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Edukacja - Technika - Informatyka nr 2(16), 245-248

2016

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ISSN 2080-9069 www.eti.rzeszow.pl
ISSN 2450-9221 online DOI: 10.15584/eti.2016.2.32

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Generic algorithms for predictive refillment scheduling in SCM-systems of large retail companies

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Abstract
The article contains a description of generic predictive refillment scheduling algorithm.

Key words: supply chain management, refillment planning, predictive refillment scheduling algorithm.

Introduction

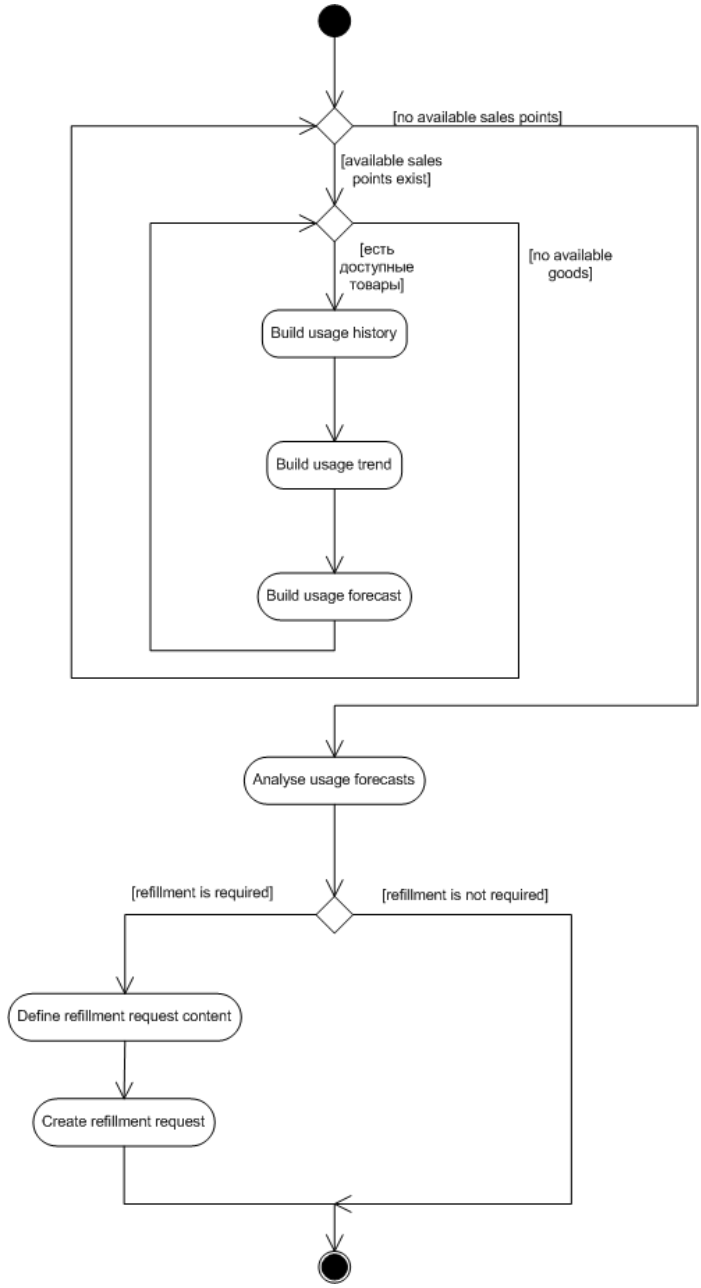
Many large retail companies prefer to have a predefined schedule in order to manage effective planning of refillments using SCM-systems, but sometimes they face a problem when created schedule is broken and real reports are not fit into it. Wrong schedule planning can turn into decreasing of company effectiveness caused by either lack of goods in retail stores when schedule was too pessimistic, or by unused goods stored in warehouses.

In order to solve this problem SCM-systems should use predictive scheduling, which allows to not create refillment schedule manually but generate it using on-the-fly statistics. Benefits of this approach can be easily measured by checking costs of transferring and storing goods in comparison between predefined refillment schedule or the dynamic one [Christopher 2002].

Most of predictive refillment algorithms contain 3 main phases:

1. building a history of goods usage;
2. building a trend of future usage of each good type;
3. detecting a moment when the quantity of each good type will be equal to 0;
4. checking for need of immediate order of any goods and selecting good quantities for requesting based on their previous usage and future trends.

A generic predictive refillment scheduling algorithm is shown on the figure below.



Most of methods for predicting goods usage are based on two basic approaches: prediction based on previous usage and prediction based on previous refillments.

Prediction based on previous usage assumes detecting trends in time series (for instance using exponential smoothing). These methods assume that previous usage statistics can be used as an indicator of future goods demands. Prediction based on previous refillments assumes analysis of refillment requests and correlations with sales statistics.

Mixed prediction methods assume taking into consideration some factors not based on historical data or trends, for instance start of discounting program or promotion campaign, and these events sometimes can happen only once. These methods use expert estimations, customer surveys etc.

Forecasting time-frame is a time frame used for prediction, a length of this frame is defined by time required for delivering goods from warehouses to sales points and directly connected with choosing of prediction method [Hugos 2005: 256].

In order to determine a moment when refillment request should be created there are two politics exist: (s,Q)-politics and demand forecasting. In simple cases it's a commonly used practice to use (s,Q)-politics, which can work in most of SCM-systems. This politics assumes periodical check of goods counts and when this count *s* goes under predefined limit count the request for *Q* items should be created. This limit should be defined in a way to avoid a change of items lack at the warehouse.

Moreover, parameter *s* can be used as a value of goods recovery time – a time frame between a moment when refillment request is created and a moment when refillmen arrives to the destination. This frame contains delivery time and all the operations of request processing. Goods recovery time and minimal goods count are correlating values and deciston of what value should be used is determined by conditions in each case [Hank 2003: 656].

Depending on the environment where the SCM-system is functioning it can be useful to replace static limit quantity with the calculated one, in this case refillment size and delivery time are nit fixed.

The last step of an refillming planning algorithm is determining of item types and their quantities to be ordered. In most of the cases there are some limitations exist such as a maximum of ordered goods and maximum quantity allowed to store in warehouse to avoid an increase of storage cost. That’s why from the one hand it’s required to manage constant availability of goods in warehouses and minimise refillment count, but on the other hand – satisfy all the limitations [Charles 2013: 384].

A union of requested goods to one refillment can be done manually, intervally and adoptive. Interval method assumes that the union is done once in a period of time (daily, weekly, monthly), while adoptive method assumes that the union should be done respective to current requirements.

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