Design and Implementation of Dongfeng Plate-Making Business Management System

Pengpeng Ren¹, Jue Wang*,², Yihui Zhang³ and Tian Zhang¹

¹School of Information Science and Engineering, Hebei University of Science and Technology, Shijiazhuang, China
²School of Computer Science and Engineering, Northeastern University, Shenyang, Liaoning, China
³State Grid Shijiazhuang Electric Power Supply Company Information and Communication Branch Company, Shijiazhuang, Hebei, China
E-mail: 1156794675@qq.com

Abstract. Shijiazhuang Dongfeng plate-making co., LTD is a small-scaly plate-making enterprise. It is engaged in designing, processing and producing of the gravure cylinder making, and it is a specific industry enterprise. Due to the specific characteristics of plate-making enterprise and the particularity of the workflow about production and process, a unified, efficient and safe plate-making management information system is urgent need to be developed. This paper introduces the system architecture, clarifies its system functions, and describes the two key technologies of the use of MySQL events and production scheduling in detail. The monthly reports are generated automatically through MySQL events. Production scheduling is implemented through genetic-ant colony algorithm. The system runs well, and it has a certain guiding significance for the project development of the business management system.

1. Introduction
The project comes from the Shijiazhuang Dongfeng plate-making co., LTD. The company is a small and medium-sized SME (small and medium enterprise) that has long been engaged in designing, processing and producing of the gravure cylinder making. At present, the informatization level of enterprise is low, which basically belongs to the mode of manual management. There are problems such as low work efficiency, difficulty in communication between departments, and information islands. For this reason, an unified, efficient and safe plate-making service management platform is needed to be developed using information technology based on its own business characteristics and actual management requirements for the enterprise. The degree of enterprise information management has become an important standard to measure the level of enterprise management [1]. The realization of enterprise informatization can be based on the characteristics of each enterprise and carry out modern management suitable for the characteristics of the enterprise [2]. This will not only reduce the cost of product production, but also increase the production efficiency of the enterprise, and greatly increase the enterprise's competitiveness in modern society [3].

2. System Architecture
The system architecture of Dongfeng plate-making business management system is shown in Figure 1.
3. System Functions
Based on the analysis of system requirements and combined with the objectives of system design, the Dongfeng plate-making business management system can be divided into functional modules such as customer management, business management, design management, warehouse management, financial management, salary management and production scheduling management. The use case diagram is shown in Figure 2.

4. Key Technologies
The key technologies of this system include the use of MySQL events and production resource scheduling technologies.
Figure 2. The system use case diagram

4.1 The Use of MySQL Events
Event schedulers are sometimes referred to as temporal triggers because the event scheduler performs certain tasks based on a specific time period trigger, and triggers are triggered based on events generated by a table. The difference is here too [4]. The system adopts this function in financial accounting management. Under unattended conditions, it can automatically realize some financial accounting work and report generation. The activity diagram of generating monthly report is shown in Figure 3.

The main implementation process of the financial monthly report generation is as follows:
1) Call the Start Event procedure when the Web service starts;
2) The Mysql database calls the function of the Month Report by Ent ();
3) Get the year and month of the previous month by calling Get Year and Month of Last Month ();
4) Obtain the balance in the previous month's record from the Cai Wu_ Month Report Info table as the previous month's balance of this month;
5) Add this month's monthly report information to the Cai Wu_ Month Report Info table and add the previous month's balance;
6) Get this month's arrears from the Cai Wu_Income Info table by calling the Month Report_Qian Kuan () function;
7) If the monthly report information exists this month, proceed to the next step, otherwise skip to step 9;
8) Update the information of the arrears of this month in the monthly report record of this month;
9) Add this month's monthly report information to the Cai Wu_ Month Report Info table and add this month's arrears;
10) Calculate the current month's borrowing by calling the Month Report_Jie Kuan () function;
11) If the monthly report information exists this month, proceed to the next step, otherwise skip to step 13;
12) Update the borrowing field information in the monthly report record of this month;
13) Add this month's monthly report information to the Cai Wu_ Month Report Info table and add the arrears;
Call the StartEvent stored procedure
Call MonthReportProcByEvent() function
Using GetYearAndMonthOfLastMonth() to get the Year and Day of the Last Month
Get balance from last month's record of CaWu_MonthReportInfo as last month's balance of this month's monthly report
Add last month's balance to this month's monthly report
Get this month's arrears from CaWu_IncomeInfo by calling MonthReport_QianKuan()
Is there monthly information in this month?
[Yes] [No]
Update monthly information on this month's debt in CaWu_MonthReportInfo
Add this month's monthly report debt information in CaWu_MonthReportInfo
Calculate this month's loan by calling MonthReport_JieKuan() function
Is there monthly information in this month?
[Yes] [No]
Update monthly borrowing information in this month's CaWu_MonthReportInfo
Add this month's monthly report borrowing information in CaWu_MonthReportInfo
Get the current month balance by calling the MonthReport_ThismonthYuE() function
Update monthly balance information for this month at CaWu_MonthReportInfo
Enter the year and month of the financial month report to be exported
Find the financial month report information of the year and month to be exported from the database monthly report information table CaWu_MonthReportInfo
No conditional record exists
There are records that meet the conditions
Using Java Open Source Tool JXL to Realize the Development of Financial Monthly Report excel
Call the CloseEvent stored procedure

Figure 3. The activity diagram of generating monthly report

14) Get the current month balance by calling the Month Report_This month YuE() function;
15) Update the monthly balance field information in monthly report records of this month;
16) Enter the year and month of the financial month report to be exported;
17) Look up the financial month report information of the year and month to be exported from the database monthly report information table CaWu_MonthReportInfo;
18) The system determines whether there are financial monthly statements that meet the conditions; if not, step 20 is performed, otherwise step 19 is performed;
19) Using the Java open source tool JXL to generate financial statements in Excel format;
20) Call the Close Event procedure when the web service is stopped.

4.2 Production Resource Scheduling
Genetic Algorithms (GA) is a kind of algorithm that uses the natural solution of natural selection and natural genetic mechanism to learn the optimal solution. It simulates the phenomena of reproduction, crossover and mutation in natural and natural genetic processes. In each iteration, a group of candidate solutions is retained, and the better individuals are selected from the solution group according to some index, and the genetic operators (selection, cross and mutation) are used to combine these individuals to produce a new generation of candidate solutions [5]. Repeat this process until a certain convergence index is satisfied.

The basic idea of the ant colony algorithm from the shortest path principle of nature's ant foraging. According to the observation of insect scientists, it has been found that although the ants of vision are underdeveloped, they can find the shortest path from the food source to the nest without any hints, and adaptively search for the new best path after the surrounding environment changes [6].
Genetic algorithm has a large range of fast global search capabilities, but it is difficult to deal with complex problems, and the use of feedback information in the system is not sufficient. When the solution to a certain range, it is often a lot of useless redundancy iterations, making the solution efficiency lower. The ant colony algorithm has the characteristics of distributed, heuristic, and positive feedback. It can use heuristic information to construct the solution step by step to facilitate the constraint conditions, but due to the lack of early pheromone and slow solution speed. In order to overcome the limitations of a single algorithm, a variety of algorithms are combined and a genetic ant colony hybrid algorithm is used to complement each other to solve the problem of production resource allocation. The activity diagram of production resource scheduling is shown in Figure 4 and its main processes are as follows:

1) Enter the population size n and randomly generate the initial population;
2) Given the production time matrix T and the cost matrix C for each subtask at the m production points;
3) Generates a scheduling matrix O by random amplification;
4) Selection of next-generation populations through roulette;
5) Cross chromosomes by a single point of intersection;
6) Chromosomal variation is performed in an insert manner;
7) The GA terminates the conditions to determine, meet the conditions, then go to step 8, otherwise skip step 4;
8) Select a certain number of better solutions from the GA solution as input to the ant colony algorithm;

Figure 4. The activity diagram of production resource scheduling
9) Initialize the node path pheromone based on the ant-cycle model;
10) Ant colony algorithm parameter initialization;
11) Apply ant colony algorithm to optimize, and update pheromone through elite strategy;
12) Ant colony algorithm termination conditions to determine, if the conditions are met then turn to step 13, otherwise go to step 11;
13) Output optimal solution.

5. Conclusions
This paper proposes a plate-making business management system design model to achieve customer management, business management, design management, warehouse management, financial management, salary management and production scheduling management and other functions. The application practice shows that the enterprise production efficiency is improved and the production cost is reduced. It has improved the company's economic efficiency and information level.

System deficiencies: First, the management modules of production scheduling have relatively poor flexibility in production scheduling algorithms, and their applicability and scope of application are small. Second, with the rapid development of smart mobile phones, the system should also develop a set of mobile phone APP management system to provide users with more convenient services.

6. References
[1] Zhu Ziming. Design and Implementation of ERP System for Printing Companies. Northeastern University, 2015
[2] Xie Zhongliao. Design and Application of ERP System for Printing Companies in Liaoning Province [D]. School of Electronic Engineering, 2014
[3] Zhao Jiebin. The Design and Implementation of Printing Order Tracking Management System in Rehe Printing CO [D]. Beijing University of Technology, 2014
[4] Liang Hengrong, Chen Taiquan, Qin Shimin. Application of database triggers in data security [C] 2016 Power Industry Informatization Conference Proceedings. 2016
[5] Nie Zhaowei, Xiong Dandan, Yang Haicheng. Study on MRO service scheduling based on hybrid genetic algorithm–ant colony optimization[J].Application Research of Computers, 2018 (2): 438-440
[6] Xia Limei, Cheng Bo, Chen Junliang. Optimizing Services Composition Based on Improved Ant Colony Algorithm [J]. Chinese Journal of Computers, 2012, 35(2):270-281.
[7] Sen T, Mathur H D. A new approach to solve Economic Dispatch problem using a Hybrid ACO–ABC–HS optimization algorithm [J]. International Journal of Electrical Power & Energy Systems, 2016, 78:735-744