

University of Medicine and Pharmacy Tîrgu Mureş

PhD Thesis – Abstract

**”A model for defining and interrogating complex data structures
used in medical research”**

PhD candidate: Oláh Péter

Scientific Coordinator: Prof. Dr. Dobru Daniela

Information systems used in healthcare are generally complex applications that manage large volumes of medical data. When used in medical research, these systems provide a double challenge to the software designers: the need to address complexity and a need for flexibility at the same time. There are several commercially available software systems that approach this issue from different perspectives. Yet, the penetration level of these applications in the science laboratories remains shallow.

In this context, we wish to present the design, implementation and evaluation of our own model for defining and interrogating complex data structures used in medical research. This model relies on the use of trees and multitrees. In order to benefit from the functions that provide data integrity, consistency and security, we have implemented this system using relational databases.

The first part of the thesis is intended to be a review of the main types of information systems used in medical practice and research. We have presented a classification of these systems along with a short description of their main functions. A more detailed review and a brief comparison was conducted for a number of applications available on the market.

As we have implemented our solution in two different areas related to medical research, we also present in the first part of the material a short description for some core concepts used in gastroenterology and tissue engineering and regenerative medicine.

The second part of the thesis is dedicated to the presentation and evaluation of the solution we propose. We present the functionality of the system along with some principles and techniques used to design it. We also present the instruments used to evaluate the system’s perception by the scientific community and discuss the results of these evaluations.

Material and method

Here we present the basic design of the system and of the data structures used to support its functionality. We emphasize the use of trees and multitrees and the implementation of these structures using metadata stored in a relational database. Two separate implementations are also described, each in a different type of research setting (i.e. clinical research and experimental research conducted in a laboratory).

In order to validate our approach with the scientific community, we have built two questionnaires. The first questionnaire was designed to evaluate an initial level of acceptance for the system by the community. The second was aimed to re-evaluate this level of acceptance after we presented the solution and to gather some more information regarding the utility and usability of the application. The design, validation methods and the statistical processing of the results of the questionnaires are described in detail in this section.

Results

This section presents the results of the two questionnaires along with all the statistical data derived from processing them. Each evaluation scale was analyzed and in some cases item level analysis was conducted also. The final acceptance level was compared to the initial one for the whole study group and also for sub-groups selected based on specific criteria.

Discussions

This section debates the results presented in the previous section, emphasizing the evolution of the acceptance level of the scientists following the presentation of the proposed system. Some key aspects about the subjects' perception of various functional areas of the system are also discussed.

Conclusions

Our conclusions are presented in the last chapter. These outline the strengths of our approach but also present the limitations of the model. As a general conclusion, we emphasize the proof-of-concept role of the two implementations and the advantages that this approach presents, particularly in the area of retrieving scientific information from the system by using the user-defined structure of the data.