Development of Inventory Optimization System for Operation Nuclear Plants

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1. Introduction

Inventory control of spare parts plays an increasingly important role in operation management. This is why inventory management systems such as manufacturing resources planning(MRP) and enterprise resource planning(ERP) have been added. However, most of these contributions have similar theoretical background. This means the concepts and techniques are mainly based on mathematical assumptions and modeling inventory of spare parts situations.

Nuclear utilities in Korea have several problems to manage the optimum level of spare parts though they used MRP System. Because most of items have long lead time and they are imported from United States, Canada, France and so on. We developed the inventory optimization system for Operation Nuclear Plants to resolve these problems. In this paper, we report a data flow process, data load and inventory calculation process. The main contribution of this paper is development of inventory optimization system which can be used in domestic power plants.

2. Development of Inventory Optimization System

EPRI has already presented several Technical Reports that support to optimization of inventory of spare parts in a nuclear utility[1,2]. But, It is difficult to apply for operating plants because of its depending on overseas inventory procurement conditions.

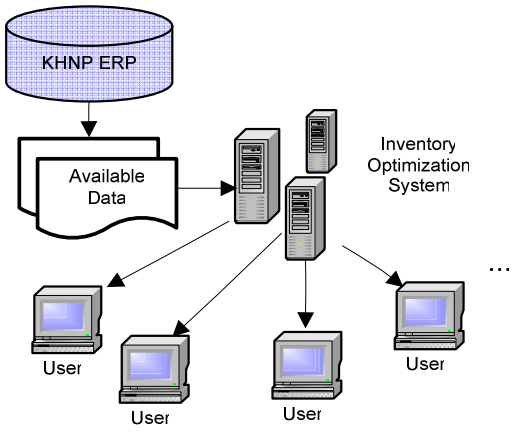

figure 1. Data flow process

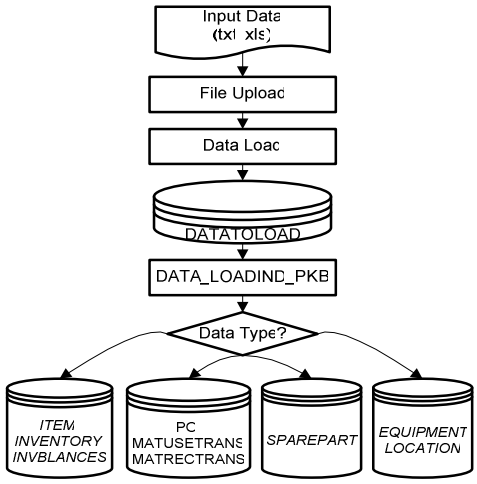

figure 2. Process of data uploading

So we developed several processes such as materials classification process, optimum inventory calculation methodology and available inventory optimization system to use in domestic power plant[3]. In this paper, we report about a development and design process of this system.

2.1 Data flow process

In order to calculate the optimum inventory quantity, it needs several factors to consider. The factors to be considered are demand quantity, evaluation of shelf life, materials currently on order, material currently in stock, lead time, item cost, historical usage, transaction cost, criticality of equipments, etc.

Data flow process is shown in Fig 1. We tried to get the data of KHNP ERP system and converted this data into the applicable data for using this system. And then, optimization system was uploaded with the applicable data and calculate optimum quantity level to keep inventory for operation nuclear plants. Users can see the results of inventory calculation data from personal computers and download in txt file and excel file by web-based.

2.2 Data load

Data uploading process to make system environment similar to KHNP ERP system is shown in Fig 2.

1) Export the available data from KHNP ERP system

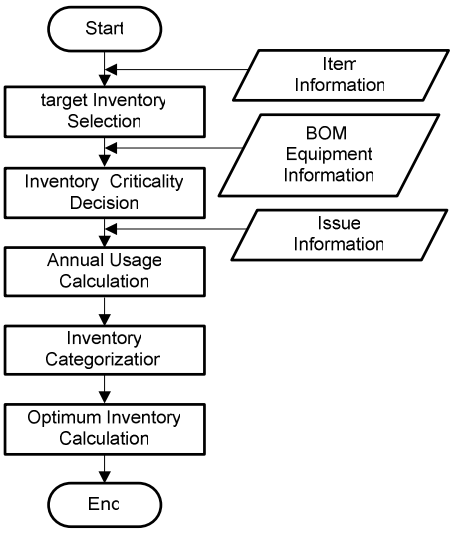

figure 3. Optimum inventory calculation process

2) Convert the exported data into the applicable data
3) Upload the applicable data(txt, xls file) onto directory of Inventory optimization system.
4) Insert the data of directory to the System temporary table
5) Insert the temporary table to the real table by data type
   - Item, purchase order, issue, equipment, etc

2.3 Optimum inventory calculation process

Loaded data is calculated the optimum inventory level according to the calculating process as shown in figure 3.

1) Select target inventory items by items information
2) Decide inventory criticality by BOM information
3) Calculate annual usage rate by issue information
4) Categorize inventory classification (Items are classified into 8 categorization)
5) Calculate optimum inventory level
   - Safety Stock (confidence level*leadtime/365)
   - Economic order quantity ((2*Purchase Cost*Annual Usage)/(Carrying Cost%*Unit Cost))^1/2)
   - Demand During Lead Time(Annual Usage*Lead time/365)

User interface as shown in Fig 4 is the developed system which has following main functions.

1) Inventory Classification: According to the material classification process, the inventory quantity is calculated.

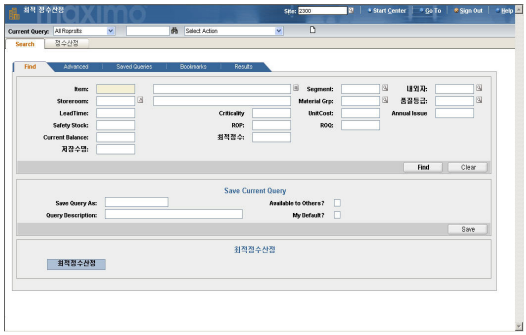

figure 4. User interface

2) Variable data management: Variable data is easily applied to inventory calculation process. (carrying cost%, confidence level, etc)
3) Economic efficiency estimate: Compare Current inventory holding Cost with Optimum inventory cost.
4) Easy view & search: Visual interface and search function help easy use.

3. Conclusion

This inventory optimization system was developed to establish optimal inventory stock level by using materials classification process and optimum inventory calculation methodology. We have confirmed the accuracy of the developed methods and work results in reviewing the work results by KHNP field engineers. We should improve accuracy even though they adopted most of calculated results. And the most important thing to use this system is that data integrity should ensured securely because accuracy of results have close related with data history(moving price, order, issue date, etc). KHNP ERP system will be adopted the developed system module after this system module is verified to have the economic efficiency and accuracy.

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