Context-aware decision support software service

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Abstract – Considered the problem of using decision support system based on context-aware computing with internal and external economic context. A structural diagram of the algorithm of its work and the chart classes.

Keywords – decision support system, context-aware computing, internal and external economic context.

Introduction

With the fast growing of industrialization and service sector of the economy, the issue of "choice" is becoming more and more relevant, since in today's dynamic world, with the constant uncertainty of economic, political and social factors, making the right decision is not a simple task.

After invention of the first personal computers, humanity began to actively engage in research and development of various systems, which, in one way or another, could simplify the life of people. One of them is the decision support system. Modern decision support systems are systems that are highly adapted to the challenges of day-to-day management, and are an instrument designed to assist decision makers [1].

The interest in decision support systems as a perspective direction in the use of computer technology, as well as in the toolkit for improving the efficiency of economic management is constantly increasing. With the help of these systems, which are included methods of mathematical modeling and management theory, a decision can be made even in unstructured and weakly structured problems, including multi-criteria ones. Therefore, decision support systems are usually multilevel and include theories of databases, artificial intelligence, interactive computer systems, simulation techniques, etc. [2].

Condition of the problem

It is quite obvious that important economic decisions, like all others, have their consequences, but the process of making economic decisions is highly complex, and in the conditions of informatization and globalization that characterize today, this complexity is increasing.

The answer to the difficulties and responsibilities in making these decisions was the emergence in the XX century of a new computer system - decision support system (DSS). DSS is an application that analyzes data in areas of its usage and interprets them in such a way that could make it easier for the user to choose the best option [2].

Any DSS, regardless of its purpose, internal structure and design patterns, implements a number of conceptions. The base concept of intellectualization of the DSS is the integration into it tools and systems of artificial intelligence, expert systems, knowledge bases, etc. [3]. Implementation of this concept allows to receive information from expert systems on specific issues of decision-making, to weaken the formalism of user communication with DSS through the using systems of interpreting the natural language in them.

Real-time context analysis is one of the main tasks of any decision support system, since in certain situations there is a risk of significant loss in decision making based on outdated data. Context awareness processes data of the environment in which DSS should work. For example, global economic trends in the region, its political and geopolitical situation and certain social processes at the moment of the decision-making [3]. The internal context of the person which makes the decision should also be analyzed, such as current and general economic situation, the status of the person in the hierarchy of the society, his physical presence in one place or another, the period of the year and the concrete time, etc.

Formulation of the problem

To propose an approach to solving the problem of decision-making in unstructured and weakly structured problems, including multi-criteria using data systems which includes the methods of mathematical modeling and control theory. Develop a structural scheme, describe the algorithm of the system and give a class-diagramm.

Proposed solutions

To solve this problem, three main and large areas of information technology and economy were combined. The field of monitoring the financial status of a person, decision support systems and context-aware computing.

The algorithm for the analysis of events and the search for regularities using the associative rules method is taken as the basis and combined with the modeling method using the "What If?" analysis.

The algorithms of associative rules allow to find patterns between dependent events. The purpose of the analysis of determining the dependence like "if the transaction met a set of elements X, then we can conclude that another set of elements of Y should also appear in this transaction" [4].

The analysis "What If?" allows solving the optimization problem based on the inverse problem [4]. This type of analysis allows you to search for the values of factors (input variables), in which the desired value of the dependent variable (output variables) will be obtained. The content of the analysis is to answer the question: "What will be obtained if the values of the input variables are given?" For the analysis of the data, it is necessary to construct a model that will simulate the considered dependence. Various algorithms can be used to construct such a "black box" model [4]. Such algorithms can be chosen neural networks, decision trees, linear regression, and others.

The structure of the context-aware decision support software service (Fig. 1) includes three basic subsystems: the user interface, the main function of which is to enable the ODR to interact with the system, using different methods of inputting information and its output formats; subsystem of work with data, the main function of which - saving, management, sampling and analyze data; subsystem of work with models, the purpose of which is to save, manage and select models to give user the answers for his requests [4].

The algorithm of the context-aware decision support software service (Fig. 2) consists of the following main steps: user authorization - login with social networks or create new account; synchronize data with a cloud database and obtain a history of banking transactions; obtaining a current economic context - request data from World Bank Open Data open API; calculation of the index of the user's economic status; building the model of the context based on the received data on trends in economic development; computing a prediction model using "What If?" and

linear regression analysis method; building of the decision model and its extrapolation in a graphical plane based on computed results.

To implement the context-aware decision support software service, the Java programming language, the Android platform as the client part and the Spring Framework for the server part were selected. The database is Firebase Realtime Database, because it allows you to flexibly synchronize data between the client and the server and automatically create backup data and encrypt them, which, in case of work with financial data, has become a decisive factor.
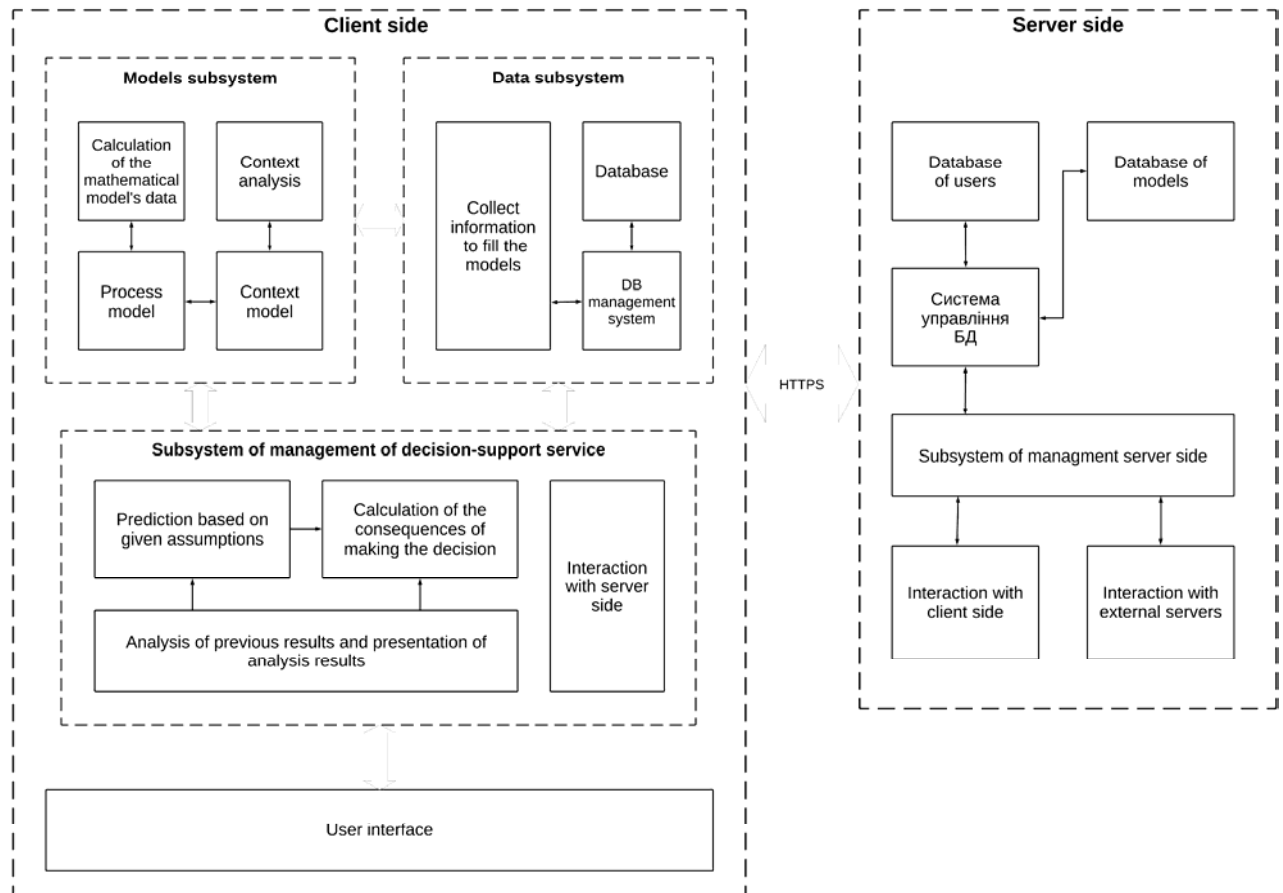

Fig.1. Structure scheme of the context-aware decision support software service.

The client part is designed according to the principles of the so-called "Clean Architecture" [5], according to which the division of the software service into three interrelated levels occurs: the level of presentation, the level of data and the level of business logic that communicates with each other using predefined interfaces according to the design pattern " Inversion of Control "[5].

Conclusion

In this paper, the context-aware service decision support software service is developed. A structural scheme and the algorithm of system are described and presented.

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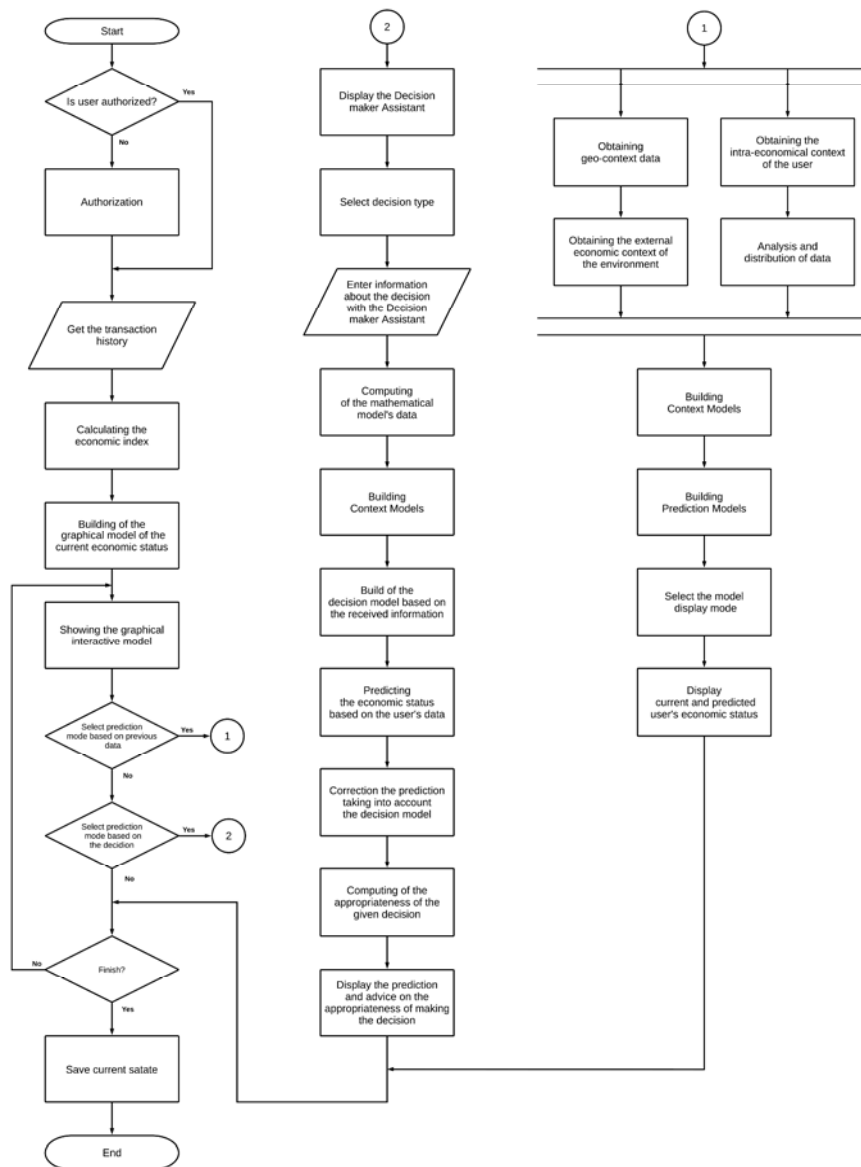
Fig.2. Algorithm diagram of the context-aware decision support software service.