Certification Training Information Management System for Drilling Personnel Based on MVC Mode

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Abstract: *In the current development process of oilfield enterprises, the decisive role of innovation driven and talent development is highlighted. Standardizing training management work and effectively improving the level of training management is to meet the needs of the implementation of the "Talent Strong Enterprise Project" and high-quality development of enterprises. This article is a management system based on MVC mode designed according to the existing certification training management needs of A Drilling Company. It is deeply integrated with the enterprise portal to build a collaborative and efficient integrated portal operation platform and system. It realizes the dynamic management and sharing of certification training information for drilling personnel, enhances the planning and foresight of certification training for drilling personnel, and meets the needs of qualification certification and drilling safety production. We have achieved refined and efficient management of employee certification training information in enterprises.*

Keywords: *Information Management System, Certified training, Model-View-Controller mode*

1. Introduction

In recent years, with the rapid development of emerging technologies such as cloud computing, big data, and artificial intelligence, Chinese petroleum enterprises are in a critical period of widely applying new generation information technology and accelerating digital transformation to enhance comprehensive competitiveness. As a special position personnel, drilling team employees holding certificates are an important guarantee for safety production, an important measure for standardized management, and a firewall for personal safety in their work [1].A drilling company's certification management involves a large number of personnel, certificates, and management departments. The overall certification management is in a rough and chaotic state, and the management of certificate information is still stuck in a paper-based management mode, unable to monitor and analyze the certification status of employees in real time. In the work, it is often overwhelmed due to different certification requirements and overdue certificates, and certificate management has become a skin pain for various units, Becoming a bottleneck that restricts enterprises from maintaining production and operation and venturing into the market. To completely solve these problems, it is necessary to step out of the traditional management mode and introduce information management technology to participate in management. It is urgent to build a networked certification training information management system that takes employees as the management object, job certification requirements as the management standard, and employee certification status as the work focus. This will achieve refined and efficient management of employee certification training information by enterprises.

In terms of enterprise information management, many foreign experts and scholars have conducted in-depth research and proposed relevant theories and analytical methods. The SW-CMM model, also known as the Capability Maturity Model, is a software maturity model developed by the Software Engineering Research Institute of Carnegie Mellon University in the 1980s to evaluate software. The main purpose of this model is to optimize the software development process, enabling software development to achieve active optimization, more standardized processes, more mature content, and more scientific and efficient software design and development. After studying some mature methods and theories of information management in Western countries, some experts and scholars in our country have proposed information management theories and methods that are in line with the current development status and national conditions of Chinese enterprises. Li Yang takes the information management of a large steel structure processing enterprise as the research object. Through the Mitchell model and enterprise system planning (BSP) method, he formulates the goals of enterprise information management

and proposes an optimization plan for information management, which also provides reference and inspiration for other manufacturing enterprises [2-3].

At present, there are many mature management methods for employee training management within petroleum enterprises, but there is no systematic management for training certificate information management. The development of this system aims to provide a new management mode for certified training information of drilling team personnel in the company. The promotion and application of this system enables multi-dimensional and fast querying of employee information, quickly completing data collection, organization, and analysis work, providing technical support for training work, improving the training and education system, and promoting the continuous and efficient operation of enterprise training work.

2. System analysis

2.1 System login analysis

Based on the high security of the system, all users need to use a unique account to log in to the system. The system judges the legality, accuracy, and complexity of the input data based on the input information. If there is inconsistency, corresponding prompts are given and the next logical processing is carried out. If there is consistency, the login is successful and the system jumps to the next logical interface, as shown in Figure 1.
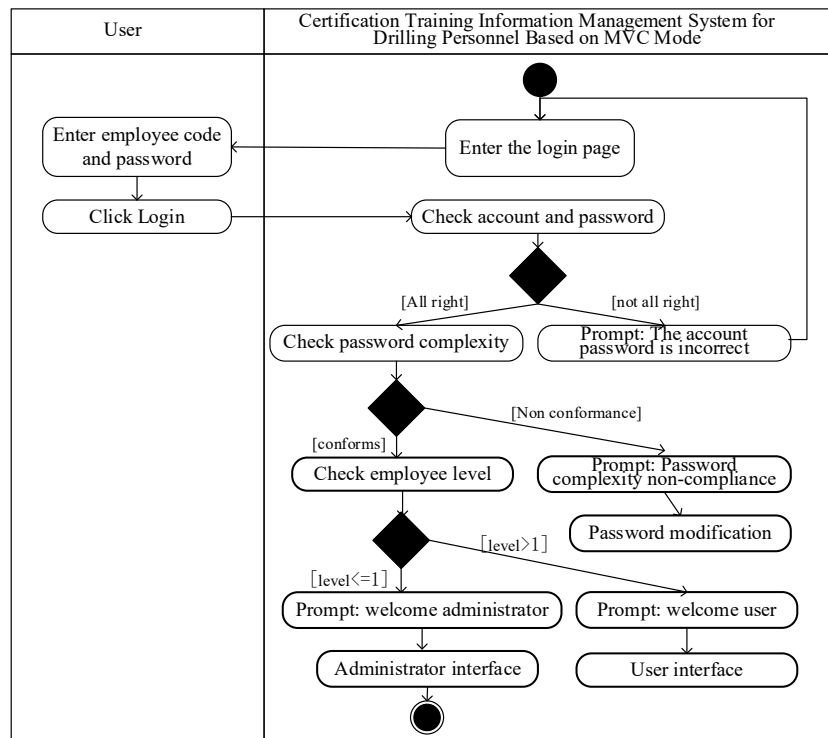

Figure 1: Login function activity diagram

2.2 Functional requirement analysis

In terms of job responsibility allocation, the Human Resources Department of Company A is responsible for organizing training courses for all employees, managing certification training information, and coordinating the relationships between the company's government agencies and various directly affiliated units. The company's well control training base is directly led by the Human Resources Department and is responsible for the training, certification, and issuance of certificates for all employees of the company. Each directly affiliated second level unit of the company is directly led by the Human Resources Department and is responsible for managing the certification status and personnel transfer of personnel on duty in the unit.

After segmenting and positioning the company's certification training business, the main functional

modules that the management system needs to implement mainly include: basic data management of drilling personnel certification training, certification training data query, system category library management, temporary certificate management, personnel transfer management, etc. The management of certified training information for drilling personnel involves a wide range of personnel, a large base, multi-level employees, multiple types of certificates, and one person holding multiple certificates. The management system is divided into system administrator function modules and user function modules based on different levels of employee hierarchy, management permissions, and security and confidentiality levels. Users can enter the corresponding management interface through different specified permission ranges, Manage the data within one's own permission range, as shown in Figure 2.
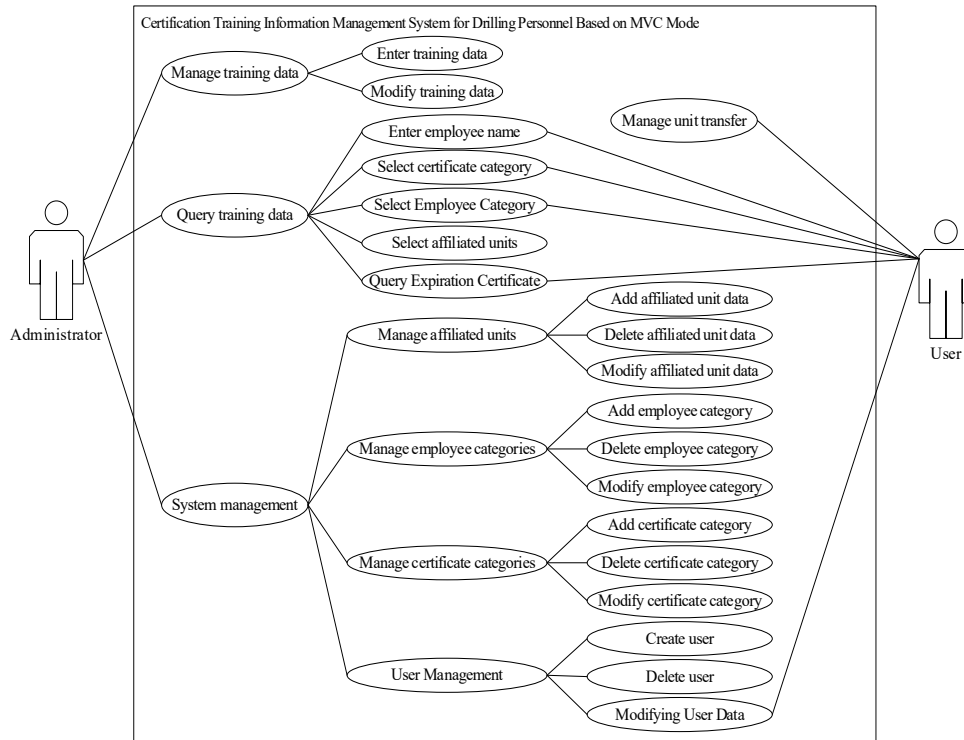

Figure 2: System use case diagram
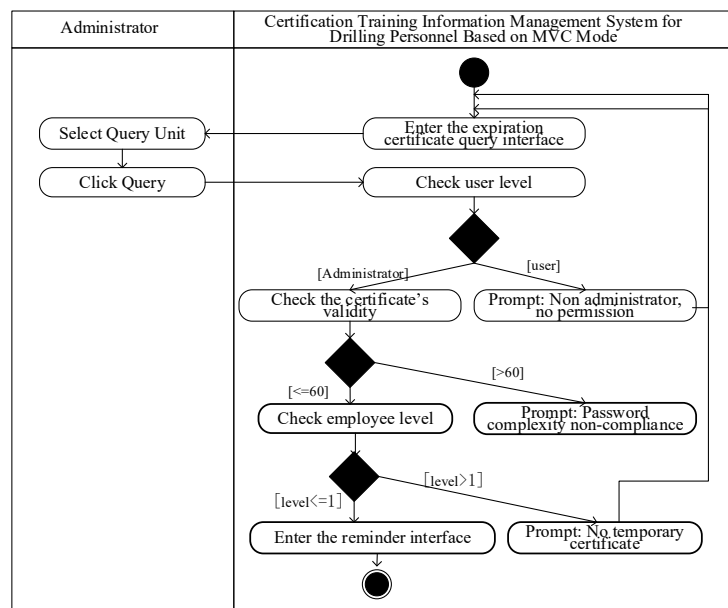
2.2.1 Administrator Function Analysis

Figure 3: Activity diagram of expiration certificate reminder function

Administrators use training data management cases to input, modify, delete, summarize, and store the basic data of licensed training; Add, modify, and delete information such as secondary units, employee categories, certificate categories, and users through system management use cases; The training data query use case allows for the query of certified training information based on conditions such as employee name, certificate category, employee category, and affiliation; The use case for querying expiration certificates can be used to query expiration certificate information, including employee name, employee code, certificate category, overdue time, and other information. The activity diagram of the expiration certificate reminder function is shown in Figure 3.

2.2.2 User Function Analysis

Ordinary users can use training data query cases to query licensed training information based on conditions such as employee name, certificate category, employee category, and expiration certificate; Perform unit adjustment operations on certified training information for personnel transferred to this unit through the use case of unit transfer management; Passwords can be modified through the password modification use case.

2.3 Functional structure analysis

In terms of system functional module design, module decomposition is an important principle in software design, which can simplify complex problems and solve them through decomposition. The functional modules of the drilling personnel certification training information management system proposed in this article mainly include: training data query module, training data management module, and system management module, as shown in Figure 4.
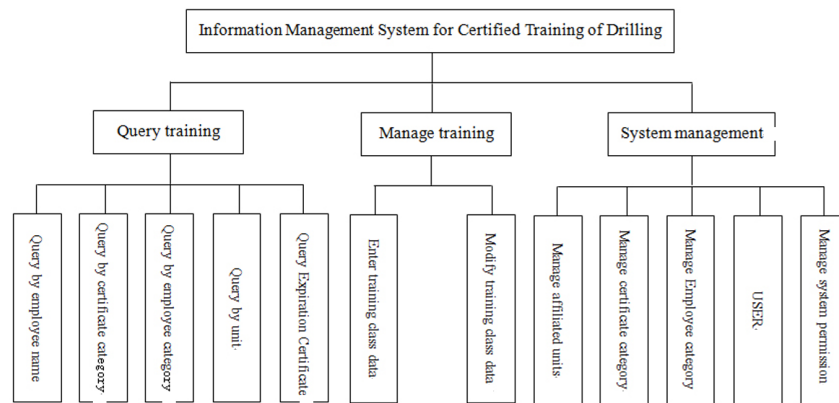

Figure 4: System function diagram

3. Systems design

3.1 System Designing principle

The design of the system requires the following conditions: a management system architecture that supports multiple users with different permissions to use online simultaneously, ensuring data sharing and interaction; Support an information search system based on intelligent search engines to ensure fast and accurate access to relevant information; The system has open interfaces, powerful functional expansion capabilities, and the ability to integrate with other application systems.

The design of the system should meet the actual needs of the company, provide practical problem solutions, focus on functional requirements, consider non functional requirements, respond quickly, and be able to import and implement reliably and stably.

3.2 Portal interface design

After successful authentication, you can access the authorized application system and enter the login homepage of the licensed training information management system [4-5], in order to effectively ensure the overall security of the system and ensure its security and high availability. The management personnel of Company A's well control training base release integrated media information such as training plans,

educational news, and training announcements through the management portal.

3.3 System Technology Architecture Selection

The system adopts a B/S structure,platform development using. NET+MVC pattern framework, and the database adopts SQL Server database. The system logic architecture is designed using the MVC pattern. The type relationship and function of MVC components are shown in Figure 5.

The physical architecture of the certification training information management system for drilling personnel is divided into three levels, consisting of a data layer, a logic layer, and an interface layer. The data layer mainly interacts with data tables in the database and serves as an interface for data exchange between the database and other data sources. The logic layer mainly implements the control logic of various functional modules in the system, processes operation requests from the interface layer, completes logical operations, including data loading, data parsing, data fault tolerance, etc., and returns operation results to maintain communication between the interface layer and data. The interface layer is implemented through ASP.NET technology implementation, supporting user system interaction, including user login, main interface, training basic data management, training data query, system management, expiration certificate reminder and other content interfaces.
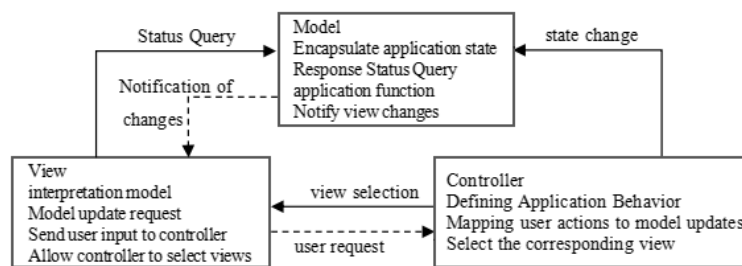

Figure 5: Relationship and function of MVC component type

3.4 Database design

The database is responsible for maintaining and managing data information. The background of the certification training information management system for drilling personnel proposed in this article uses SQL Server database. This article uses an E-R diagram to represent the relationship between data entities, as shown in Figure 6.
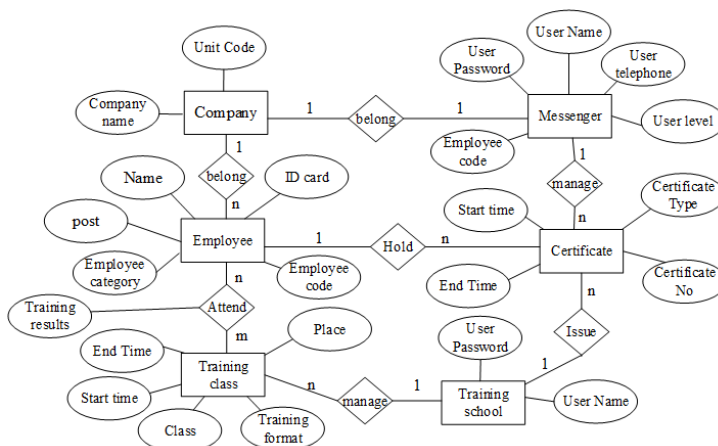

Figure 6: Database E-R diagram

The allocation of system permissions is a guarantee of system security. Users log in according to their own roles, and different roles have different permissions to access the system. System administrators have super permissions to manage users and assign permissions based on user roles. The user permission data table is shown in Table 1.

Table 1: User Table(PXGL_USER)

Field name	Data type	Length	Primary key	null	describe
User_ID	varchar	40	yes	no	System ID number
User_NAME	varchar	12		no	User Name
User_CODE	varchar	10	yes	no	User employee code
User_PASWORD	varchar	13		no	User Password
User_JIB	varchar	8		no	User level
User_DW	varchar	60		no	User's unit

The storage of information is reflected in the design of data tables and the connections between them. In addition, the database of this system also includes a certificate training information data table, a affiliation data table, a certificate category data table, an employee category data table, etc., as shown in Table 2.

Table 2: Certificate Category Table (PXGL_ZSLB)

Field name	Data type	Length	Primary key	null	describe
ZSLB_ID	varchar	12	yes	no	Certificate category ID number
ZSLB_NAME	varchar	30		no	Certificate category name
ZSLB_CODE	varchar	20		no	Certificate category code
ZSLB_BZ	varchar	50		no	notes

4. System implementation

4.1 System User Interface Implementation

The user interface is the only way for users to interact with the system, and the user interface design of this system adheres to the principles of simplicity, clarity, minimal memory burden, and high security. The login interface of the system is shown in Figure 7.

Figure 7: System login interface diagram

4.2 Implementation of Training Data Management Module

Training data management mainly refers to the administrator's input, addition, modification, and deletion of basic data for various certified training courses, including HSE certificate training, well control certificate training, hydrogen sulfide certificate training, emergency certificate training, first aid certificate training, on-the-job certificate training, drilling operation certificate training, and other basic data. Training data entry interface, enter necessary training basic information for confirmation, click submit input, send a request to the server, the server responds, connect to the database to perform the input operation, return a successful input result prompt, and save the training basic information added by the user.

4.3 Implementation of Training Data Query Module

Training data query mainly involves querying the basic data of licensed training according to different composite conditions, including querying by employee name, unit, employee category, certificate category, and expiration certificate. When the user clicks on "search by name" on the homepage, the system will automatically redirect to the page. After selecting the search unit and clicking the "search" button, they can perform a conditional search.

4.4 Implementation of system management module

System management mainly involves administrators entering, adding, modifying, and deleting database data such as users, affiliations, certificate categories, and employee categories; Ordinary users are responsible for managing personnel unit transfers and password changes. The interface implementation results are shown in Figure 8.

Figure 8: System Management Module Interface Diagram

5. Conclusions

This system adopts the method of binding enterprise organizational structure with application positions, solidifying the certification requirements for each position into the system. Each drilling employee can see the certification requirements for their position, so that they can more timely grasp the latest updates on their certification. Each unit authorizes hierarchical administrators to only manage the certification training information of their own employees, disperse data volume, and reduce the work pressure of hierarchical administrators. It effectively solves the problems of unclear management standards for job certificates, inadequate management, and difficulty in obtaining certification for employment. By utilizing the dual high security mechanism of enterprise portal IAM identity authentication technology and password verification, unified identity management and authentication can be achieved. With the help of portal control capabilities, system services and information security protection capabilities can be enhanced, enhancing system security management. The system provides warning and reminder functions for various types of certificates with re examination and expiration dates. Management personnel of each unit can respond in a timely manner, book a reasonable time, plan employee training work in advance, avoid delaying the construction and production of the drilling team, eliminate hidden economic losses of the company, and have certain practical application value for improving the company's economic benefits and comprehensive competitiveness.

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