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DEVELOPMENT OF A MODEL FOR THE INTELLIGENT SOFTWARE SYSTEM SYNTHESIS

Mahmudova Shafagat
Ph.D., Associate Professor
Azerbaijan National Academy of Sciences Institute of Information Technology

1. INTRODUCTION

Under certain conditions, software synthesis becomes very important for the mathematical description of the processes of building the most probable and alternative set of the system elements [1].

Synthesis refers to coordination and construction. The term was first introduced in 1845 by the German scientist Kim Adolf German.

The issue of synthesis in decision-making becomes its part when the alternative variants have a complex multi-element structure; and in this case, the combination of different subdivisions of certain elements occurs in a single variant. Synthesis involves procedures for analyzing solutions. These issues can be classified for many traits [2].

Available approaches to the development of decision support software system are grouped as follows:

- Approaches based on the mathematical methods of decision-making theory and the artificial intelligence;
- Systems building with expert data, mathematical modeling and data structure based on mathematical methods.

One of the most important issues is the role of the most permissible alternatives of the set of criteria in the set of criterial evaluations.

In intelligent systems, information obtained from experts is stored in a knowledge base, thus the user of such systems may not be an expert. Both these and other systems are generally designed to solve the problems of certain serious class problems. Decision making and choosing the right software system is not an easy task, and can only be solved by a highly qualified specialist.

One of the main issues is the study of methods for solution and hierarchy analysis in uncertainty, the methods of fuzzy set theory and modeling methods. When using them, the information obtained from experts may include a hierarchy of goals, criteria and alternatives. Preference is given to the criterial evaluation of alternatives, mainly in pairs, which assess the importance of criteria [3].

The disadvantage of the method is the limitation of the number of objects to be simultaneously compared, the number of long-term pairs to be compared, as well as the independence of criteria [4].

Different decision-making methods are used based on fuzzy sets theory [4, 5].

Nowadays, the problem is to choose a method from a wide range, and only a good specialist can manage it. Five methods are used in the US manufactured decision support software based on a fuzzy approach:

- method based on hierarchical analysis;
- maxmin method;

- adaptive method;
- method based on fuzzy rules;
- method based on expert preference rules [6].

Innovations in solving the problem of synthesis of Intelligent Software Systems (ISS) are as follows [7]:

1. The use of intellectualization in the ISS synthesis, which includes the use of artificial intelligence methods at all stages of the ISS synthesis;
2. Development of various algorithms in the ISS synthesis using artificial intelligence methods;
3. Development of models and algorithms in the ISS synthesis, depending on the measurement and information situation.

2. PROBLEM STATEMENT FOR THE ISS SYNTHESIS

The main issues in the ISS synthesis are as follows (Figure 1):

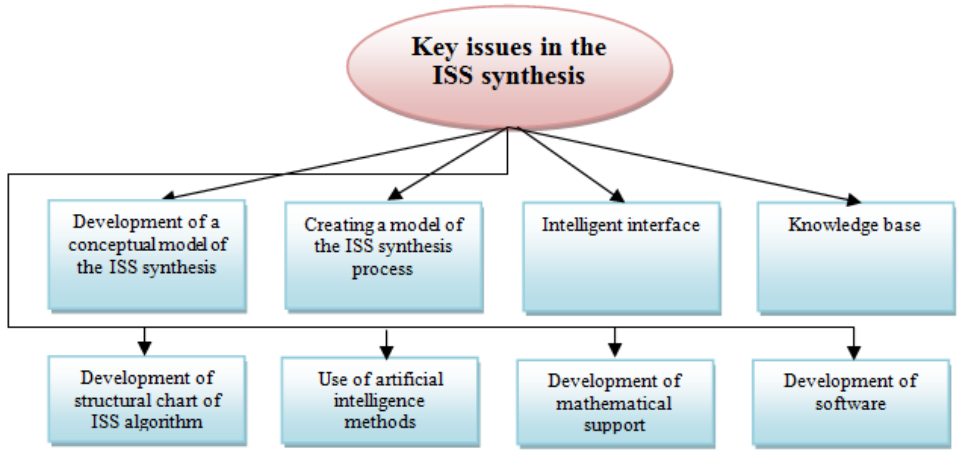

Figure 1. Key issues in the ISS synthesis

- Development of a conceptual model of the ISS synthesis;
- Creating a model of the ISS synthesis process;
- Development of knowledge base, intelligent interface, structural chart of ISS algorithm, and use of artificial intelligence methods, etc.;
- Development of mathematical support;
- Development of software.

Conceptual model of the ISS synthesis. To solve the problems of ISS synthesis successfully, the presence of other aspects of the problem area at the conceptual level is required. An expanded description of the components as a compact descriptive-graph is called a conceptual model.

The features of the conceptual model in the ISS synthesis are as follows: the structure of the model develops according to the stages of the ISS synthesis; the model uses a database and knowledge in the development of ISS; a functional and information model of ISS is built on the basis of a conceptual model.

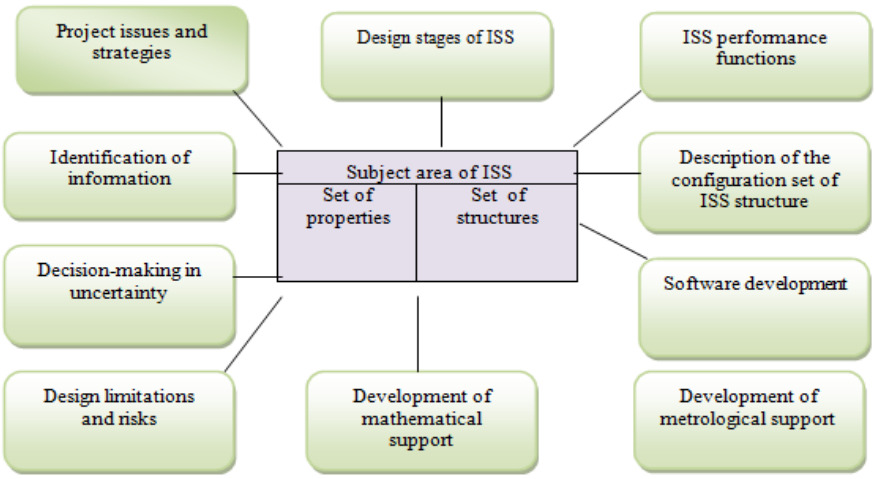

Figure 2. Conceptual model of the ISS synthesis

3. MODEL OF THE SYNTHESIS PROCESS

A model of the ISS synthesis process using modeling systems and the system approach theory [8] is presented as a graph in Figure 2. A model of the ISS synthesis process is illustrated in Figure 3.

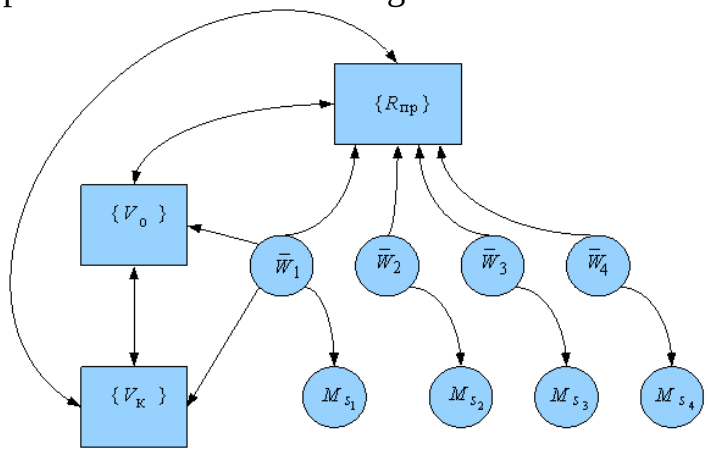

Figure 3. Model of the ISS synthesis process

The top of the graph M_{si},i= 1,…,3 denotes the structure of the ISS model

M_{s1} denotes a model of the typical structure of ISS

M_{s2} denotes a structural model of ISS and products of the subject area

M_{s3} denotes a structural model of ISS and products of the 2nd subject area

M_{s4} denotes a structural model of ISS and the products of the 3rd subject area.

In the synthesis process model, $\overline{W}_i$ i = 1, ... 4 denotes the structure configuration and are the operators used to convert the models of the ISS structure depending on the measurement condition.

About the intelligent interface. Intelligent interface is a user interface additionally equipped with software. Performing elementary functions for analysis, synthesis, comparisons, generalizations, training of all components involved in the process of interaction with the user makes the ordinary user interface smart (efficient), i.e., intelligent.

To provide the user with an intelligent interface, first, the software itself must be intelligent. Within the human-machine system, the intelligent interface providing a

direct interaction between the end user and the system during the problem solving must perform three groups of tasks [9]:

1. to provide user opportunities for the system only subject to the conditions (without specifying the program decision);

2. to create the user opportunities for the problem solving using the professional activity of the user, that is typical forms;

3. to provide a flexible dialogue using a variety of non-preconfigured tools, including those used to correct possible user errors.

The system structure (Figure 4) uses three components to meet the problem-solving requirements:

- **System execution**. A set of tools to ensure the execution of software;
- **Knowledge base**. Knowledge system about problem environment;
- **Intelligent interface** customizes the computing system for the user.

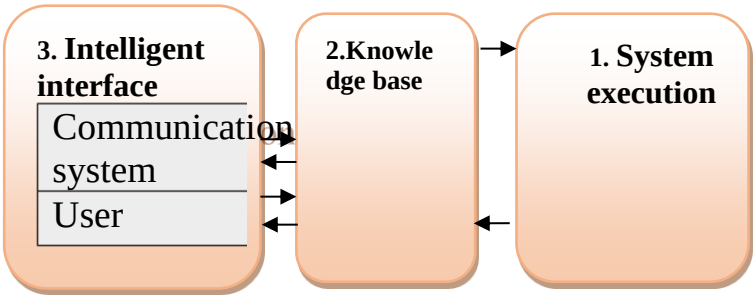

Figure 4. Advanced system structure to solve applied problems

Systems equipped with intelligent interface (II). The following types of IIs used to increase the communication capabilities of information systems are available:

- **Intelligent databases**. Unlike traditional databases, it selects the data required out of non-public but stored data set.
- **Natural language interface (NLI).** It is used to provide text data and voice command search in control systems using intelligent databases and for machine translation from foreign languages. To implement NLI, morphological, syntactic and semantic analysis problems have to be solved. *Morphological analysis* performs recognition and verification of the spelling of words in the dictionary. *Syntax control* ensures the input messages to be split down into separate components. *Semantic analysis* provides the construction of semantic accuracy of syntactic structures. Unlike synthesis analysis, the synthesis of ideas results in the numerical presentation of information in natural language.
- **Hypertext systems**. It is used to search for keywords in a database containing text-type data. A complex semantic organization of keywords is required to more fully represent the different semantic relationships of terms. Solution to this problem is ensured with the help of intelligent hypertext systems. The search is then performed using keywords in the knowledge base. Correspondingly, multimedia information is searched through graphic, audio and video information.
- **Contextual help systems**. It refers to the class of knowledge distribution systems. Generally, such systems are attachments to documents. Contextual Help Systems are a special case of hypertext systems.

CONCLUSION

The synthesis of ISS was concluded to be one of the most pressing issues. The issue of synthesis plays an important role in decision-making for ISS. Further use and development of such issues for ISS will reduce the cost of ISS and make the system more efficient.

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