Scheme Design of Structured Process Data Management System Base on Android

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Abstract. The traditional paper process regulation form wastes a lot of resources and has low circulation efficiency, which is difficult to promote the digital transformation of enterprises. Based on Teamcenter platform, Process knowledge base and bill of processes can be built. Extract and summarize structured process information through Teamcenter and output process regulation form. On this basis, this paper develops an Android Application of process data management, which transmits the electronic process regulation form to the Android Application of process data management through JSON format in the internal LAN of the enterprise, to guide the operation and production. Verified by enterprise users, the process management collaboration platform improves the enterprise business flow, process preparation efficiency and process knowledge reuse rate, reduces many processes data redundancy, and lays a foundation for the digital transformation of enterprise process data management.

Keywords: Process, Teamcenter, Secondary development, Android.

1. Introduction

Process design is the key link between product design and product manufacturing. At the same time, it is also closely related to quality management, workshop operation planning and other departments. It is receiving more and more attention and has become one of the bottlenecks restricting the development of enterprises. This is because the traditional process design mainly depends on the technical level, experience, habits, and production experience of process personnel. With strong personality and low efficiency, it has become more and more unable to meet the needs of modern manufacturing mode with multiple varieties, small batch, and short delivery time.

At present, all departments use paper-based process documents or instructions outside the system, resulting in the fact that the process documents used on the factory production site cannot be paperless, and the connection between the process and the process change order cannot be realized. This paper develops an Android application for process data management, which calls WebService service in the internal LAN of the enterprise to complete the data interaction between the client and Android APP for process data management, and realize the collaborative management of process data between Teamcenter and android APP [1-4].

The main contents of this paper include: (1) process data management android app server and front-end function module interface design. (2) Database design, call WebService service to complete the data interaction between client and Android APP for process data management, and realize the collaborative management of Teamcenter process data and android APP.

2. Process data management scheme design of Android APP

The android APP for process data management is divided into two parts: the Server and the Front. The front is an APK application developed based on Android and deployed on mobile terminals. The server is the service required by the system and is deployed on the enterprise intranet.

The whole system design is divided into three layers, including mobile application layer (interface presentation layer), mobile service layer (logic layer), integration service layer (interface layer) and enterprise resource layer (data layer).

The mobile application layer is mainly the user interface, which is responsible for realizing terminal services such as interface display and user operation, including downloading and uploading process specification reports, document viewing, process step execution, etc.

As the file container and database for front-end document viewing, the mobile service layer is responsible for data interaction with the mobile service database, including mobile app user management, relevant configuration logic, supporting document online browsing and data storage.

The integration service layer software includes mobile application web service container and web service interface. It is the service interface developed by each system for the call of front-end app business functions, which are deployed on their respective servers according to the situation. The enterprise resource layer includes the existing PLM system and the newly added mobile service database. The newly added mobile service database is mainly used for the storage and management of users and related configurations. As the data source of the whole system, it is accessed interactively through various service interfaces.

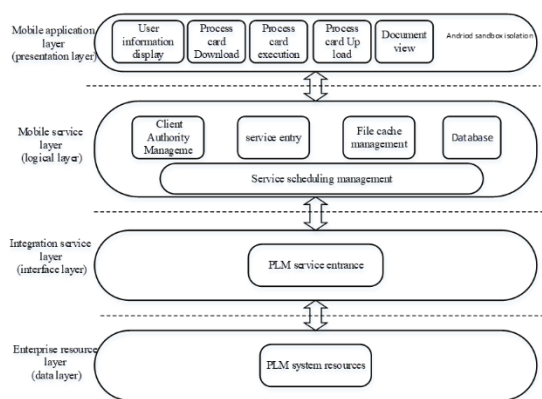The system structure diagram is shown in Fig. 1.

Fig. 1 The system structure diagram

3. Android APP interface design for process data management

3.1 Design of android APP server interface for process data management

Record the information of all users on the mobile server, including login records, online status, etc. When the mobile user initiates the downloading and uploading of process data information, it sends a request to the mobile server, and the server interface is responsible for the recording and transmission of data.

The interface design of each functional module of process data management APP server is shown in the table 1.

Table 1. Interface of each module of the server

Serial number	Interface	Purpose	Remarks
1	work-instruction-tcservice.src.main.com.avic.workinstruction	Acquisition of process data information; Process data information update	SOA development
2	work-instruction-tcservice.src.main.com.teamcenter.clientx	Process data information operation tools	Tool classes for SOA development encapsulation
3	work-instruction-tcservice.src.main.resource	Resource file used to configure user name, password, IP and port number	Configuration file
4	work-instruction-tcservice.target	Generate the target file of war	Target file

3.2 Design of android APP client interface for process data management

The interface design of each functional module of Android APP client for process data management is shown in the table 2.

Table 2. Interface of each module of the Cilent

Serial number	Interface	Purpose	Remarks
1	work-instruction-v2.src.views.login	Login interface rendering	Login interface
2	work-instruction-v2.src.views.dashboard.admin	Homepage interface rendering	Welcome to the process data management interface
3	work-instruction-v2.src.views.workcard	Process data information download and process data information upload interface rendering	Process data download and upload
4	work-instruction-v2.src.components.WorkUnit	View the downloaded process card information and improve the process card information	Detailed interface rendering of mobile terminal process data
5	work-instruction-v2.src.components.ScrollPane	Rendering of menu bar of mobile end process data and server end process data	Click the menu bar to go back and view the corresponding interface
6	work-instruction-v2.src.router	Process data routing configuration, routing determines the direction of the page	Page Jump, redirect
7	work-instruction-v2.src.store	Store function, store shared information	Used to store shared data
8	work-instruction-v2.src.style	Introducing external styles	Introduce common styles and animation effects
9	work-instruction-v2.src.utils	Process data management tool package	Open files, log in to media, etc.

4. Selection of process information collaborative management platform and development tools

The system is mainly based on the analysis of user needs, configure the appropriate system environment, select the supporting hardware and technology to build each module, so as to realize the design scheme of the whole system. The process information collaborative management and process procedure release system is based on the PLM Software teamcenter11 platform of Siemens and has been realized through secondary development. The development environment deployment of the system is as follows.

Platform: Teamcenter11.3
Computer programming language: Java
Operating system: Windows Server 2016 standard
Development tool: Eclipse4.4.2 + Tomcat9.0.30
Android development version: Android 7.0

5. Function realization

5.1 Realization of user management function

System login management is generally a security barrier of the system. Only qualified users can log in. The system should verify whether the username and password entered by the user are correct. The mobile app user account is consistent with the PLM platform account, and the validity of its account is verified on the PLM platform server. In the login interface of the mobile terminal, the user

needs to fill in the username and password in the username and password dialog box, click login, if it does not meet the authentication information, the system prompts to re-enter, if it meets the authentication information, directly enter the main interface of the system. The login logic is shown in Fig. 2. After logging in the system successfully, users can use the functions within the permission of the account.
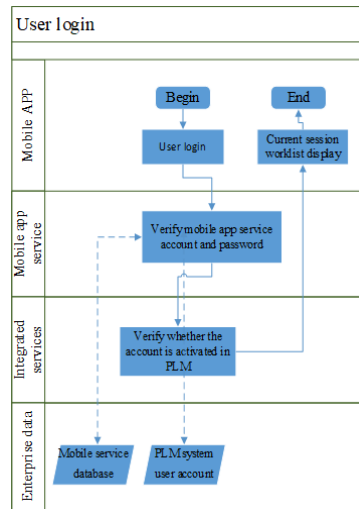

Fig. 2 The login logic

5.2 main interface

The main interface mainly displays the current user's basic information, Navigation view, user exit, etc. It can jump to other function pages through the navigation area in real time. The key in the upper right corner of the main interface is the exit login function key, and the navigation key in the upper left corner is the navigation key of each view. The interface design is shown in Fig. 3.
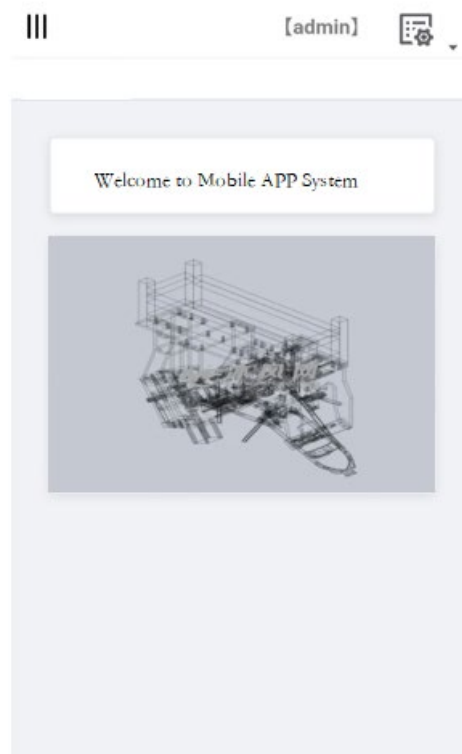

Fig. 3 The interface

5.3 Process card query

The process information system stores the process information in the server in the form of electronic process card, and the mobile device queries and downloads the process card from the server on demand through networking. Process cards are divided into different types according to different execution types, which is convenient for people in different departments to manage and quickly query the required process card information. The user selects the process card type to be queried, and the interface displays the query configured in the background. The query conditions are set according to the requirements. After the query is executed, the query results can be displayed on the interface. The logical control flow of job card query and content attribute display is shown in Fig. 4.
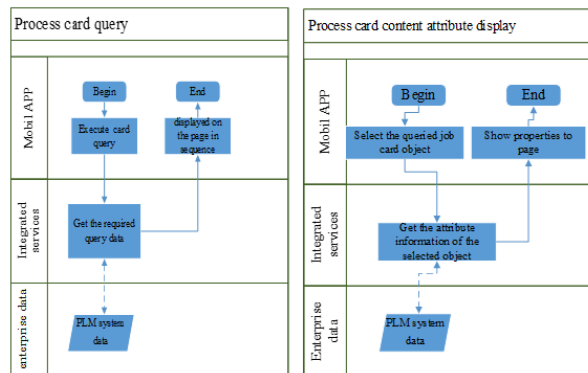
Fig. 4 The logical control flow

5.4 Process card execution

After completing the process card query and downloading as required, the user can click the downloaded process card to open the content details, view the process information, and select the process card to execute. The executed process card considers that the process content of the current process card has been executed, select the process card, upload it, and return the process card execution information to the server at the same time.

6.   Platform test

This test uses the virtual machine loaded with Windows Server 2016 standard system as the server and Meilan note6 of Android system as the mobile client. The system version tested is Android 7.0. This test focuses on black box test, also known as function test, which is to check whether each realized function of the system can be used normally [5-8]. The test environment is shown in Fig. 5.
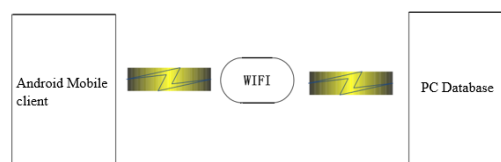
Fig. 5 The test environment

The system includes several modules, such as process resource database, process design, output work order, process card download, process card execution, process card upload and so on. In order to ensure that each system module can meet the user's use requirements, this paper checks whether the data input and output meet the requirements through test cases.

6.1 Mobile terminal and client connection login test

The purpose of this test function is to judge whether you can log in. In order to ensure the security of system information, users are required to enter user name, password and other information when logging in the system, and the information must be correct. When logging into the system, users with

different identities have different login permissions and operation permissions. When the user completes the correct user name and password input, he can successfully enter the platform for corresponding operations. The test results meet the requirements.

6.2 Interactive test of process information between mobile terminal and client

The important research content of this system also includes the connection between Android mobile terminal and Oracle database and the data interaction between mobile terminal and server. After successfully creating entity classes and tool classes, the client can interact with the server, and the data returned by the server is displayed on the Android client in JSON format. The server checks whether there is a request to listen to the Android mobile client through port 8099. The mobile terminal accesses the server interface through the server's IP + port number 8099. The mobile terminal remotely invokes the server's data through WebService. If the server interface is published successfully, the server's data can be accessed at the mobile terminal. Figure 6 shows the success of the mobile terminal connecting to the server.
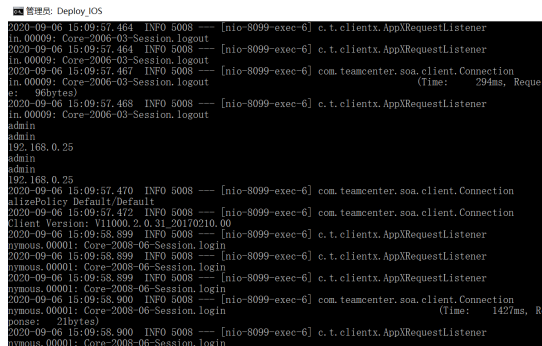

Fig. 6 Connection server display

After the Android mobile client sends an HTTP request to the server to obtain the job card data, the server will send the data to the mobile client after listening to the request. The Android mobile terminal parses the job card data in JSON format sent from the server and presents it on the screen. Part of the data accessed by the server is shown in Figure 7.

Fig. 7 The data accessed by the server

7.　conclusion

Based on Teamcenter platform and mobile Internet technology, this paper develops a process data management platform based on Teamcenter platform and an android app system to assist production personnel to access process information. Through the cooperation of the two systems, the two-way correlation between product process and manufacturing is realized. The system adopts the concept of PLM and structured form to manage process data. After running, the consistency and relevance of product data transmission can be realized. The following key technologies are applied in the design and implementation of process data platform, including client plug-in development, web service data interaction technology, Android application development, etc.

Acknowledgments

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