Design and Implementation of WEB-based Multi-entry Face Recognition Customer Management System

Liang Zheng[1], Jieling Wang[2], Hao Wang[3]

[1]School of Mobile Communications, Guangdong Vocational College of Post and Telecom, Guangzhou, Guangdong, 510000, China
[2]Haitong Securities Company Limited, Guangzhou, Guangdong, 510000, China
[3]Guangzhou Haige Communications Group Incorporated Company, Guangzhou, Guangdong, 510000, China

Abstract: In recent years, with the rapid development of the automobile sales market, automobile 4S stores, as one of the main channels for automobile sales, are also facing increasing customer management pressure. The 4S car shop customer management systems have shortcomings such as slow synchronization of information, inefficiency and time-consumption, unable to meet the needs of the pre-sale, after-sale and technical support. These problems seriously affect customer satisfaction and loyalty, which in turn affects the sales performance of 4S stores. To these problems, this paper mainly combines multi-face recognition technology and multi-feature cascade database to design and implement a Web-based multi-entry face recognition customer management system for 4S car shop. The system adopts a multi feature cascaded database as the core technology for storing and processing data, which can achieve synchronization of multi entry customer recognition with high recognition accuracy. It effectively solves the problems of traditional customer management systems, improves the efficiency and accuracy of customer management, and has certain practical value.

1. Introduction

The customer management system based on face recognition plays a very important role in the application of the new retail industry. However, due to the fact that such systems are generally implemented in a stand-alone hardware network or a local area network, the scope of use of the system is greatly limited[1,2]. In addition, the system considers more single-entry scenarios, and is less compatible with multi-entry and multi-store scenarios for 4S car shop[3]. Therefore, developing a face recognition customer management system that meets the needs of 4S car shop has practical significance. Large 4S car shops generally have multiple entrances, the current face recognition solutions for multiple entrances are rarely studied, the design and implementation of a multi-entry face recognition customer management system has become an important issue[4]. Most of the customer management system is based on the PC platform, have shortcomings such as slow synchronization of information, inefficiency and time-consumption, unable to meet the needs of the pre-sale, after-sale and technical support[5,6]. This paper addresses the above issues, combines

multi-face recognition technology and multi-feature cascade database to design and implement a Web-based multi-entry face recognition customer management system for 4S car shop. The system can support the synchronization of multi-entry customer identification, and can efficiently identify and analyze customers, includes face detection, tracking, screening and recognition features. The system has been tested to effectively improve the efficiency of face detection, enables 4S car shop to focus on effective customers, increasing store transactions and customer satisfaction, which has certain practical value.

2. System Description

Web network architecture generally use the B/S structure (Browser/Sever), this architecture effectively unifies all clients, so that the core of the system functions are mainly focused on the server, the customer only needs to install a browser to use services and obtain data conveniently and efficiently[7].

Multi-feature cascade database is mainly in accordance with the collection of face image content, structure, texture, grayscale and other characteristics of the face image in the form of multi-feature stored in the database[8]. When face recognition is needed, by using the correlation of multiple features, we can quickly identify image feature matches to enhance the speed of identification and recognition efficiency.
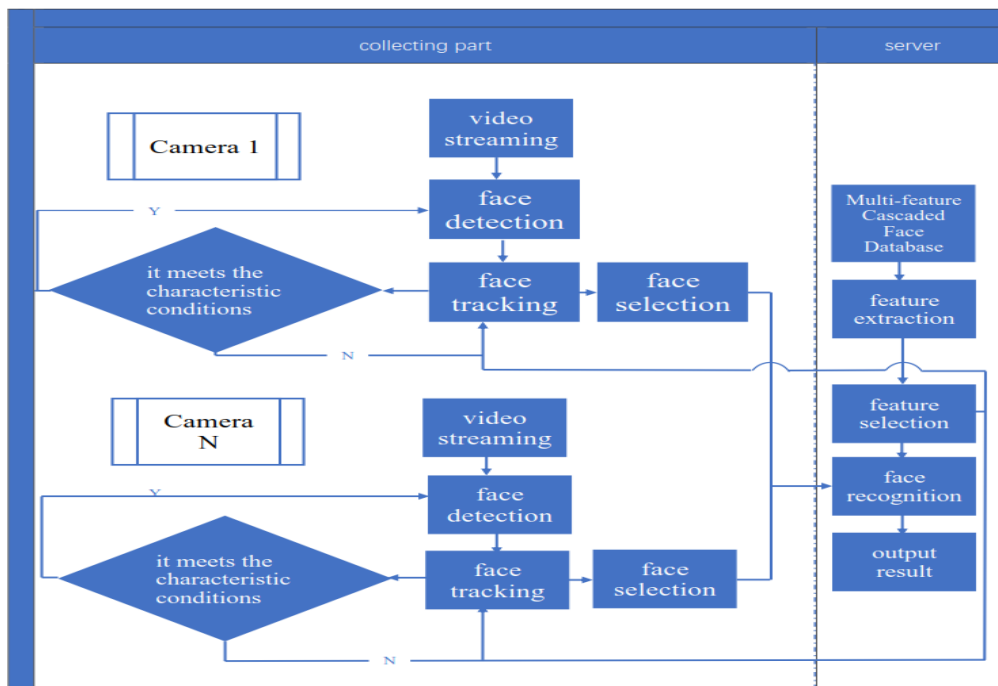

Figure 1: System schematic diagram

Introducing multi-camera and multi-face recognition technology, cameras at multiple entrances collect data in real time from different angles and connect to the same server, which is responsible for face recognition and processing in the background[9]. This system mainly includes a monitoring collection terminal and a backend server. The functions of the monitoring collection terminal include: video collection, faces detection, and face transmission; the functions of the backend server include: feature extraction and feature optimization, as well as face recognition. The monitoring collection terminal uses the HAAR model to crop face images from the video stream, and transfer all images to the backend server for processing. The backend server prefers valid images and

features to be stored in the database. At the same time, the server can load an offline database of face images for processing[10]. The schematic diagram is shown in Figure 1.

This paper reanalyzes and designs the architecture of multi-entry face recognition customer management system to meet the needs of 4S car shop, the overall workflow of the system is given and the data transmission path is designed. The system does not require intervention during the recognition process, saving personnel time and energy. The system can efficiently identify customers and process customer information, increasing store transactions and customer satisfaction. Salesmen are able to get rid of tedious account management tasks and spend more time on sales and customer service.

3. System Composition

The WEB-based multi-entry face recognition customer management system is oriented to the needs of the 4S car shop, mainly focusing on system integration and customized development for the 4S store business[11]. The system is designed in three main layers: database, application logic layer, and browser application (including mobile APP). By analyzing the needs of customer management, the system adopts the WEB-based B/S architecture model, and is managed and operated in a browser, which simplified system backend management, terminal installation, and maintenance, making it easier for more stores to share applications in the future. The system architecture is shown in Figure 2.
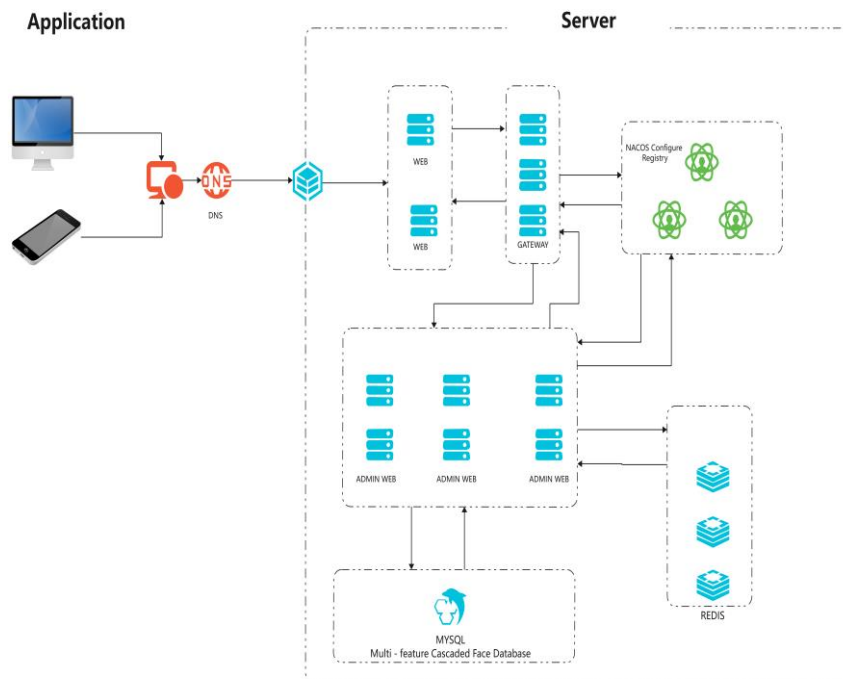

Figure 2: System Architecture Diagram

4. System Function Module Design

This system mainly achieves the communication connection between multiple cameras and the backend server. The camera captures face images in the 4S shop, automatically takes and uploads

pictures, sends them to the server for analysis[12]. The system supports functions such as querying, matching, and statistics. It can make backups to make sure data doesn't get lost, and can quickly update and restore the data. Here are the system components: system login, customer manager portal, customer management, target customer management, customer analysis, service management, system management, report management, and backup management. The functional modules of the system are shown in Figure 3.
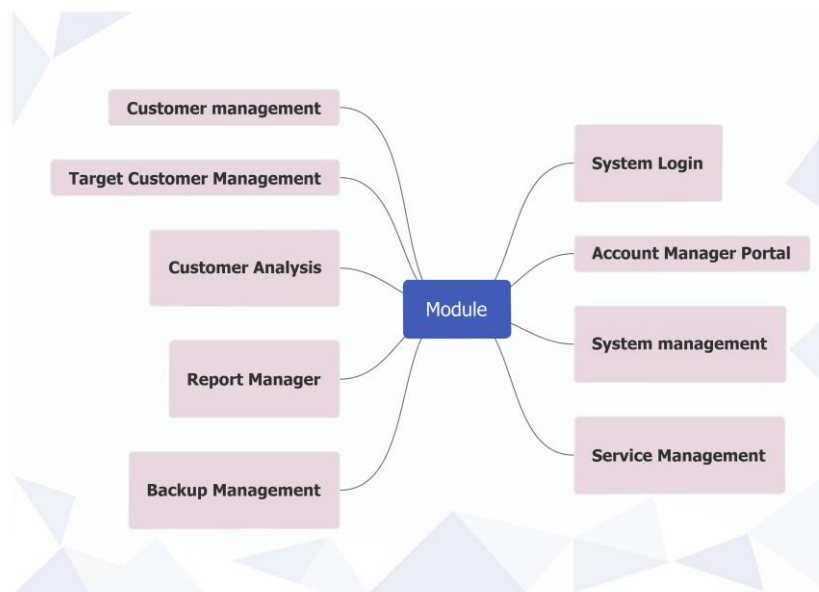

Figure 3: System Function Module Diagram

System Login: System login module verifies correct username, password, and code for access to management system.

Customer Manager Portal: Provides managers with an exclusive page for quick access to functional modules, enabling swift completion of operations and direct access to relevant information.

Customer Management: This module is mainly used to help customer managers view the personal basic information of customers, and by matching faces can identify key clients, helping managers target marketing more effectively.

Target Customer Management: This module is for viewing target customers, including unassigned customers, potential customers, and customer classification management. Only authorized users can use it.

Customer Analysis: This module is mainly used for querying and analyzing customer situations, such as the number of orders, transaction volume, etc. Customers can be analyzed according to different dimensions.

Service Management: Configuring client SMS push, including templates, frequency, range, and threshold.

System Management: This module manages users and permissions. Admins can modify personal info and menus.

Report Management: This module is used for statistical, query, and printing of customer manager's basic information and performance data. It can be retrieved based on query conditions and provide a basis for the performance assessment of customer managers.

Backup Management: This module backs up customer info, face images, and databases for future

retrieval and refresh.

5. Face Database Management

The database uses Mysql and stores multi-feature cascading databases. It can load offline face image database via the provided interface. It supports the storage and input of portrait photos and corresponding basic information, template data, as well as comparison results under asynchronous comparison mode. The system can group and store face images, feature data, and template data for various business needs. It can handle all kinds of business questions and keep track of logs, so you can see the latest status every day and look back at past logs. The system manages 4 DB types, as in Fig. 4.

Face feature database: Content, structure, texture, grayscale, and other features are stored as unique identifiers.

Face photo database: Automatically or manually selected high-definition facial photos are stored, with each facial photo calibrated for quality, angle, posture, and providing identification fields for calibration.

Face log database: The collection, selection, and storage logs of face images are stored, used for back-checking, checking, and comparison.
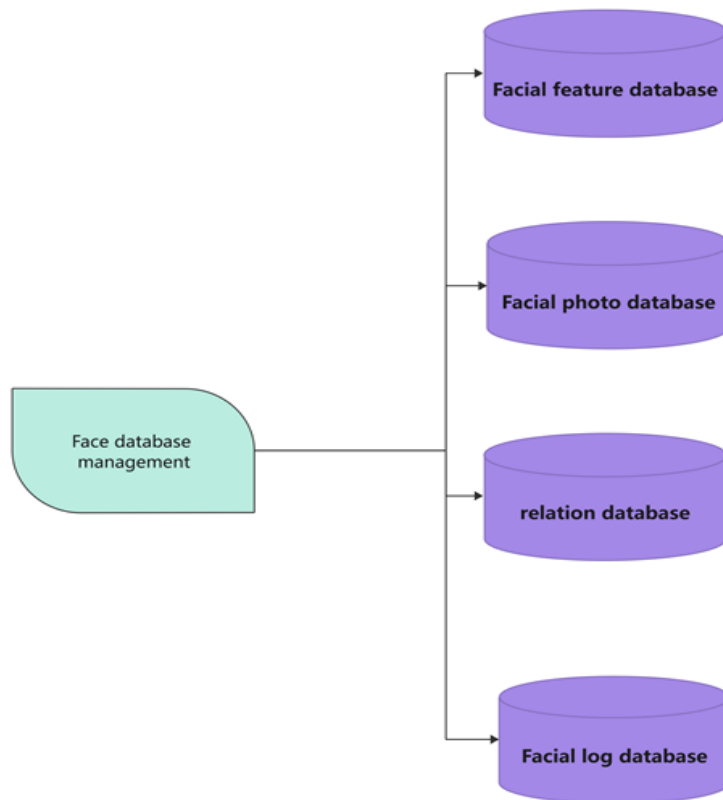

Figure 4: Facial Database Diagram

6. Conclusion

This paper fully considers the application scenarios of face recognition technology and proposes a WEB-based multi-entry face recognition customer management system for the 4S car shop. The system supports the synchronization of multi-entry customer identification, which can efficiently

identify and analyze customers for processing, greatly promoting the store transactions and customer satisfaction of the 4S car shop, and improving store efficiency. The results of this research will help promote the application and promotion of face recognition technology in the 4S car shop.

References

[1] Wang L, Li Q, Guo H. A research on deep learning model for face emotion recognition based on Swish activation function. Journal of Image and Signal Processing, 2019, 8(3): 110-120.

[2] Meng Q, Zhao S, Huang Z, et al. Magface: A universal representation for face recognition and quality assessment. Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. 2021: 14225-14234.

[3] Linares O A C, Botelho G M, Rodrigues F A, et al. Segmentation of large images based on super-pixels and community detection in graphs. Iet Image Processing, 2017, 11(12):1219-1228.

[4] Wu M, Zhao X, Sun Z,et al. A Hierarchical Multiscale Super-Pixel-Based Classification Method for Extracting Urban Impervious Surface Using Deep Residual Network From WorldView-2 and LiDAR Data. IEEE Journal of Selected Topics in Applied Earth Observations and RemoteSensing, 2019, PP(1):1-13.

[5] Coşkun M, Uçar A, Yildirim Ö, et al. Face recognition based on convolutional neural network. 2017 International Conference on Modern Electrical and Energy Systems (MEES). IEEE, 2017: 376-379.

[6] Kortli Y, Jridi M, Al Falou A, et al. Face recognition systems: A survey. Sensors, 2020, 20(2): 342.

[7] Wang X. Intelligent multi-camera video surveillance: a review. Pattern Recognition Letters, 2013, 34(1):3-19.

[8] Chen J, Jenkins W K. Facial recognition with PCA and machine learning methods. 2017 IEEE 60th international Midwest symposium on circuits and systems (MWSCAS). IEEE, 2017: 973-976.

[9] Coşkun M, Uçar A, Yildirim Ö, et al. Face recognition based on convolutional neural network. 2017 International Conference on Modern Electrical and Energy Systems (MEES). IEEE, 2017: 376-379.

[10] Held C, Krumm J, Markel P, et al. Intelligent video surveillance. Computer, 2012, 45(3):83-84.

[11] Tang J, Su Q, Su B, et al. Parallel ensemble learning of convolutional neural networks and local binary patterns for face recognition. Computer Methods and Programs in Biomedicine, 2020, 197(1): 622.

[12] Kak S F, Mustafa F M, Valente P. A review of person recognition based on face model. Eurasian Journal of Science & Engineering, 2018, 4(1): 157-168.