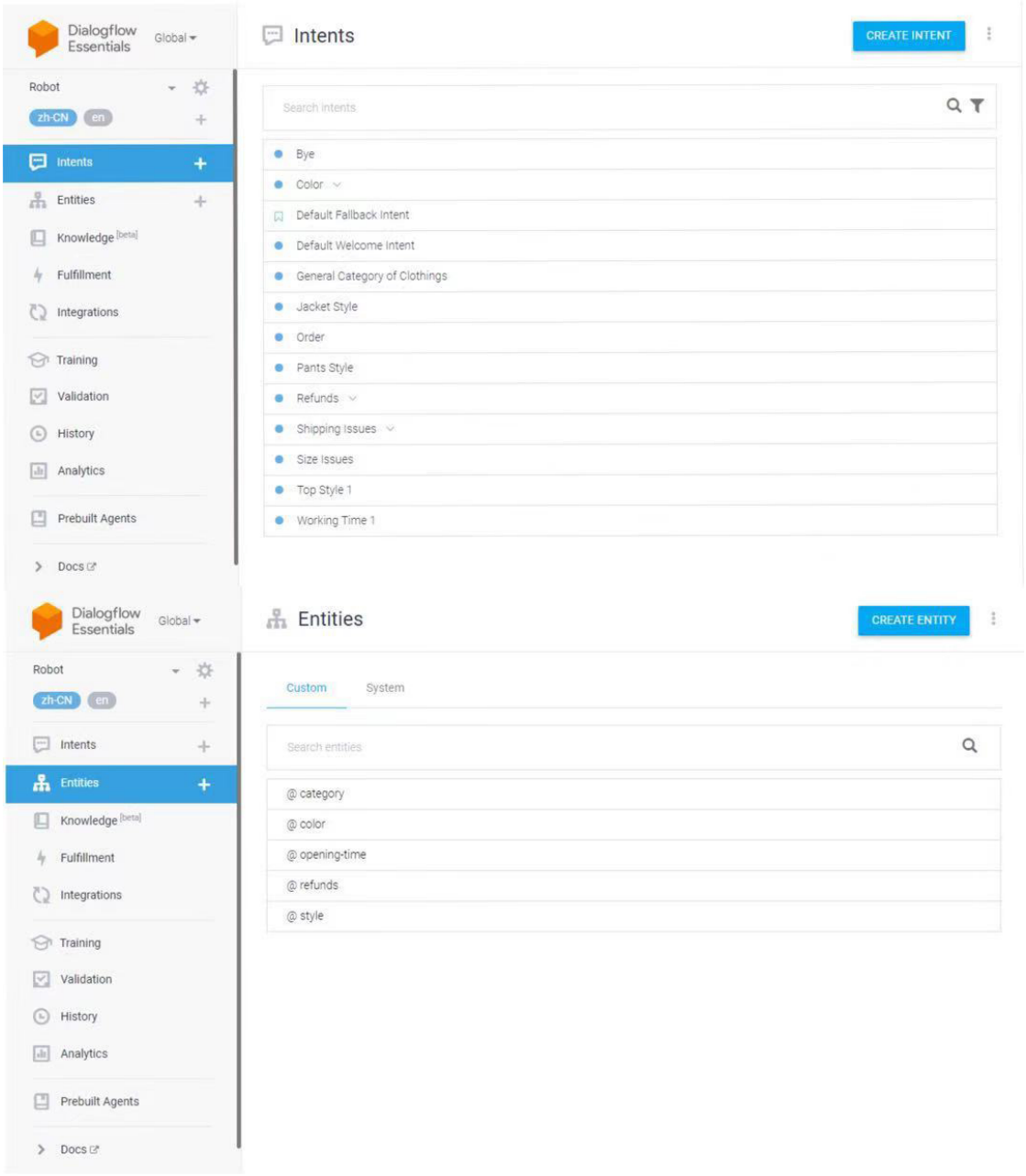

Figure 5. Setup intent, entities in console.

manual customer service, but also improves customer satisfaction. Especially in the face of a large number of customers, the robot can provide 7x24 hours of service to ensure that customers can get a timely response no matter when. Therefore, active training robot service for merchants is not only an important means to improve operational efficiency, but also an effective tool to improve customer experience and increase sales. The flowchart is shown in Figure 4.

2.3 Integration of robot customer service and mall

When integrating robot customer service in many mall systems, the complexity of different platforms varies. Some platforms have a cumbersome integration process, requiring more technical support and development resources, often requiring developers to write a large amount of code on their own and set up complex interfaces in order to allow robots

and mall systems to dock smoothly. On the other hand, although some platforms are more convenient to integrate, the scalability and intelligence of the functions may be limited, and cannot well meet the needs of merchants for personalization and flexibility.

In contrast, Google's Dialogflow platform shows great advantages in integration. Its integration process is simple and efficient, merchants and developers only need to go through a few simple steps, the robot customer service can be seamlessly embedded into the mall system. This experiment is just a simple integration of robot customer service into the mall, using the platform to provide a specific iframe code, click on the interactive window can pop up. In addition, Dialogflow provides a rich API interface that supports bidirectional communication with the mall system via HTTP requests to facilitate data interaction. In addition, it can be directly integrated with several third-party platforms and tools, such as Google Cloud, Slack, Facebook Messenger, etc., further expanding the use of the robot scene.

Another important advantage of Dialogflow is its highly intelligent natural language processing capability. Through machine learning and semantic analysis technology, Dialogflow can accurately understand customer questions and make intelligent responses based on context. At the same time, merchants can easily configure the entity, intent and context to train the bot to more accurately answer a variety of questions within the mall, including inventory inquiries, order status, product recommendations and more. This flexibility enables Dialogflow to provide customers with a personalized shopping experience and enhance the level of service intelligence. In addition, Dialogflow offers the advantages of multi-language support, cross-platform compatibility, and scalability, making it not only suitable for small e-commerce businesses, but also equally capable of meeting the needs of large enterprises. With Dialogflow, merchants can easily build an intelligent, flexible and full-featured robot-customer service to help them efficiently manage customer service and improve operational efficiency.

3 Main Functions Implementation

3.1 Robot customer service training function realization

This section will show the training results of the robot customer service. First, as shown in Figure 5, these are the various intents and entities of the robot service.

The interaction of the robot customer service will be shown next, as shown in Figure 6. The green part is the content replied by the robot customer service and the gray part is the information asked by the customer. Only a part of the interaction is shown here. As a result, the initial training of the robot service is complete, and it can respond to basic questions autonomously.

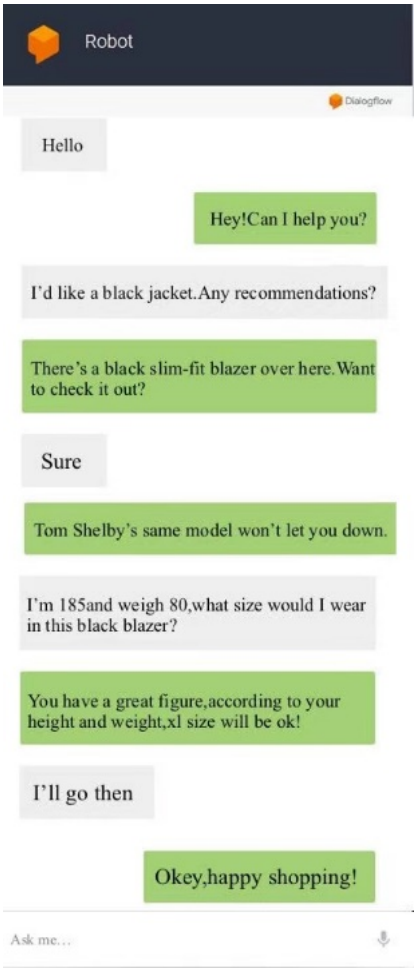

Figure 6. Robot service training results.

3.2 Mall system design and realization

3.2.1 Commodity information management

When the administrator logs in to this module, he can see all the commodity information, and at the same time, he can operate and maintain the commodities, including newly adding commodity information, deleting commodity information, modifying the operation of commodity information, and he can also click on the commodities to view the details. When the user to the commodity information module, you see a different interface, including the search for commodity information, view commodity details, add a shopping cart, buy goods and other functions. The administrator

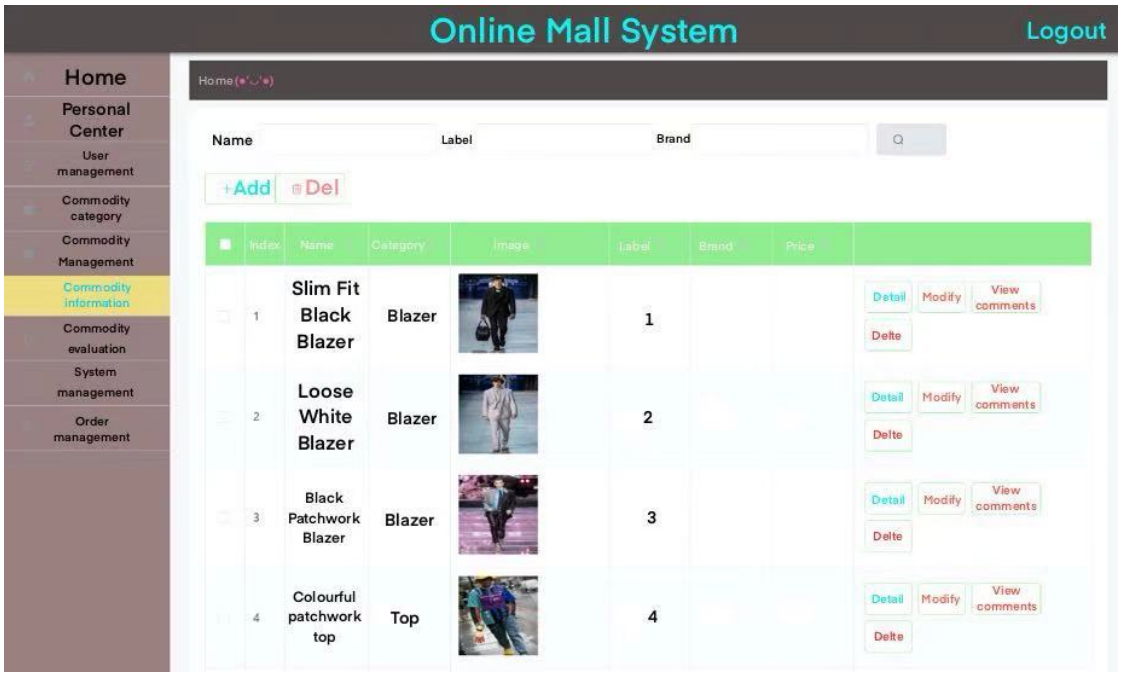

Figure 7. Administrator commodities information.

product information interface is shown in Figure 7.

3.2.2 *Order management*

In the order management module, both administrators and users can see various information about orders, including unpaid orders, paid orders, refunded orders, shipped orders, unpaid orders, and completed orders. Users can create orders by directly placing an order, and the same can be achieved by first adding to the shopping cart and placing an order inside the shopping cart to add an order. Administrator in this module, you can operate on the order, such as deleting the order, shipping goods, into the order details page. Order management interface shown in Figure 8.

3.2.3 *Robot-user interaction*

In this module, users can interact with the customer service. The customer service knows the business hours of the mall, and all the product information in the mall, including style, price, size, availability,

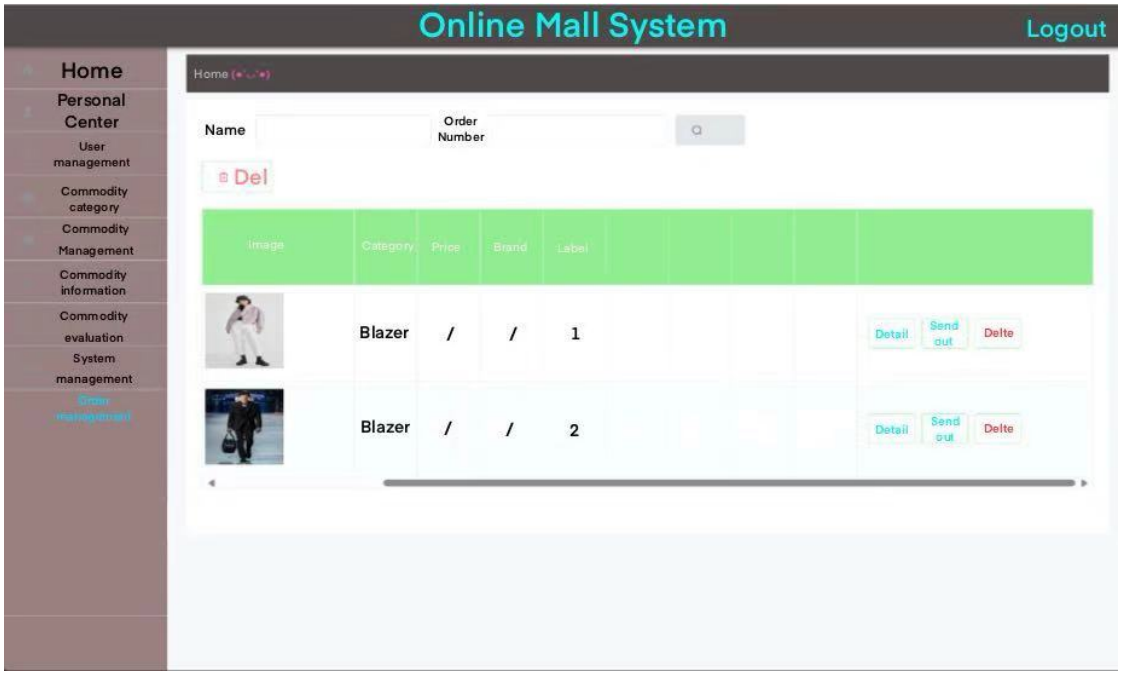

Figure 8. Order management.

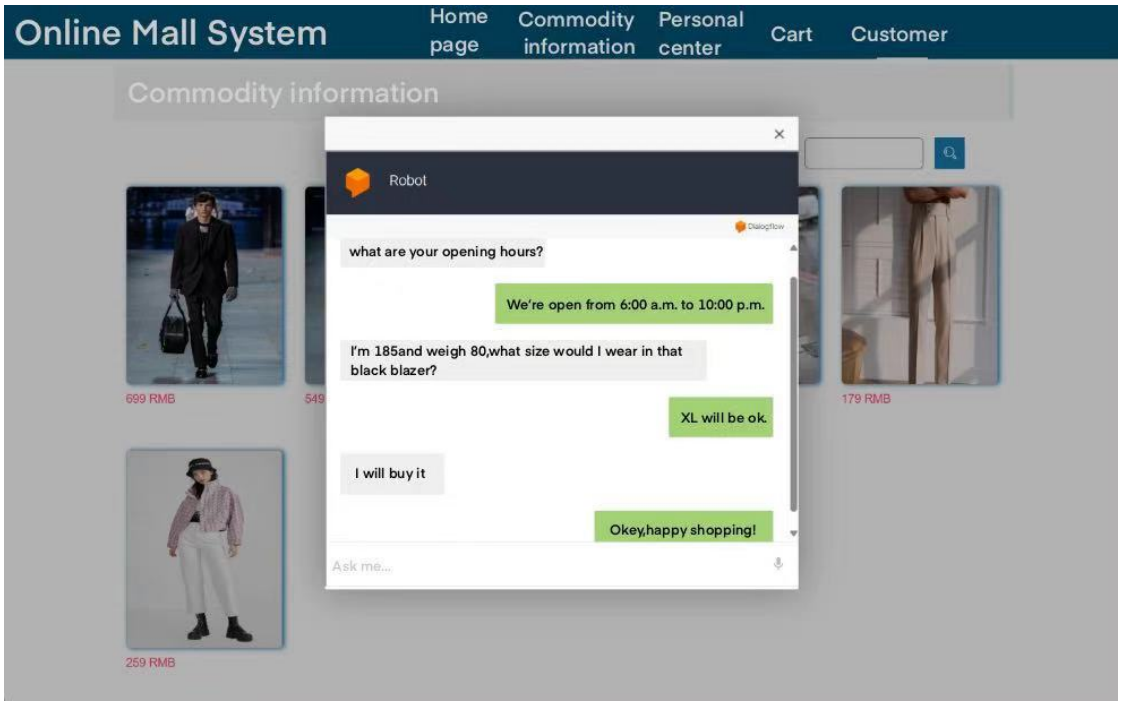

Figure 9. Robot customer service and user interaction interface.

and can make a recommendation of the correct size of a product through the height and weight provided by the buyer. The main basis for customer service robots to respond to customer questions, in addition to the content of the customer's current questions, but also take into account the customer's age, gender, preferences, the user's browsing, purchasing, evaluation of behavioral information and so on [11]. When the user clicks on the customer service button in the navigation bar, the interface will pop up a chat box, in the chat box, the user can consult the mall products related information, as shown in Figure 9.

4 Conclusion

In this experiment, the design and realization process of the mall system is elaborated in detail, including the system architecture design, the training of the robot customer service and the integration of the mall with the customer service robot. Through the Google Dialogflow platform, the intelligent customer service applicable to the mall is successfully trained, focusing on the key configuration parts such as intent and entity. The basic functions of the mall are demonstrated, and the interaction between buyers and the customer service robot is presented through actual scenarios, indicating that the integrated system significantly improves the automation and intelligence of customer service. The advantages of this design are reflected in three aspects: first, the system adopts a front-end and back-end separation architecture, which enhances the flexibility and scalability of the module; second, Dialogflow is utilized for efficient and convenient robot training, and a highly intelligent dialogue experience is provided through rich entity and intent configurations; and lastly, the mall system is smoothly integrated with the robot service and the robot is able to respond to customer issues in real time and reduces the burden of manual customer service. Despite the simplicity of Dialogflow integration, the degree of intelligence depends on the quality of the initial training data, and the quality of the bot's response may be affected if the data is insufficient. In addition, despite the high scalability of the system, further customization and development may be required in complex business scenarios to ensure that the robot can handle a wider range of customer needs.

Conflicts of Interest

The authors declare no conflicts of interest.

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