Formation of an integrated model for providing information support for organizational decisions

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Abstract. The article describes modern information systems that automate the process of collecting, accumulating, processing and transmitting information flows. In the work, various information platforms were studied, which allowed the authors of the study to form an integrated model for providing information support for organizational decisions at different stages of the functioning of industrial enterprises.

Keywords: Information technology, Monitoring of government support measures, Government information systems, Client-server model.

1 Introduction

The use of information technology to support organizational decisions is a prerequisite for the effective functioning of industries. The development of a system of state support requires timely monitoring of the state of affairs in industries that use state support measures [1].

For a more efficient operation of the monitoring system for various measures of state support provided by the state to enterprises, decision-making models based on the GIS system can be distinguished. On the basis of GIS, platforms are being created that can solve a fairly wide range of problems. These platforms help users to research, compose, and produce accurate calculations for effective organizational decisions [4]. These technologies provide the ability to display analysis results on maps or satellite images. Such GIS applications to support and evaluate decisions made have been used in many areas of research, such as marketing, strategic planning [2].

2 Materials and methods

To solve complex decision-making situations, intelligent systems such as expert systems or knowledge-based systems have been integrated into GIS. This integration has led to the creation of environments commonly known as "smart GIS".

Internet technologies have been assimilated into GIS, leading to the emergence of various GIS web applications. Several researchers have demonstrated the use of the Internet and GIS to develop applications to improve decision making. Despite some progress in using the Internet as a medium for the exchange of economic data and data visualization. Currently, there is an increased interest in continuing the development of the WEB to support more effective decision-making and formulating the vector of policy development [3].

3 Results and Discussion

The client-server model used in the development of Internet GIS (or WEB GIS) applications allows users to access GIS databases through an open connection to the databases. However, a client can only access one source at a time with predefined connection platforms. It is even possible that, if necessary, the client may have a dynamic ability to access various sources. As network computing gains momentum and the network provides the infrastructure necessary to materialize peer-to-peer computing, we believe there will be a lot of demand for a mobile version of GIS, which will enable small and medium-sized enterprises and innovative enterprises to participate effectively in the monitoring system. Mobile GIS is created by separating the client and server sides of an application into self-contained units that can interact between networks, integrating languages, applications, tools, and operating systems. Advances in wireless technology have led to the development of mobile support systems that provide access to spatial data as well as decision support applications using handheld devices from remote locations [5].

The whole program consists of 7 files linked to each other:

— Form1.cs [constructor] - sets the appearance of the main screen Map;
— Settings.cs [constructor] - sets the appearance of the Settings screen;
— Form2.cs [constructor] - sets the appearance of the Legends screen;
— Program.cs - the file from which the program starts and which opens the Map screen (where the most popular support measures by territory and industry will be displayed);
— Form1.cs - file with functions executed from the Map screen;
— Settings.cs - a file with functions executed from the Settings screen;
— Form2.cs - file with functions executed from the Legend screen.

Program.cs file
The file from which the execution of the program starts opens the "Map" window, global variables are created in it, which are presented in any part of the code:

- *year* is an integer variable containing the selected year;
- *nomberList1* is an integer variable containing the page number in the Excel work-book of the selected database (which reflects existing support measures);
- *nomberList2* is an integer variable containing the number of the additional page in the Excel workbook of the selected database, necessary if the indicator is obtained by the ratio of two parameters, for example, the indicator "R&D cost subsidization (ratio provided / not provided);
- *pokazatel* - an integer variable containing the number of the selected indicator (for example, number 1 - exemption from VAT when performing scientific research);
- *pokazatelString* is a string variable containing the name of the selected indicator, which is required to be sent to the label on the main Map screen;
- *mean, mean1, mean2, mean3, mean4, mean5* - row variables containing the aver-age value of the selected indicator for the country and for each group of support measures, respectively. Needed to send these values to the Legend window;
- *variation1, variation2, variation3, variation4, variation5* are line variables contain-ing the variation value for each group of support measures, respectively. Needed to send these values to the Legend window;
- *min1, min2, min3, min4, max2, max3, max4, max5* - string variables containing the minimum and maximum values of the indicator for each group of support meas-ures, respectively. Needed to send these values to the Legend window;
- *leder, loser* - string variables containing the name of the best and worst region for the selected indicator. Needed to send these values to the Legend window.

Also in this file, the Group class was created, which contains the name of the re-gion, its number in the ordered list, the value of the indicator and the polygon that will be displayed on the map [6].

Form1.cs file

First, global variables are created, which are visible in all functions of this file:

- 85 variables of the Group type for each subject of the Russian Federation (this type is described in the Program.cs file), which already contain the name of the subject;
- 85 variables of the StreamReader type with the specified directions to the files with the coordinates of each subject;
- Canvas overlay to which all branches of the regions are added;
- Array of coordinate files MassFileOfCoordinate;
- Array MassGroup and MassGroupOld of Group variables containing the data of the selected indicator and the previous selection, respectively;
- Variable "bulling" of the firstStart type, which takes the value true at the first start of the program and the value false at the next start;
- Three variables of type Image containing images for buttons of years.

The file includes the functions:

- *CoordinatOfRegion* - a function that accepts one variable of the StreamReader type containing the coordinates of a constituent entity of the Russian Federation and re-

turns a list of coordinates of enterprises using support measures in a specific constituent entity of the Russian Federation;

— *MassOfData1* - a function that takes a variable containing the sheet number of the Excel workbook. It reads data from the SDDataYear database and creates a dataset for a specific measure of support per year;

— *MassOfData2* - a function that accepts variables containing the numbers of two sheets of the Excel workbook with the data of the indicators, the ratio of which we need. It reads data from the SDDataYear database and creates an array of data;

— *MassOfData3* - A function that reads data from the Sustainability Year database and creates a dataset;

— *ColorPoligon1* - a function that takes a variable of the Group type and, by number in the ordered list, assigns a specific color to the extent that this variable is supported;

— *ColorPoligonInversion* is a function that works like ColorPoligon1, but is used if a higher value corresponds to a better rating group. For example, the more businesses used the support measure, the better;

— *ColorPoligon2* - a function that works like ColorPoligon1, but is used when the indicator "Demand for measures of state support in the region" is selected;

— *CleanFlags* - a function that removes flags from the rating group display switches;

— *VisibleFlag* - a function that takes a variable of the selected indicator. Responsible for displaying specific radio buttons for selecting a rating group, depending on the indicator;

— *ShowPoligons1* - the function responsible for displaying regions on the map. The first thing it does is call the CleanFlags and VisibleFlag functions. Then, depending on the indicator, the function for creating an array of data (MassOfData1, MassOfData2 or MassOfData3) is called, after which the data is sorted and each measure of government support is assigned a number in an ordered list, depending on which the function ColorPoligon1, ColorPoligonInversion or ColorPoligon2 assigns the desired color to the measure. At the end, state support measures are added to the canvas and the canvas is displayed on the map [7];

— *ShowPoligons2* - the function of displaying regions with a selected group of measures for indicators from "Measures to support promising enterprises";

— *ShowPoligons3* - function of displaying support measures for the selected rating group for the indicator "Demand for support measures for the industry";

— *RegionJump* - a function for checking changes in the group of demand for support measures by region.

The following features are enabled when interacting directly with form elements:

— *Form1* - starts when the Map window is opened. Here, the setting of the map parameters and its display are initialized, the already created variables of the *StreamReader* type with the files of the coordinates of enterprises by industry of the subjects of the Russian Federation are added to the *MassFileOfCoordinate* and *MassGroup* arrays;

— *button1_Click...button14_Click*, except for *button11_Click* and *button12_Click* - are triggered when you click on the year selection buttons. Inside each function,

the variable year is assigned a specific year and the button color changes, after which the *ShowPoligons1* function is initialized, which displays the measure of support;
— *button11_Click* - starts when you click on the "Indicator" button and opens the settings window;
— *button12_Click* - starts when you click on the "Legend" button. Within this button, statistical indicators are calculated and the result of calculations is stored in the variables *mean, mean1, mean2, mean3, mean4, mean5, variation1, variation2, variation3, variation4, variation5, min1, min2, min3, min4, max2, max3, max4, max5 , leder, loser and opens the Legend window*;
— *checkBox1_CheckedChanged...checkBox5_CheckedChanged* - run when the support measures group selection switch is changed and initialize the *ShowPoligons2* function;
— *checkBox6_CheckedChanged...checkBox12_CheckedChanged* - triggered when the industry group selection switch changes and initializes the *ShowPoligons3* function;
— *checkBox14_CheckedChanged and checkBox15_CheckedChanged* - are triggered when the switches for displaying subjects who have improved / worsened their position are changed. Inside, using the RegionJump function, the change in the group of demanded support measures by industry for each subject is checked and the necessary entities are displayed.

Settings.cs file
This file contains the following functions:

— *NomberOfList* is a function that checks which indicator is selected and sends information to the variables *nomberList1, nomberList2, pokazatel, pokazatelString*;
— MainMark1_CheckedChanged - triggered when the "Demand for support measures for the industry" radio button is selected. It displays information about a given indicator and sends information to the variables *pokazatel, pokazatelString*;
— MainMark2_CheckedChanged - starts when the "Measures to support promising enterprises" radio button is selected. Displays possible metrics;
— button1_Click - starts when you click on the "Map" button. Initializes the *NomberOfList and ShowPoligons1* function, and then closes the Settings screen.

Form2.cs file
This file draws a table that is displayed in the Legend window and displays the values of the variables *mean, mean1, mean2, mean3, mean4, mean5, variation1, variation2, variation3, variation4, variation5, min1, min2, min3, min4, max2, max3, max4 , max5, leder, loser.*
Database
For a full-fledged work, 2 main databases are required. They are implemented in the form of Microsoft Excel tables, divided into sheets according to various indicators [8].

The first SDDataYear database includes annual indicators for support measures used by industry enterprises in a specific region, as a result of which the demand for

support methods used in various industries is assessed and monitored, allowing the assessment and monitoring of support mechanisms by enterprise, industry and territory.

The second database is a list of enterprises and projects that have benefited from support measures [9].

4 Conclusion

User-visible screen displaying statistics on required support measures. Depending on the selected parameter, the screen may look in two ways [10]. On the one hand, such an image allows enterprises to make decisions on new support measures and evaluate the most effective ones, on the other hand, the control system over the use of certain measures allows state bodies to assess the situation from different angles and make decisions aimed at developing support measures that turned out to be the most in demand and proved to be economically significant for the development of industries, individual enterprises and projects.

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