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Design and implementation of production tracking systems

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Abstract

In recent years, the quality and safety issues of agricultural products have frequently arisen, which not only poses a huge threat to people's health, but also reduces people's trust in the government. In order to ensure the quality and safety of agricultural commodities, the relevant information of each process of agricultural products from production to marketing is recorded in detail, and the output, storage and inflow information of agricultural products can be viewed to enhance the quality and safety of agricultural commodities Control. At present, in order to enhance their core competitiveness, more and more agricultural products merchants hope to improve production efficiency by building related product tracking systems to achieve agricultural product production management, production scheduling, workshop management, quality supervision, product tracking and other functions of their own products. The barcode-based factory product tracking system is mainly written through the C# language, and the corresponding tracking and recording is carried out with the help of barcode recognition technology. Visual Studio 2019 is the main software development platform, and SQL Server is the corresponding database. The operator can track and manage the product by scanning the code. At the same time, this system provides users with a more convenient and fast interface, and has the characteristics of intuitive and convenient operation, simple and generous in design. The system investigates and analyzes the specific production process of the factory to ensure that it can solve practical problems, and improve work efficiency while reducing production costs as much as possible, with the goal of making enterprises using this system have a greater competitive advantage in the future development.

Keywords

Agricultural products; Product management; Barcode tracking.

1. Introduction

At this stage, with the increasingly fierce competition in the external environment, all enterprises want to enhance their competitiveness, if the material products or services provided by the relevant enterprises do not have specific process records, then the information transparency of such a product chain is not clear. To develop each specific process in the product chain, the logistics and information in the product chain should not be well coordinated, and the full control of the product tracking process should be realized to achieve transparency of production information This tracking management system is proposed with the goal of enhancing responsiveness, reducing costs and improving competitive efficiency.

2. Introduction to system development tools

2.1. Visual Studio Brief introduction

Visual Studio is an application development environment from Microsoft Corporation[1]. The interface of its environment is more polished, simple and straightforward. Support for

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Microsoft SQL Server, but also for IBM DB2 and Oracle. At the same time, you can create applications under the Windows platform.

2.2. Introduction to SQL Server

SQL Server is a large relational database from Microsoft[2]. It has the advantages of easy to use and high integration with related software, and can be used across multiple platforms. It is a comprehensive database platform.

2.3. MVC frame

The MVC (Model-View-Controller) framework is used in this system. The MVC framework is mainly divided into three parts: model, view and controller [3]. It is to separate business logic, data and interface display, and concentrate part of the business logic into specific components, and when operations and interactions are required, the business logic is not rewritten, which has the purpose of improving efficiency. M stands for model and represents business rules. V stands for view and refers to the interface. C is the controller, which refers to the simultaneous call of the model and view that accept interaction.

First the user sends a request to the controller, and the controller sends the request to the model. The model interacts with the database, completes the required actions [4], then selects the view display, the user gets feedback, and the next action is performed, and so on. Figure 1.1 illustrates their relationship.

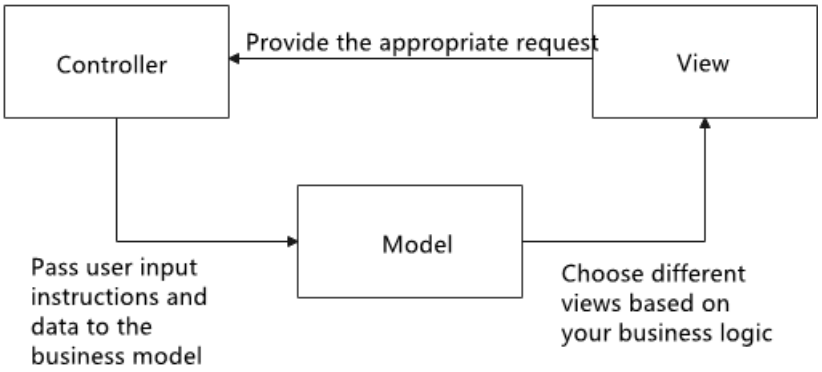

Figure 1.1 Model-view-controller relationship

2.4. EF frame

The Entity Framework abstracts data structures, converting objects in a database into application objects, data fields into properties, and relationships into combined properties. Convert the E/R model in the database to the object model, so that users can access it in a more familiar language [5].

Advantage of the EF framework: It eliminates the need for programs to have hard-coded dependencies on the storage architecture of a particular data engine. The mapping between the conceptual model and the storage schema can be modified without changing the program code. And the same storage architecture can map multiple conceptual models [6].

2.5. Barcode technology

Barcode technology is based on the computer and information communication two technologies on the basis of the development of a technology with coding, printing, data collection, identification, and processing functions [7], widely used in commercial, mail, storage, product production and other fields of identification, and has the characteristics of fast input speed, high accuracy, low cost, occupies an important position in the field of identification.

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A barcode is a mark that consists of a bar, a blank, and a corresponding character. "Bar" refers to the part that reflects low light, "empty" refers to the part that reflects high light, and the bar and empty with different widths are combined to express specific information, which can be read by the device and converted into information that can be recognized by the computer. Generally speaking, the code of an item is unique, and when the information on the bar code is transmitted to the computer, the identified data can be processed accordingly. The barcode is composed of three parts, which are the static zone, the barcode area, and the character number area.

3. System requirements analysis

3.1. System requirements description

The construction of this factory product tracking system should be able to simplify the production process, reduce the work burden, improve production efficiency, and the product quality can be easily traced. In order to achieve this purpose, the system should be able to realize the management and statistics of contract delivery orders, weekly plan management, shift plan management, product flow card generation and management, pallet identification card generation and management, automatic generation of code transfer plan, inbound and outbound management and other functions. Realize the traceability of all process information from the production department to the contract transmission order to the product outbound link to ensure product quality. The system simplifies the process, reduces the burden and improves production efficiency by automatically planning the code transfer plan, scanning the pallet identification card, simplifying the information required to generate product flow cards and pallet identification cards, and automatically printing them. At the same time, the data generated by the system can be statistically analyzed to help optimize and improve production .

3.2. Functional requirements

The system is roughly divided into three parts for the production process of products, which are production planning, production tracking and data management [13]. The production plan includes the creation of the contract transmission order, through the weekly plan formulation process and the shift plan formulation process. The production tracking part includes the corresponding production link, brick and packaging link, inventory management link to product delivery. The last section allows you to categorize the user's roles and functions. From the above perspective, the traceability of the product production process is realized, and certain statistics and analysis are carried out based on the system data.

3.3. User role analysis

3.3.1. Primary user type

Administrator: view the progress information of each batch of contract delivery order, view statistical data, and product traceability;

Trade Department: order generation and management, input contract transmission order information;

Weekly planner: maintain contract delivery slip information, develop and manage weekly plan;

Class planner: assign the weekly plan to each machine, formulate and manage the class plan;

Quality inspector: generate product flow card, check the completion of the shift plan and enter it into the system;

Kiln area operator: use barcode equipment to record the relevant information of products entering and leaving the production workshop in the form of scanning codes, and plan the expected kiln shift;

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Code brick quality inspector: print the generated code conversion plan, manage the actual number of code bricks, etc.;

Warehouse manager: Record the work related to inbound, outbound and inventory inquiries.

3.3.2. User operation functions and related use case analysis

Based on the analysis of the user's role and related functions, the following subdivision structure of the system is determined.

1. Administrator operation function and use case analysis

In the system, the administrator has the most permissions, the administrator can assign permissions to other users, view and debug the specific data of each link of the system, and can also statistically compare the production of each machine, and at the same time can carry out overall statistics and analysis of the number of production, with the identity of the overall controller.

The administrator use case analysis is shown in Figure 3.1.

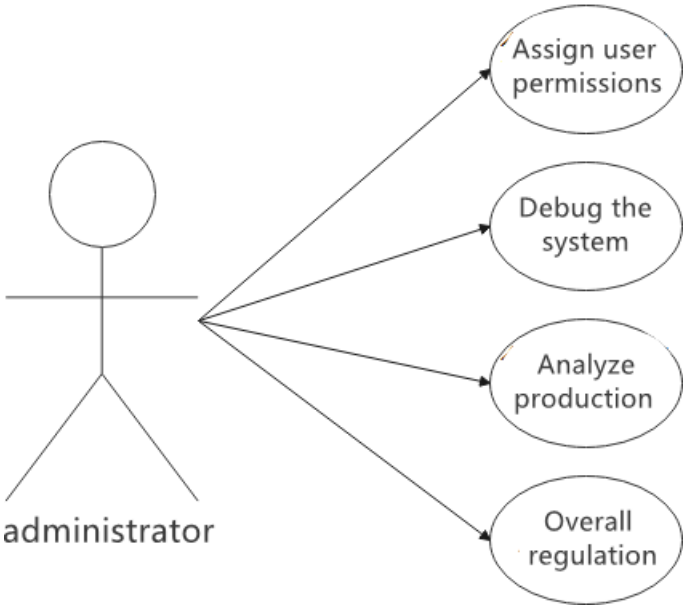

Figure 3.1 Administrator

Table 3.1 shows the administrator operation functions and use cases.

Table 3.1 Administrator operation functions and use case analysis

Example name	Administrator use cases
Use case description	The specific operation permissions of the administrator
executor	administrator
Prefix	The administrator user logs in successfully and performs related operations in the administrator state

2. Analysis of the operation functions and use cases of the personnel of the Ministry of Trade

The staff of the Trade Department mainly imports the received contract transmittal slip into the system so that the remaining links can proceed smoothly. The Department of Trade use case analysis is shown in Figure 3.2.

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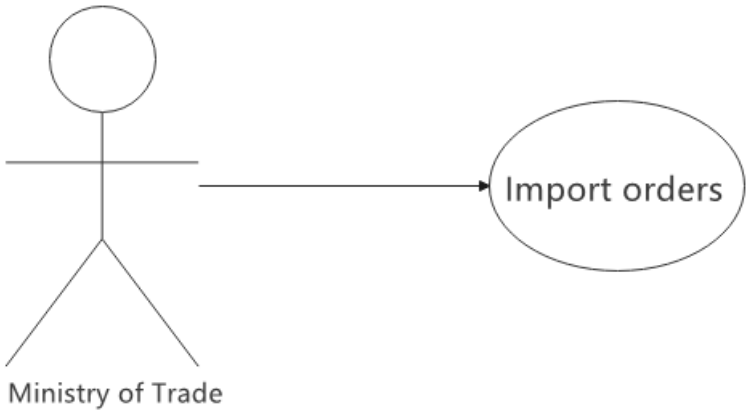

Figure 3.2 Ministry of Trade

The operation functions and use case analysis of the Ministry of Trade are shown in Table 3.2.

Table 3.2 Analysis of operational functions and use cases of the Ministry of Trade

Example name	Department of Trade use case
Use case description	The specific operation of the personnel of the Ministry of Trade
executor	Ministry of Trade
Prefix	Successful login, contract delivery slip and other related materials are prepared
Basic operating procedures	Import of contract routing slips and management of contract routing orders at the same time

3.Weekly planner operation function and use case analysis

In the system, the part of the weekly planner is mainly the relevant weekly plan management, and in the process of weekly plan management, the weekly planner first selects and assigns the work week according to the contract transmittal sheet that has been imported into the system Corresponding weekly schedule. The weekly planner use case analysis is shown in Figure 3.3.

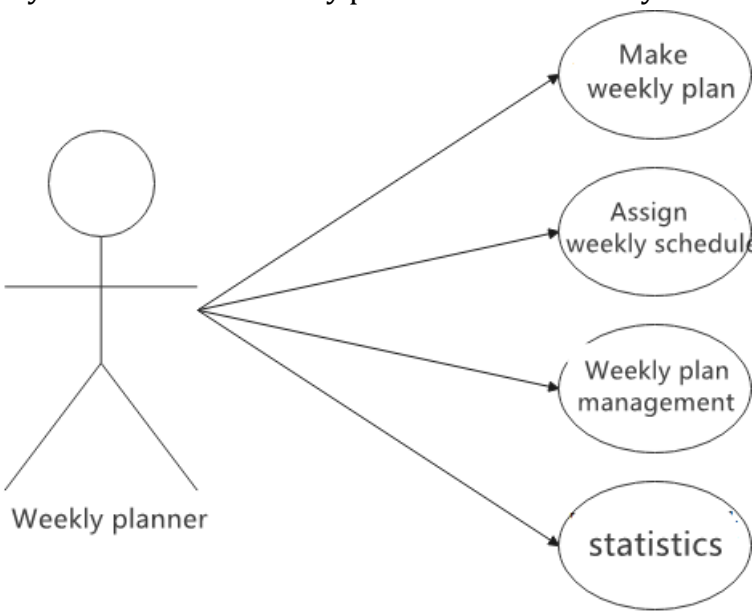

Figure 3.3 Weekly planners

The operation functions and use case analysis of weekly planners are shown in Table 3.3.

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Table 3.3 Weekly planner operation function and use case analysis

Example name	Weekly planner use case
Use case description	The specific operation authority of the weekly planner
executor	Weekly planner
Prefix	Successfully logged in with relevant permissions for weekly plan management
Basic operating procedures	1. Formulate the corresponding working week according to the requirements of the order 2. Allocate weekly plans according to the work week 3. Manage the allocation week, such as modification and query 4. View the status or statistics of the finished products

4. Quality inspector operation function and use case analysis

The quality inspector is mainly responsible for the management of the product flow card. The QA use case analysis is shown in Figure 3.4.

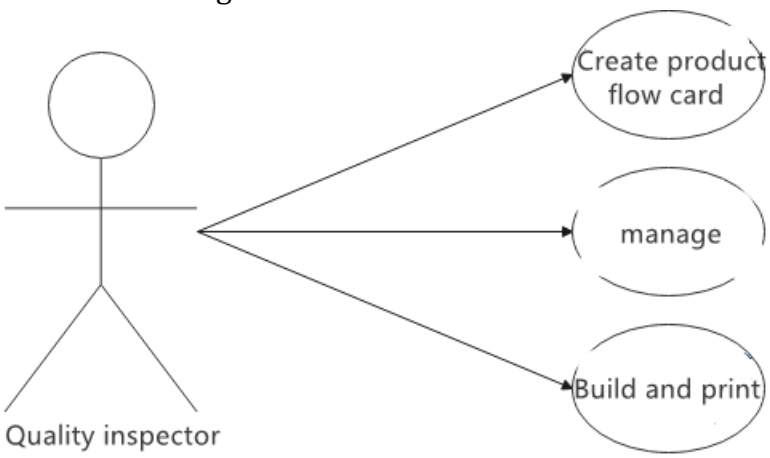

Figure 3.4 Quality inspector

The operation functions and use cases of quality inspectors are shown in Table 3.4.

Table 3. 4 Quality inspector operation function and use case analysis

Example name	Inspector use case
Use case description	The specific operation authority of the quality inspector
executor	Quality inspector
Prefix	Successfully logged in, the previous process is completed, and has the relevant permissions for product mobile card management
Basic operating procedures	1. Create a product flow card 2. Query the product mobile card and manage it 3. Make mobile cards for printing products

5. Warehouse administrator operation function and use case analysis

The warehouse manager is mainly responsible for the storage of products after the production is completed. The warehouse administrator use case analysis is shown in Figure 3 5 shown.

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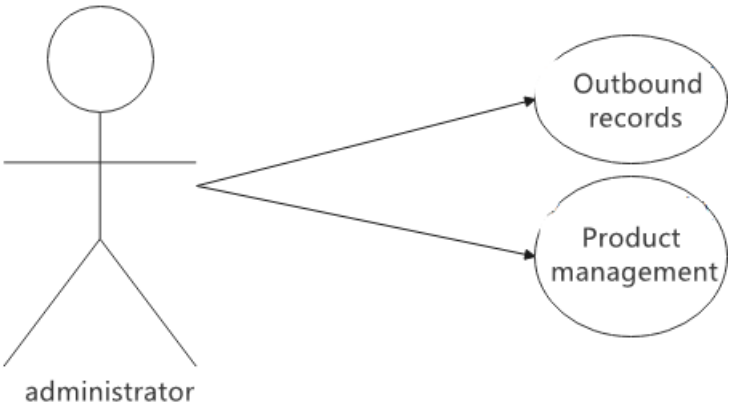

Figure 3. 5 Warehouse administrators

Table 3.8 shows the operation functions and use cases of warehouse managers.

Table 3. 5 Warehouse administrator operation function and use case analysis

Example name	Warehouse administrator use case
Use case description	The specific operation permissions of the warehouse administrator
executor	Warehouse administrator
Prefix	Successfully logged in, the previous procedure completed, participation in the designation of the program and associated permissions
Basic operating procedures	1. Scan and record when the product is in and out of the warehouse 2. Query and manage the stock of products in the warehouse

4. Overall system design

4.1. System network topology

The equipment that needs to be connected in the system has three parts: code scanner, server and client, and the three parts form the corresponding LAN through the router to maintain the normal operation of the system. The system requires employees to use the barcode scanner to scan the barcode generated during the transportation of the product to record the specific flow process information of the product, and transmit the relevant information through the built local area network.

4.2. System Operating Environment

For the various features of this system, the following configurations are provided.

4.2.1. Hardware Environment Requirements

Processor: Intel Intel Core i5 7200 @ 2.50GHz

RAM: 8 GB

Hard disk space: 128GB

4.2.2. Software Environment Requirements

Development language: C#

Development tools: Microsoft Visual Studio Community 2019 version 16.9.2

Operating system: Windows 7 Ultimate 64-bit

Database tools: Microsoft SQL Server 2008

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Browser: Cheetah Secure Browser 7.1

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