

# Research of software verification methods for waste management and review the waste treatment legislation in Russia

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**Abstract.** The article considers the possibility of working with natural and technical systems of the Leningrad region in terms of processing several main types of waste. In article is collection some interesting program product software for waste management. In the process of analyzing the situation with waste management and the involvement of Russian citizens in the methodology of separate collection, the importance of modern software products installed on personal computers and gadgets was emphasized - it is the constant interaction with such software products that adapts the methodology of separate collection, allows Russian citizens to learn more about methods of waste treatment, taking care of the environment. In addition, the task was set to create a perfect software product that takes into account the advantages of all previously created software products for recycling waste in the Java Script environment. The author emphasizes the possibility of developing a series of software products for waste management and developing waste management competencies in St. Petersburg residents. It is also worth noting that the created program described in the article is currently being developed in the third version, taking into account more and more information sources on waste processing. It should be noted that the described product contains several built-in hyperlinks to the most significant freely installed products for environmental monitoring. The article contains a separate chapter on the development of legislation in the field of waste management in the Russian Federation in order to reduce spontaneous dumps, and the organization of modernized state-owned enterprises - regional operators for waste processing, creating a comfortable economic environment for recycling, rather than storing waste. In the last task, the ECO-365 software product may also be useful for better ecology in all peace.

## 1 Introduction

According to GOST 30772-2001 " Resource Saving. Waste treatment. Terms and definitions" [1], consumer waste includes "residues of substances, materials, items, products, goods that have partially or completely lost their original consumer properties". It also notes that this category of waste should include not only MSW generated in households, "but also waste generated in offices, commercial enterprises, small industrial facilities, schools, hospitals, and other municipal institutions." This definition corresponds to the foreign term "municipal solid waste". The legal basis for the classification of solid waste in Russia is the Federal classification catalog of waste (FKKO), which classifies waste by origin, aggregate state and hazard, using the term "municipal solid waste" [2]. Classification of hazardous waste is based On the order of the Ministry of health of the Russian Federation No. 511 "on approval Of criteria for classifying hazardous waste as a hazard to the environment".Government Decree No. 712 of August 16, 2013 introduced the concept of certification

of waste of hazard class I-IV: "For waste of hazard classes I–IV included in the Federal classification catalog of waste, individual entrepreneurs and legal entities draw up and approve a passport in the form approved by decree of the Government of the Russian Federation No. 712 of August 16, 2013. A copy of the passport certified by individual entrepreneurs and legal entities, as well as copies of documents confirming that the type of waste is classified as a specific hazard class, are sent to the territorial body of the Federal service for supervision of natural resources at the place of economic activity by individual entrepreneurs and legal entities in a way that allows them to determine the fact and date of their receipt, or are handed over to them under a signature." Introduced changes to the existing system of household waste removal caused an increase in tariffs for services [13,14].

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## 2 Materials and Methods

To manage the system of waste removal and disposal, 4 programs were allocated, working as a full-fledged ERP-system:

1) "RG-soft: waste Removal" - program designed for the analysis and monitoring of waste removal companies, analysis of the threshold of garbage limits, section accounting for waste disposal, As well as: accounting of recyclable materials, Accounting of own coupons, accounting of third-party coupons, Environmental reporting, formation of documents, Accounting of payments from customers. As a drawback-the lack of environmental monitoring of the waste disposal area [3]

2) "RG-soft: waste Treatment and disposal " - offers possible forms of waste treatment, but in the absence of the proposed methods at the landfill, as appropriate, which occurs in most cases, does not offer options to sell waste to interested enterprises from other regions. In this case, of course, the carrier has no alternatives other than a simplified waste disposal procedure ;

3) "Recycle Map" - with the possibility of pop-up tips on the location of containers for disposal of batteries and incandescent lamps according to the user's geodata[3,4]

4) "1S: Enterprise 8. Waste and recycling management" - the configuration supports the main operational processes in the processing plants, such as the reception and shipment of solid waste (MSW) and recyclables, sorting, processing, transportation and disposal of waste. Integration with various equipment used in such enterprises (scales, cameras, access control systems, etc.) is envisaged.

5) "2GIS" - the program and the application allows the search module to determine the location of the organization receiving the waste closest to the location of the interested person

It is possible to conclude that the majority of IT applications are concentrated in the field of construction, engineering, mining industry and economy [9,10]

Of course, the main priorities of the Soft program are: dispatching; calculation salaries drivers; regulatory accounting of fuel. Accounting for the location of the bunkers; a record of the reception of solid waste and recyclables; accounting of weight and volume characteristics of solid waste and recyclable materials; setting circuits receiving and passing solid waste and recyclables; Accounting for certification and quality control of received and shipped MSW and recyclables; Management of electronic queue at the cash Desk receiving and recyclables; etc. [7,8]

6) Another important product – ECOScan on the free software market is a program that has a neural network and is able to recognize various materials and give comments on the possibility of their disposal. This is an Ecoscan software product that was developed by Dutch programmer Rick Buiten and can be downloaded from the App Store.

## 3 Experimental part

A software product is currently being developed that focuses on the documentation base for waste classification and has several built-in extended technical reference books , as this product makes up for the shortcomings of previous software products. This product is called ECO 365. During repeated upgrades, the product is updated and now has several versions.

formatting shown in Table 2 should be used.

ECO-365 program-assistant in the field of storage, processing and sale of waste for the operator. The program systematized electronic information resources in the field of waste processing, developed in Java script direct code, adapted to the current requirements of Rosprirodnadzor (Russian ecology department). The method of waste search is maximally adapted in the software interface and visually ergonomic for users. As a writing application software was used Java Script language, which is an object-oriented language. Prototyping used in the language causes differences in working with objects in comparison with traditional class-oriented languages.

The main fields of the program, which are automatically filled in when specifying any type of waste:

- FCCO code-11 digit classifier code
- Production – what type of industry waste is generated
- The process – what the process produces waste
- Name of components, content, % wt. - composition of waste

- Physical state and the physical form – the form in which the waste is transported [11,12]. In the process of developing the program, it was necessary to build a promising structure for the development of the project to enter state support (Figure 1).



Fig. 1. Project development.

The program in the form of an application is easily installed on the Windows XP platform and runs provided that the folder is a waste database in Excel format.

The database of Rospirodnadzor, on which the "engine" of the program is based, is the most extensive and is presented in the form of spreadsheets on several sheets.

Beginning and ending program text in Java Script is presented below.

The main requirements for the creation of the program were - the possibility of free installation on a personal computer, the ability to use the system how professional autodirectory [5-6].

Consider the interface of the program below. Schematically, the work of a software product developed in the university's laboratory and patented in the program system for electronic computers can be seen in the diagram below (Figure 2).

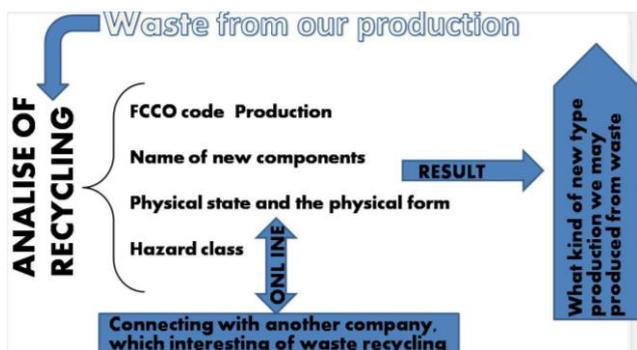


Fig. 2. Flow-synthesis algorithm of ECO-365.

Below are the versions of software products that have been adapted to meet modern user requirements. The program is easily installed as an application on the Windows XP platform and runs if the folder contains a database in Excel format ("new data"). Let's look at the program interface. When you open version 1.1, the window shown in figure 3 is displayed.

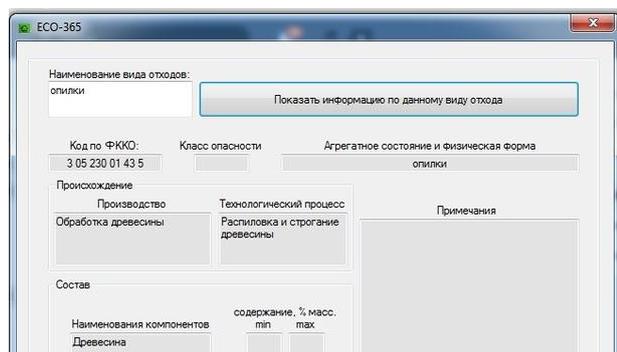


Fig. 3. Opening directory sheets in "ECO-365" V. 1. 1.

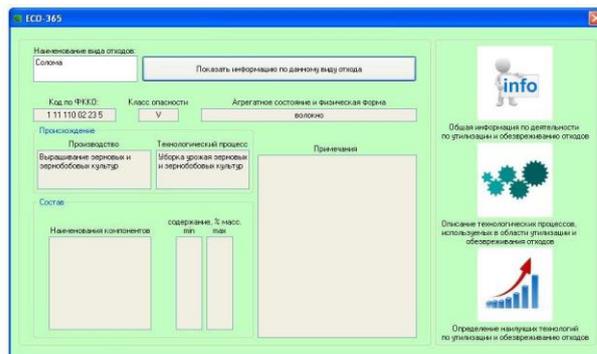


Fig. 4. Opening directory sheets in "ECO-365" V. 1. 2.

The method of waste search is maximally adapted in the software interface and visually ergonomic for users [5-6]. The scientific and technical novelty of the software product under study is the use of software automation systems and management creation in the waste management system, followed by the possibility of modeling the waste processing cycle and the possibility of implementing waste through the personal accounts of users connected to the network.



Fig. 5. Opening directory sheets in "ECO-365" V. 1. 2.

In article research program software . Below is the algorithm of the program :

- using System;
- using System.Collections.Generic;
- using System.ComponentModel;
- using System.Data;
- using System.Drawing;
- using System.Linq;
- using System.Text;
- using System.Windows.Forms;
- using System.IO;
- using Excel = Microsoft.Office.Interop.Excel;
- namespace Waste

```

{
    public partial class MainForm : Form
    {
        protected String filePath;
        protected
        Microsoft.Office.Interop.Excel.Application objExcel;
        protected Microsoft.Office.Interop.Excel.Workbook
        objWorkbook;
        public MainForm()
        {
            InitializeComponent();
        }
        private void MainForm_Load(object sender,
        EventArgs e)
        {
            this.Size = new Size(688, 130);
        }
        private void btnLoad_Click(object sender,
        EventArgs e)
        {
            filePath = txtDirectory.Text;
            if (File.Exists(filePath))
            {
                objExcel = new
                Microsoft.Office.Interop.Excel.Application();
                objWorkbook =
                objExcel.Workbooks.Open(filePath, 0, false, 5, "", "",
                false,
                Microsoft.Office.Interop.Excel.XlPlatform.xlWindows,
                "", true, false, 0, true, false, false);
                gbMain.Location = gbDirectory.Location;
                gbMain.Visible = true;
                gbDirectory.Visible = false;
                this.Size = new Size(637, 518);
            }
            else
            {
                MessageBox.Show, MessageBoxButtons.OK,
                MessageBoxIcon.Error);
            }
        }
        private void btnShowInfo_Click(object sender,
        EventArgs e)
        {
            txtCode.Clear();
            txtManufacture.Clear();
            txtTechProc.Clear();
            txtState.Clear();
            txtComponents.Clear();
            txtMin.Clear();
            txtMax.Clear();
            txtAddition.Clear();
            txtDanger.Clear();
            if (File.Exists(filePath))
            {
                Microsoft.Office.Interop.Excel.Worksheet
                objWorksheet = new
                Microsoft.Office.Interop.Excel.Worksheet();
                for (int i = 1; i < 10; ++i)
                {

```

```

                objWorksheet =
                (Microsoft.Office.Interop.Excel.Worksheet)objWorkboo
                k.Sheets[i];
                String searchString = txtWasteKind.Text;
                if (searchString != null)
                {
                    baseline code
                    txtDanger.Text = objWorksheet.get_Range("I" +
                    range.Row.ToString()).Value2.ToString();
                }
                i = 10;
            }
            else
            {
            }
            else
            {
            }
            System.Windows.Forms.Application.DoEvents();
        }
    }
    private void MainForm_FormClosed(object sender,
    FormClosedEventArgs e)
    {
        if (objExcel != null) objExcel.Quit();
    }
}
}

```

### 3 Result and discussion

The program module created on the basis of University laboratories ECO-365 it has been patented and is currently being tested.

Currently to admit that this module is only the 1st step in which you want to include and means of geolocation, messaging, opportunity management and creation of the personal account of each user in the environment, with the ability to share videos. It is also expected to broaden the base of the waste, as currently in the standard is not given a detailed description of possible recycling of each waste individually, are not defined a particular company or polygons for mechanical recycling, which havr in the narrow direction of the recycling of a certain list of materials [15].

Undoubtedly, the increase in the family of such programs contributes to the growth of the government's interest in the problems of separate collection and the creation of similar environmental projects. It is important to note that many of the compared programs given at the beginning of the article united the C ++ language, but the presented development uses the Java language as one of the most tested from the point of view of interaction with similar programs and further implementation and unloading through similar programs (related in language).

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