

Development and Evaluation of Effectiveness of the Automated Method for Control of Goods Expiry Date in Trading Network

K. Zemliak

Khabarovsk State University of Economics and Law,
Khabarovsk, Russia
firnfjord@yandex.ru

D. B. Solovev^{*,**}

^{*}Far Eastern Federal University,
^{**}Vladivostok Branch of Russian Customs Academy
Vladivostok, Russia
solovev.db@dvfu.ru

Abstract— Article introduces a problem of expired products in trade and losses from it. Ways of control of the expiry date of goods, their advantages and disadvantages are revealed by author; noted that the methods offered at the present do not allow to solve the existing problem. In view of this, the requirements to be met by the method of control of expiry date are defined, and an application for mobile devices is developed that allows to add and edit data about the goods, calculate their expiry date and receive information about the goods with the expiration date that is close to the end. The application has minimal system requirements and, unlike existing analogs, stores information about goods in a remote database and is available to all employees online. Based on the results of evaluation of planned economic effect, expediency of implementing of the developed application in trade enterprises has been shown.

Keywords— *expiry date, control of expiry date, expired products, trade automation, software complex, mobile application.*

1. INTRODUCTION

One of the significant problems in the field of trade are goods with expired shelf life. In the course of trading activities, for various reasons, some of the goods are not sold within the expiry date. Every day in each small shop, at least one cart of products with expiring shelf life is removed from the shelves. And what about supermarkets and hypermarkets with an assortment of several thousand items?

The problem of overdue products is especially urgent for trade enterprises that sell food products. The share of perishable goods in their commodity turnover reaches half: 30% is for dairy products, meat products, eggs and bread, 11% for fruits and vegetables, 9% for chilled meat, poultry, fish [1].

According to statistics, in Russia the annual volume of recycled products is about 2.6 billion tons. According to experts, in large hypermarkets the amount of write-off of overdue products from the entire commodity turnover often reaches 1% [2, 3].

Trade organizations have to solve a whole list of problems associated with overdue products:

- losses from unrealized products (cost price, expenses for transportation, storage, manufacturing of own production);

- expenses for recycling;
- decrease the company's image;
- fines of state control and supervision agencies.

To prevent the appearance of overdue products in trade organizations, following methods can be used:

- forecasting of commodity stocks;
- price reduction;
- industrial processing and utilization for feed of agricultural animals;
- automated control of shelf life.

The last method can be realized by creating a database, in which the name of the product and its expiry date will be entered. Such a database is a journal for the control of expiration dates, both printed and electronic. The electronic version has a number of advantages and is designed as a program for a desktop personal computer or application for mobile devices [4].

2. SUBJECTS AND METHODS

In view of the above, the development and evaluation of effectiveness of the automated method for control the shelf life of goods in trading network, chosen as the research topic, are urgent.

Although the control of commodity stocks and their shelf life is conducted in warehouses and shopping rooms of any trading enterprise, it is realized with a different level of automation and efficiency. Characteristics of the main ways of controlling the shelf life used in trade at the present time are presented in Table 1 [5].

As can be seen from Table 1, the most reliable way to control of shelf life is automated control by software. Used software tools can be divided into two groups: 1) software complexes for inventory accounting, the main function of which is an account of the movement of goods, and control over the expiration dates is an additional function; 2) applications for mobile devices, for which the control of expiration dates is the main and only function.

The comparative characteristics of these programs are presented in Table 2.

Table 1. Characteristics of the main ways of controlling the shelf life [5].

Method for control of shelf life	Advantages	Disadvantages	Terms of use
Control is not conducted	Absence of expenses	High possibility of occurrence of overdue balances in the shopping room and warehouses	Shelf life of goods is more than 5 times and more than turnover
Manual control (by paper cards)	Ease of use. Ability to prevent an appearance of overdue products	Complicating processes in the warehouse, frequent inventory, absence of opportunity to optimize the routes of selection of goods	Shelf life of goods is more than 3 to 5 times the turnover. There are no rammed racks
Automated control (by software)	Continuous control of shelf life	Complicating the control of goods in the warehouse	Shelf life is comparable with the period of turnover of goods (perishable food, medicines, etc.)

Table 2. Comparative characteristics of software for controlling of the shelf life of goods.

Characteristic	Mobile applications	Software complexes
Operating system	«Android 4.2», «iOS 7», «Windows Phone»	«Windows», «MacOS» (beta version), «Linux»
System requirements	Less than 100 MB of HDD, less than 50 MB of RAM	At least 40 GB of HDD, at least 256 MB of RAM
Functions	Control of shelf life	Work with suppliers, registration of goods movement, printing of commodity information, control of shelf life, etc.
Hardware base	Smartphones, tablets, desktop computers by dint of an emulator	Desktop computers
Licensing	Not necessary	Necessary
Support and maintenance	Absence of the ability to make changes to the application independently, only the developer fixes the errors	Ability to modify and refine the system for specific purposes and tasks independently or with the involvement of outside specialists
Technical capabilities	Limited database size	A large database, as well as the possibility of expanding it
Cost	0 – 3 USD	About 1400 USD

At present, the assortment of goods and volumes of commodity turnover have become so great that account of trading operations is impossible without a computer with specialized software (software complexes). Therefore, software complexes are installed and used at each enterprise. For example, «IS: Predpriyatie» (development of the IS company), «Fregat Roznitsa» («Information Technology Center FREGAT»), «Parus» («PARUS Corporation»), «Bset» («Best IT Pro»), «SAP» («SAP SE»), etc. It performs many functions, starting with formation of orders to suppliers, operational analysis of trading activities, inventory and revaluation, formation of price tags, labels and various codes, and ending with work on POS, check printers and fiscal registrars, control of shelf life of goods, etc. Software complexes are characterized by high cost, which is constantly increasing due to their improvement and the need for constant support. Available free versions of the programs allow to use not all the functions that are necessary for accounting of goods.

Notice that the control of shelf life is not the main function of such programs. During the acceptance of goods the date of manufacture and shelf life of goods are entered in the invoice. In order to check the expiration date, there are need to go to the invoices, find the necessary goods and calculate the expiration date. This method of control is imperfect and more suitable for food products with a long shelf life, as well as for non-food products sold in small stores.

As an alternative to software complexes in electronic stores («AppStore», «PlayMarket»), several mobile applications are proposed for control of the expiration dates: «Best Before», «Freshbox», «Shelf Life», «Kholodilnik», etc. Low system requirements for mobile devices required for installation, as well as low cost (from 0 to 200 rubles per copy) determine the availability and popularity of such applications.

Applications allow to record the expiration dates of products and in advance inform about the expiring date by the built-in reminder function. The application interface is a «virtual refrigerator» with shelves on which the program puts images of products added to the list [6]. Data about goods can be entered into the application after acceptance of goods in the store by a commodity expert, administrator or other responsible person.

It is worth noting two significant disadvantages of mobile applications: the absence of the ability to customize the application for a commercial enterprise and a small database, which limits their use by large enterprises.

3. RESULTS AND DISCUSSION

With considering the high costs of implementing software complexes on the trading enterprise, as well as the absence of mobility, we set a goal to develop an application for mobile devices, each copy of which will have access to a single database of all products and perform only one function - expiration date control. Introduction of such application will reduce the time and labor expenses for finding overdue

products, and almost eliminate the possibility of its appearance.

We have developed the application «Srok na kontrol» for mobile devices (smartphones, tablets, etc.) with the operating system «Android». It is suitable for both large and small trade organizations, allows employees to add and edit goods data, calculate their shelf life and receive information about goods with an expiration date that is close to the end.

The application has minimal system requirements, keep information about goods in a remote database and is available to all employees online. Integration with the software complex allows to display only those goods that are remains on store. In case of impossibility of interaction with the software complex, the application provides user the opportunity to independently make the goods into the database, which makes it completely autonomous.

In the case of notification from the application about overdue product or product, expiration date of which is soon expiring, the employee must withdraw this product from the sale and put a note about it in the application. To monitor employees responsible for the appearance of overdue products, the application provides authorization through the enterprise domain controller.

At the final stage of the study, we estimated economic effect of implementation of the developed application in one of the major trading enterprises of Khabarovsk.

The amount of write-off of overdue baby food and children's hygiene products in the department of industrial goods of the store in 2016 amounted to 728 thousand rubles (1.4% of sales of these groups of goods).

To estimate the economic effect of implementation of the «Srok na kontrol» application, we calculated expenses of its development and support and compared them with expenses for writing off overdue products in the department of industrial goods (Table 3).

Table 3. Estimating of economic efficiency of implementation of the mobile application «Srok na kontrol», rubles.

Losses from overdue products		Expenses for developing and maintaining of a mobile application		
Write-off	728 200	Expenses for development		81 616 (once)
		Administration		24 000/month
		Maintenance		10 000/month
Penalties of the Rospotrebnadzor	20 000	Expenses for communications		1 000/month
		Indirect expenses		10 000/month
Total (per year)	748 200	Total	(1st year)	621 616
			(from the 2nd year onwards)	540 000

As seen, the planned economic effect from application implementation in the first year will be about 127 thousand rubles, and from the second year onwards – 208 thousand rubles.

4.CONCLUSIONS

If the developed application will be implemented in all departments of all stores of the analyzed trade network, the economic effect will increase tens of times. Considering the almost identical structure of each store in the network, the administration of the application can be carried out by the IT department of the head office, and modifications and changes made by the developer will be applied to all copies of the application. On this basis, these expenses can be attributed to the entire network.

The developed application is recommended for implementation in trade enterprises. It is aimed at reducing the write-off losses and penalties for overdue products, expenses of their recycling, as well as increasing customer loyalty.

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