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Bachelor in Computer Science

Accelerating SQL with Complex Visual Querying

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ABSTRACT

The dissertation must contain two versions of the abstract, one in the same language as the main text, another in a different language. The package assumes that the two languages under consideration are always Portuguese and English.

The package will sort the abstracts in the appropriate order. This means that the first abstract will be in the same language as the main text, followed by the abstract in the other language, and then followed by the main text. For example, if the dissertation is written in Portuguese, first will come the summary in Portuguese and then in English, followed by the main text in Portuguese. If the dissertation is written in English, first will come the summary in English and then in Portuguese, followed by the main text in English.

The abstract should not exceed one page and should answer the following questions:

- What's the problem?
- Why is it interesting?
- What's the solution?
- What follows from the solution?

Keywords: Keywords (in English) ...

RESUMO

Independentemente da língua em que está escrita a dissertação, é necessário um resumo na língua do texto principal e um resumo noutra língua. Assume-se que as duas línguas em questão serão sempre o Português e o Inglês.

O *template* colocará automaticamente em primeiro lugar o resumo na língua do texto principal e depois o resumo na outra língua. Por exemplo, se a dissertação está escrita em Português, primeiro aparecerá o resumo em Português, depois em Inglês, seguido do texto principal em Português. Se a dissertação está escrita em Inglês, primeiro aparecerá o resumo em Inglês, depois em Português, seguido do texto principal em Inglês.

O resumo não deve exceder uma página e deve responder às seguintes questões:

- Qual é o problema?
- Porque é que ele é interessante?
- Qual é a solução?
- O que resulta (implicações) da solução?

E agora vamos fazer um teste com uma quebra de linha no hífen a ver se a \LaTeX duplica o hífen na linha seguinte...

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-lhe zzz zzzz zzz zzzz

Sim! Funciona! :)

Palavras-chave: Palavras-chave (em Português) ...

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INTRODUCTION

This project was developed **on a particular environment**, and, as such as, this chapter will introduce this thesis, starting by all the contextualization about the company, the product, **and its section which will be the nuclear focus of this thesis**, followed by the description the motivation behind it. In addition, will be presented an overview of the problem, such as expected contributions and the structure of the document.

1.1 Context

The main idea in this section, is to present a short description, with three or four paragraphs, which contains some executive summaries of the problem and of the topics of this work.

Nowadays, Information and Computer Systems have been in everyone's life, aggregating not only personal information, but also in all sectors of corporate environments. However, well before any system like this, since the people started to count or write, they have needed to store pieces of information. [1] Thenceforth, by many years, people have used physical information, like paper, to store data, but with the digital transformation, these resources are less and less used.

In the decades of the 1960s, Database Management Systems (DBMS) arose, and later at 1970s new management systems that use relational models, designated as Relational Database Management Systems (RDBMS). Moreover, first Data Query Languages (DQL) appeared, like SQL [4], which was considered by the ANSI ¹ and ISO ² as the standard query language [5]. These technological evolutions have improved the effectiveness and the efficiency of the querying process. However, to find some information on databases

¹American National Standards Institute

²International Organization for Standardization

more knowledge is needed. Thus, if from one side the technological evolution and the digital transformation have optimized the data querying process, only a subset of people can use these powerful querying technologies.

Visual Query Systems (VQSs), defined by Catarci, *et. al.* [2] as “systems for querying databases that use a visual representation to depict the domain of interest and express related requests”, are used to mitigate some problems already referred, since these systems use different visual representations and interaction strategies to made database queries using more intuitive visual approaches instead of using textual languages which are more difficult to learn manly for people without programming base knowledge. In addition, even if it is not mandatory to be considered a VQS, some systems have also data visualization features which can be useful to view the query result, even as the possibility to manage the database schema in a visual way too.

However, usually, these visual languages are associated as more useful to naive users, while textual languages are associated to more expert users. Conversely, some studies have revealed that these might be convenient to the expert users too. For example, the comparison made by Catarci and Santucci [3] concludes that diagrammatic languages can reduce the error rate of the queries made in a textual language by expert users, since even these make mistakes in simple queries (e.g. because they do not remember the name of the tables or the precise syntax of some language expressions). Thus, it is important to analyse how those languages could be used to optimize the querying process not only to the users with a low experience level but also for highly experienced users.

Nonetheless, the widely users’ background and the diversity of the data domain made that a lot of these systems need to be modelled to a specific domain, because it is very difficult to find an global integrated solution that covers necessities of all users on all domains being this personal or professional.

1.2 Motivation

It will be presented the motivation behind this project. So, it will be explained what are the user possibilities to build queries, including visual and not visual ways, and what are the problems related with both of them. Also, will be presented what is the company’s motivation to do this project, since users can do the queries that they want in different ways.

1.3 Problem Description

In this section, will be presented generally the problem of this thesis. The goal of this section is to provide a global view of the problem without many details.

1.4 Research Questions

Following, will be enumerated the most important question which guides the workflow (e.g. Can we enable OutSystems developers to easily do most kinds of database queries without ever using SQL?). The goal is to do all the research and development in order to obtain answers to all of these questions.

1.5 Main Expected Contributions

In the Main Expected Contributions, will be enumerated what are the thesis contributions to this work and to the proposed final solution.

1.6 Structure

The remaining chapters of this thesis are organized as follows:

- Chapter 2 - [Related Work](#): presents a short description of the OutSystems Platform, as well as a description of the existing techniques that already exist on the context of the main topic of this thesis - data visualization and visual querying. Besides, other commercial applications will be enumerated which can have relevant content for this study;
- Chapter 3 - [Proposed Solution](#): describes the proposed solution, starting with a requirement analysis, followed by a more detailed explanation about the problem, and finally with a definition of the development scope to understand what problem will be tackled on detail;
- Chapter 4 - [Work Plan](#): includes a planning of the inherent total work. Thus, will be presented an overview of the tasks that were done on this dissertation plan, together with the preview of the work which will be the focus of the second phase of the thesis, the elaboration.

RELATED WORK

On this thesis, it is pretended to apply Human-computer interaction (HCI), Data Visualization and Visual Querying concepts, techniques and technologies to improve a Visual Querying Feature of the OutSystems Low-code Development Platform. Thus, in this chapter, will be presented the results of a study that analysed what is the Low-code development platform background and its actual situation, as well as what are the techniques and technologies which already exist, including some comparison between them. Finally, will be enumerated what products, technologies and tools exist on other commercial applications which can be related with the topics of this thesis.

It is necessary to add more sections to describe some key concepts about user experience testing and analysis.

2.1 OutSystems Background

The entirety of this thesis has the aim of improving the OutSystems Platform, so it is very important to understand what is that product and what can be developed with it. This section provides an overview of this Low-code Development Platform, describing its value proposal, and its technological goals and approaches. In addition, it will be used some images to illustrate some relevant aspects of the platform.

The next sections depend on the research done.

2.2 Data Visualization

2.3 Visual Queries

2.4 Data User Experience and Expressiveness

2.5 Technologies and Commercial Applications

Such as the techniques research, it is also very important to search what are the technologies related with the subjects of this thesis that already exist, as this knowledge can be very important to the concept of a solution proposal.

Furthermore, in any research, the academic content should not be the only taken into account, because sometimes the knowledge does not evolve only in the research centres but also in the companies. Since this thesis is made to improve a company product, the latter assertion has additional strength, so also, will be introduced commercial applications which can be useful to all the entirety of this process.

PROPOSED SOLUTION

This chapter presents the solution proposed to the problems presented, that includes a description of the process realized to understand why the people use SQL to made queries instead of Aggregates, such as Personal Interviews and a Quantitative Analysis of the queries which customers ran on the cloud. Furthermore, this chapter presents what is the scope of the project, so it will be explained what problems will be tacked in detail.

3.1 Requirements Analysis

As referred above, this section presents the results of the analysis made to understand why developers use SQL to make queries instead of Aggregates through its Visual Querying Features.

3.2 Proposed Implementation

Following, will be detailed the pretended project, indicating all the problems identified and all the approached that will be adopted.

3.3 Scope Definition

In this section, will be presented what were the decisions made of which problems will be addressed in this thesis, once the initial problem presentation had a wide scope and it was concluded that it's not possible to resolve all the Aggregates expressiveness and experience problems in this project.

WORK PLAN

This chapter includes a planning of the total work from beginning to end. Thus, will be presented in a chronological way all the work realized in the preparation phase. Furthermore, after all the analysis realized on this dissertation plan, will be presented an expected plan to the remaining time until the final of this thesis.

BIBLIOGRAPHY

- [1] K. L. Berg, T. Seymour, and R. Goel. “History of databases.” In: *International Journal of Management & Information Systems (IJMIS)* 17.1 (2013), pp. 29–36.
- [2] T. Catarci, M. F. Costabile, S. Levialdi, and C. Batini. “Visual query systems for databases: A survey.” In: *Journal of Visual Languages & Computing* 8.2 (1997), pp. 215–260.
- [3] T. Catarci and G. Santucci. “Diagrammatic vs textual query languages: a comparative experiment.” In: *Working Conference on Visual Database Systems*. Springer. 1995, pp. 69–83.
- [4] D. D. Chamberlin and R. F. Boyce. “SEQUEL: A Structured English Query Language.” In: *Proceedings of the 1974 ACM SIGFIDET (Now SIGMOD) Workshop on Data Description, Access and Control*. SIGFIDET ’74. Ann Arbor, Michigan: Association for Computing Machinery, 1974, 249–264. ISBN: 9781450374156. DOI: [10.1145/800296.811515](https://doi.org/10.1145/800296.811515). URL: <https://doi.org/10.1145/800296.811515>.
- [5] J. Gehrke and R. Ramakrishnan. *Database management systems*. McGraw-Hill, 2003.

