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**THE ES\_RFCHD EXPERT SYSTEM FOR THE ANDROID PLATFORM****Burdaev V.P. / Бурдаєв В.П.***c.ph.math.s., as.prof. / к.ф.м.н., доц.*

ORCID: 0000-0001-9848-9059

*National Technical University "Kharkiv Polytechnic Institute",**Kharkiv, Kyrpuchova 2, 61002**Національний технічний університет «Харківський політехнічний інститут»,**м. Харків, Курпучова 2, 61002*

**Abstract.** *The ES RFCHD application is an expert system for determining the risk of coronary heart disease (CHD) in a healthy person for the Android platform. The relevance of the development of the system lies in the fact that at present in medicine the process of transition to the concept of CHD prevention, that is, to the concept of risk factors associated with the lifestyle of a particular person, is clearly expressed. The purpose of the system is to recognize the presence of CHD risk factors with an emphasis on the individual lifestyle of a person, using the knowledge base of medical experts.*

**Key words:** *knowledge base, expert system, mobile application, Android and Embarcadero platforms.*

**Introduction.**

Expert systems (ES) are designed to help the user in making decisions in informal subject areas [1]. The main important points in the design of an expert system are the structure of the knowledge base and the inference engine, which allows you to get an explanation of the decision. The traditional ways to implement an inference engine are backward, direct, mixed Bayesian chains of reasoning. Due to the asynchrony of the Android operating environment, the mobile application inference engine algorithm mainly uses direct and Bayesian chains of reasoning.

Taking into account current trends, the development of mobile applications that perform the functions of expert systems is an urgent task. Since there is a constant need to adapt them for use on mobile devices.

Various frameworks (shells) are used to create mobile expert systems: Flutter, Ionic, React Native, Android Native, Xamarin and others [2].

The framework for creating knowledge bases KARKAS was created using the FireMonkey (FMX) cross-platform framework from Embarcadero, which is part of the RAD Studio development environment and is designed to create user interfaces. A remarkable feature of the framework is that the application code can be compiled into native code to work on different platforms: Windows, Android and iOS [3].

One of the main advantages of mobile applications in customer service is that interlocutors are free to ask questions that they would not ask a support representative or company manager.

**Main text.**

Consider the structure of the mobile application ES\_RFCHD.

The appointment of ES\_RFCHD is a preventive counseling of the patient to assess the risk of developing coronary heart disease.

The scope of ES\_RFCHD are various medical enterprises: dispensaries, polyclinics, medical units.

The purpose of ES\_RFCHD is to model the decision making about the risk of developing coronary heart disease in a healthy person.

Initial data: medical tests.

Expected results (list of possible consultation goal values):

- individual prevention of coronary heart disease;
- independent acquisition of knowledge about the risk of coronary heart disease;
- self-monitoring of the risk level of coronary heart disease;
- receive appropriate advice to reduce the risk of coronary heart disease.

Subject area identification. A risk factor is understood as the social, biological and economic status of a person, his behavior patterns and conditions that contribute to the occurrence of coronary heart disease.

Based on the results of expert studies, it has been established that the activities of an outpatient doctor should be aimed at identifying only the main risk factors for coronary heart disease, namely: hypercholesterolemia, arterial hypertension, smoking, overweight, poor diet and alcohol consumption. The validity of this recommendation is due to the fact that the main function of the doctor is the diagnosis of the disease itself, and not its prenosological conditions. The practical priority of prenosological diagnostics contributed to the fact that the expert group expanded the number of CHD risk factors to 13: hypercholesterolemia (high cholesterol), arterial hypertension (high blood pressure), smoking, physical inactivity, overweight, coronary behavior, stress, lack of social and psychological support, malnutrition, diabetes mellitus, unfavorable heredity, insufficient rest, alcohol.

In addition, the mobile application provides an analysis of additional risk factors: the physical condition of a person, a symptom of shortness of breath, and others.

The obtained values of the coefficients of the hierarchy became the basis for calculating the coefficients of reliability of knowledge facts and determining its filtration in a hierarchical functional system.

A functional system (FS) is a system formed to achieve a given useful result (target function) in the course of its functioning. A system-forming factor is a useful result [4].

Hierarchical functional system is characterized by the following properties:

- connectivity – a chain of knowledge base connections
- complexity – hierarchy of levels of local knowledge bases
- stability (adaptive behavior of the system) – the structure of the FS digraph does not change with vertical perturbations (changes) in the rules.

The mobile application contains the following modules:

- 1) Inside expert system details – allows the user to view the state of the knowledge base, get information about how the result of the consultation was obtained, analyze the output machine trace;
- 2) Inside knowledge base – allows the user to view the knowledge base stack, the consultation goals stack, the status of active facts;
- 3) About risk factors of CHD – for the user to analyze the hierarchy of risk factors and their coefficients to obtain an argument about the decision made by the expert system;

- 4) Gallery ES\_RFCHD – provides the user with information and a view of the hierarchical functional system for the result of the consultation;
- 5) Directions ES\_Karka's – the user can get acquainted with the main directions of development of the KARKAS system, the ES\_RFCHD mobile expert system, Telegram chat bots (@Ribs\_karkas\_bot, @es\_test\_karkas\_bot, @es\_economy\_karkas\_bot, @es\_info\_tech\_karkas\_bot) integrated with the KARKAS system for organizing online consultations in various subject areas [5,6];
- 6) ES\_RFCHD is the main module of the expert system that allows you to download the knowledge base, select the CHD risk factor, conduct a dialogue with the user and provide the result of the consultation with the reasoning for the decision.

About Us – provides information about the ES\_RFCHD mobile application: purpose, purpose of the application, source data.

Additional information can be found on the web site of the shell for creating knowledge bases KARKAS [6].

### **Summary and conclusions.**

A mobile application ES\_RFCHD has been developed for the Android platform, which is available on Google Play.

The main function of this mobile application is to provide the user with control over the level of risk factors for coronary heart disease.

A knowledge base was built to determine the risk factor for coronary heart disease.

The knowledge base contains rules and frames for representing knowledge. Facts and heuristics can be stored in a knowledge base. In addition to these, meta-knowledge is used to guide decision making. The knowledge base contains both static and dynamic rules that change their structure.

Frames have the following characteristics:

- inheritance of slot values;
- managing daemon attributes.

Inheritance avoids duplication of information. Grouping the knowledge base into clusters allows you to:

- perform flexible inference by activating clusters during consultation;
- test the knowledge base by clusters, that is, check for consistency and completeness of knowledge.

The knowledge base of the system is constantly being modified and updated with new rules. Further design of the system is aimed at developing top-priority preventive recommendations to reduce the risk of coronary artery disease.

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