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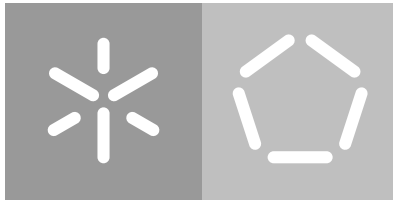
Escola de Engenharia

Departamento de Informática

João Filipe Campos Lameiras

**Urban Evolution of Fafe
in the XIX and XX centuries**

October 2018



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in the XIX and XX centuries**

Master dissertation

Master Degree in Computer Science

Dissertation supervised by

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October 2018

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ABSTRACT

The movement of people from dispersed living to concentration in urban environments is a large change both for human civilization and for the environment. Urbanization is the process of changing from natural habitats to dense grey space made up primarily of buildings, roads, and accessory infrastructure accompanied by dense human populations. While many cities are well established, humans continue to build new cities or expand cities outward in a network of suburban environments. And urbanization is not simply about a transition from green to grey space, other abiotic changes such as changes in light regimens due to artificial lighting, increased pollution, and increased impervious surfaces leading to runoff are found in urban areas. The study of Urban Evolution of Fafe in the XIX and XX Centuries is an interesting theme not only because of the lack of works in this area but also because of the possibility of understanding the organization of the current city. The main problem that we faced it was that as the years go, the mapping and buildings of cities change. And the information of these changes is stored in texts, records, maps, etc. This fact made the study of urban evolution difficult because the information is widespread and hard to gather. So, in order to study Fafe urban evolution we needed to recover and gather information of the changes and new buildings in the city during the XIX and XX centuries. Given the inexistence of an exhaustive investigation of an urban history we had to seek to interpret from the present formation the successive processes of urbanization and respective extensions, juxtapositions and overlaps. More important is the diverse set of sources that allowed to characterize the urbanism of the city of Fafe. With that said it was important to create an integrated repository in digital format to enable its analysis and search of information, and visual exploration through a map. For that purpose, it was necessary to create ontologies related to urban evolution that allowed us to develop web-supported tools derived from these ontologies for the acquisition of the state and the location of the buildings and in order to analyze the changes as the years go by. The web-supported tools are available in <http://www4.di.uminho.pt/~gepl/UEF/>.

Keywords: Urban Evolution, Urban Research, Urban morphology, Ontology, XML

RESUMO

O movimento de pessoas de zonas rurais para zonas de concentração urbana é uma grande mudança tanto para a civilização humana quanto para o meio ambiente. A urbanização é o processo de transformação de zonas naturais em zonas densas e cinzas, compostas principalmente por edifícios, estradas e infraestruturas, acompanhadas por densas populações humanas. Embora muitas cidades estejam bem estabelecidas, os humanos continuam a construir novas cidades ou a expandi-las para fora em uma rede de ambientes suburbanos. E a urbanização não é simplesmente sobre a transição do espaço verde para o cinza, outras mudanças abióticas, como mudanças na luz devido à iluminação artificial, aumento da poluição e aumento das superfícies impermeáveis que levam ao escoamento são encontradas nas áreas urbanas. O estudo da Evolução Urbana de Fafe nos séculos XIX e XX é um tema interessante não só pela falta de trabalhos nesta área, mas também pela possibilidade de compreender a organização atual da cidade. O principal problema que nos enfrentamos foi que com o passar dos anos, o mapeamento e os edifícios das cidades mudam. E as informações dessas mudanças são armazenadas em textos, registos, mapas, etc. Esse fato dificultou o estudo do desenvolvimento urbano, pois a informação está difundida e é difícil de reunir. Para estudar a evolução urbana de Fafe, foi necessário recuperar e coletar informações sobre as mudanças e novos edifícios da cidade durante os séculos XIX e XX. Dada a inexistência de uma investigação exaustiva da história urbana, tivemos que procurar interpretar da formação atual os sucessivos processos de urbanização e respetivas extensões, justaposições e sobreposições. Mais importante é o conjunto diversificado de fontes que permitem caracterizar o urbanismo da cidade de Fafe. Com isso dito, foi importante criar um repositório integrado em formato digital para permitir sua análise, a pesquisa de informação e a exploração visual através de um mapa. Para esse efeito, foi necessário criar ontologias relacionadas com a evolução urbana que nos permitiram desenvolver ferramentas suportadas pela Web derivadas destas mesma ontologias, para a aquisições do estado e a localização dos edifícios e para analisar as mudanças á medida que os anos passam. As ferramentas suportadas pela Web estão disponíveis em <http://www4.di.uminho.pt/~gepl/UEF/>.

Palavras-reservadas: Evolução Urbana, Investigação Urbana, Morfologia Urbana, Ontologia, XML

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INTRODUCTION

This chapter presents the motivation for this dissertation and the objectives that must be accomplished. Furthermore, it will also describe the structure of the remaining document and the research hypothesis.

1.1 MOTIVATION

The movement of people from dispersed living to concentration in urban environments is a large change both for human civilization and for the environment. While many cities are well established, humans continue to build new cities or expand cities outward in a network of suburban environments. We can read about urban evolution in various sources [Conzen (1968), Benevelo (Modern Urbanism, Origin of modern urbanism), Nogueira (2001), Portas (2005), Ribeiro (2008), Ribeiro (1994) The study of Urban Evolution of Fafe in the XIX and XX Centuries is an interesting theme not only because of the lack of works in this area but also because of the possibility of understanding the organization of the current city. At present there exist some books related with this subject [Coimbra (1997), Idem (2003), Monteiro (2004)]. In other words, we are going to study the morphology of the city. Given the inexistence of an exhaustive investigation of an urban history we will have to seek to interpret from the present formation the successive processes of urbanization and respective extensions, juxtapositions and overlaps. More important is the diverse set of sources that allow to characterize the urbanism of the city of Fafe.

1.2 RESEARCH HYPOTHESES

Extracting information from documents belonging to the Municipal Archive and crossing information using an ontology, it is possible to reconstruct the urban evolution of Fafe.

1.3 OBJECTIVES

The main problem that we face is that as the years go by, the mapping and buildings of cities change. And the information of these changes is stored in texts, records, maps, etc. This fact makes the study of urban evolution difficult because the information is widespread and hard to gather. So, in order to study Fafe urban evolution we need to recover and gather information of the changes and new buildings in the city during the XIX and XX centuries. It is important to create an integrated repository in digital format to enable its analysis and visual exploration.

For that purpose, it is necessary to develop web-supported tools for the acquisition of the state and the location of the buildings and in order to analyze the changes as the years go by. More specific our objectives are:

- Create a repository to store the information about the different buildings;
- Create a web interface to insert information of the buildings;
- Populate the repository with information;
- Allow users to search for information;
- Make available the visualization of the buildings on the map (in different years)

As a final result it is expected to have a tool that can be easily used by users. This program will be very useful for historians to analyze the evolution of the city along the years.

1.4 METHODOLOGY

To achieve the objectives identified, the work will be composed of the following steps:

- Bibliographic research;
- Identify the knowledge sources about private and public buildings;
- Develop the repository;
- Develop the web interface;
- Make available the visualization of the buildings on the map.

1.5 PAPER ORGANIZATION

This document is organized in 6 chapters. The first chapter describes the motivation behind this work, as well as its goals and its methodology. Its main purpose is to identify the

problem at hand and set up objectives that should be accomplished. The second chapter introduces the main concepts of Urban Evolution, explaining the meaning behind them. Addresses the factors that impulse and impact cities evolution. And even tho the study of the impact of urban evolution is not one of the objectives for curiosity it was also approached in this chapter. Finally describes the current state of the art, focusing on what similar tools exist. The third chapter describes the problems faced in the beginning of this project and what solutions were found to solve them. In this chapter is also described the ontologies built with all the concepts related to urban evolution that were found in documents related to the subject. Finally explains and shows the first version of the propose system architecture. In the fourth chapter it is outlined the technologies and major development points of the application, what choices were made, why and how they were implemented. At the end of this chapter the architecture is revisited and a final version is shown and explained. In the fifth chapter it is illustrated the website created to show the work done and to provide more details on the project in general. Finally in the sixth chapter is the conclusion of the document, where is resumed the document, concluding what objectives were achieved and what were the contributions. And it ends with some ideas for future work.

STATE OF THE ART

This chapter will present the current concepts and standards of the urban evolution domain, mainly a description of urbanization and urban morphology. Will address the factors that impulse and impact cities evolution. And even though the study of the impact of urban evolution is not one of the objectives for curiosity it is also approached in this chapter. Along with the study of similar tools.

2.1 CONCEPTS

This Section will present the concepts that are related with urban evolution and are needed to understand the subject of the thesis.

2.1.1 *Urbanization*

Urbanization is the process of changing from natural habitats to dense grey space made up primarily of buildings, roads, and accessory infrastructures accompanied by dense human populations. While many cities are well established, humans continue to build new cities or expand cities outward in a network of suburban environments. And urbanization is not simply about a transition from green to grey space, other abiotic changes such as changes in light regimens due to artificial lighting, increased pollution, and increased impervious surfaces leading to runoff are found in urban areas. A study in 2009 showed that half of the world's human population lived in cities and was expected to grow to 66% by 2050.

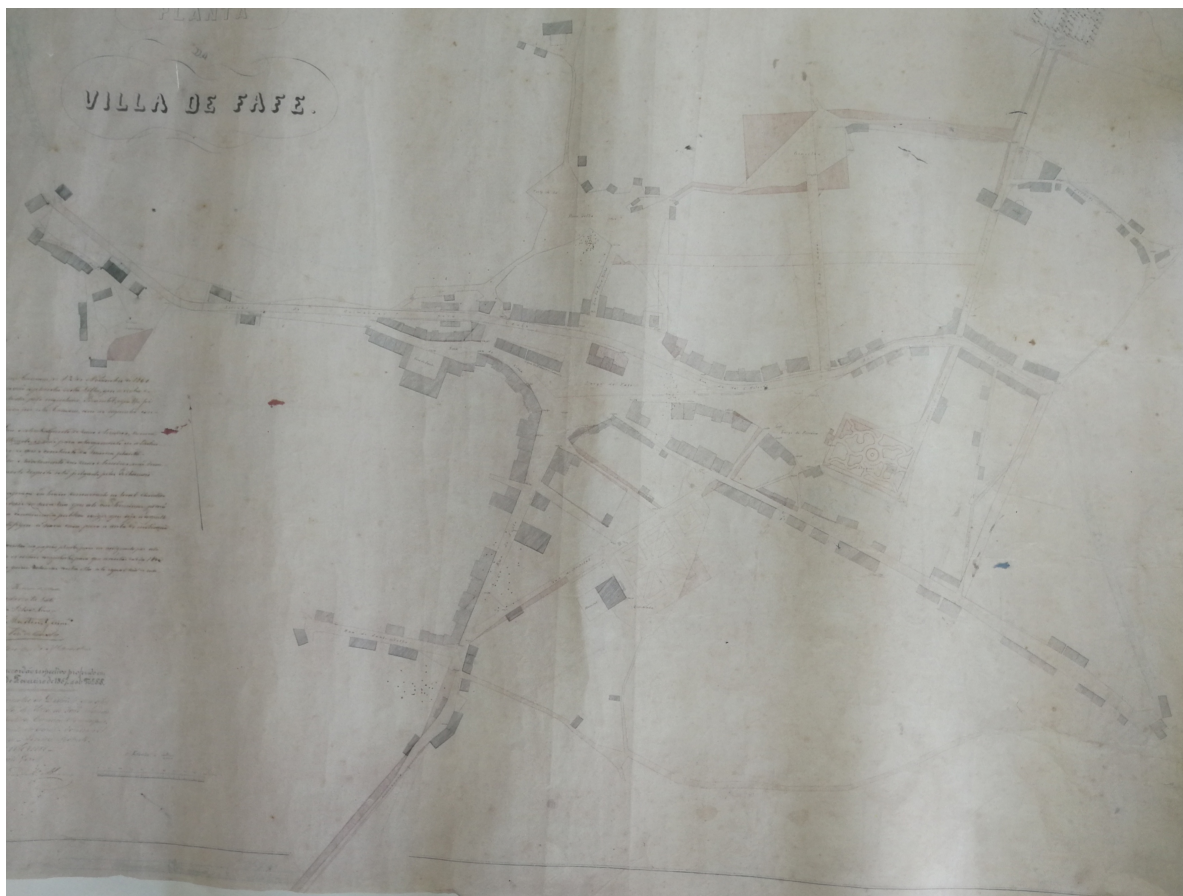


Figure 1: Fafe map around 1866.

2.1.2 Urbanism

Urbanism can be understood as discipline relating to the planning, control and regulation of structures that form the city. The meaning, however, of this term presents variations according to the approximation of the territory, the time in which the study focuses. The discipline is associated with architecture, landscape architecture, Design or politics, at the level of scale of the city, from the region to the small dwelling or plot. Urbanism is multidisciplinary, fully human science, which must be inserted in a very specific context of intervention, linked entirely to a given society, to its problems, articulating political, social and economic constraints, and responding to problems of the most varied types, civilization and urbanity.

The Urbanism understands the practical approach to political and administrative action, since it interacts directly with justified social and economic needs. The urban space and the resolution of public and private problems are focus of the study of urbanism. The analysis of the urban space implies a multidisciplinary in which urbanism "will assume in the

conception of the urban environment all the contributions of the different disciplines and sciences that are linked to it" Garcia (2010).



Figure 2: Fafe in 1836.

2.1.3 *Urban Morphology*

When we speak about urban evolution it is inevitable to not talk about Urban morphology. Urban morphology is the study of the form of human settlements and the process of their formation and transformation. The study seeks to understand the spatial structure and character of a metropolitan area, city, town or village by examining the patterns of its component parts and the ownership or control and occupation. Analysis of specific settlements is usually undertaken using cartographic sources and the process of development is deduced from comparison of historic maps. Special attention is given to how the physical form of a city changes over time and how different cities compare to each other. Another significant part of this subfield deals with the study of the social forms which are expressed in the physical layout of a city, and, conversely, how physical form produces or reproduces various social forms. The essence of the idea of morphology was initially expressed in the writings of the great poet and philosopher Goethe (1790). However, the term as such was first used in bioscience. It is increasingly used in geography, geology, philology and other subject areas. Urban morphology is considered to be the study of urban tissue, or

fabric, as a means of discerning the environmental level, and is associated with urban design. Tissue comprises coherent neighborhood morphology (open spaces, building) and functions (human activity). Neighborhood exhibit recognizable patterns in the ordering of buildings, spaces and functions (themes), within which variation reinforced an organizing set of principles. This approach challenges the common perception of unplanned environments as chaotic or vaguely organic through understanding the structures and processes embedded in urbanization.



Figure 3: Downtown Fafe Ancient Postcard.



Figure 4: Downtown Fafe in the present.

2.1.4 *Notary public or Public notary*

A notary public or public notary of the common law is a public officer constituted by law to serve the public in non-contentious matters usually concerned with estates, deeds, powers-of-attorney, and foreign and international business.

2.1.5 *Registry of trade of auctions*

Purchase made at one auction.

2.1.6 *Contracts*

A contract is a promise or set of promises that are legally enforceable and, if violated, allow the injured party access to legal remedies.

2.1.7 *Legal grounds*

- Decree

A decree is a rule of law usually issued by a head of state (such as the president of a republic or a monarch), according to certain procedures (usually established in a constitution).

2.1.8 *Expropriation*

The process of expropriation "occurs when a public agency (for example, the provincial government and its agencies, regional districts, municipalities, school boards, post-secondary institutions and utilities) takes private property for a purpose deemed to be in the public interest". Unlike eminent domain, expropriation may also refer to the taking of private property by a private entity authorized by a government to take property in certain situations.

2.1.9 *Plans*

- Municipal Master Plan

The Municipal Master Plan - PDM, is a fundamental legal instrument in the management of the municipal territory. The PDM defines the strategic framework of territorial development of the municipal territory, being the reference instrument for the elaboration of the other municipal plans. Example of one PDM is shown in Figure

5 extracted from <http://www.cm-porto.pt/pdm/o-pdm.5>).

The PDM consists of the following documents:

- Regulation - which is the normative element of the PDM and that establishes the rules and the parameters applicable to the occupation, use and transformation of the soil, binding the public entities and also, directly and immediately, the individuals;
- Planning plan, which represents the spatial organization model of the municipal territory;
- Conditioning plan that identifies administrative easements and existing public utility restrictions that may constitute limitations or impediments to any specific form of land use.

The PDM is also accompanied by:

- Report, which explains the local development strategy and model, namely the strategic objectives and the territorial-based options adopted for the spatial organization model;
- Environmental report, identifying, describing and assessing any significant environmental effects resulting from the implementation of the plan and reasonable alternatives, taking into account the respective objectives and territorial scope;
- Execution program containing the provisions on the implementation of the State and municipal priority interventions foreseen in the short and medium term, and the framework of State interventions and long-term planned municipal interventions;
- Financing plan and justification of economic and financial sustainability.

It is supplemented by the following elements:

- Regional framework plan;
- Plan of the existing situation with the occupation of the soil;
- Plan and report indicating the existing urban commitments;
- Noise map;
- Participation's received in public discussion and its weighting report;
- Statistical data sheet.

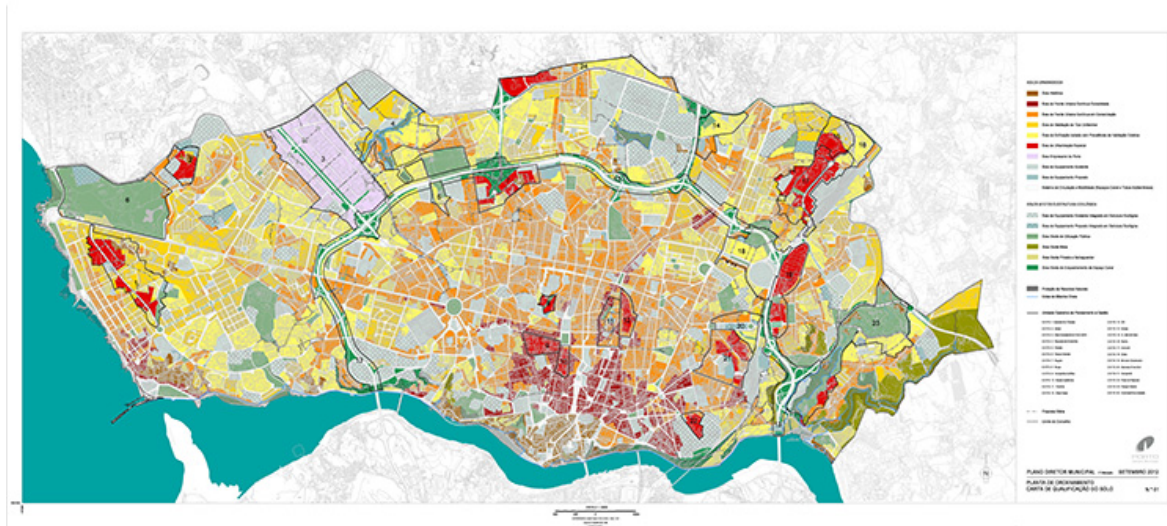


Figure 5: Example of one PDM from Porto.

2.1.10 *Toponymy*

Toponymy is the study of place names (toponyms - A word derived from the name of a place), their origins, meanings, use, and typology.

2.1.11 *Roads*

- **Royal Road**
 Royal Road or real way was the name given in Portugal and throughout the Portuguese Empire to the main roads built in the country, regions and colonies, whose construction and maintenance were the responsibility of the Portuguese Crown, either directly or through its local representatives. In Portugal, many of these roads became National Road after the Implantation of the Republic in 1910, while others, out of current use, remained as pedestrian paths.
- **Municipal road**
 The Municipal roads or municipal ways are in Portugal important roads at local level, often totally included in a single parish.

2.1.12 Sources

- Primary Sources

A primary source (also called an original source) is an artifact, document, diary, manuscript, autobiography, recording, or any other source of information that was created at the time under study. It serves as an original source of information about the topic.

- Secondary Sources

A secondary source is a document or recording that relates or discusses information originally presented elsewhere. A secondary source contrasts with a primary source, which is an original source of the information being discussed.

- Minute Book

Minute book, is a book containing permanent and detailed record of the deliberations, and resolutions adopted at a entity official meetings. A minute book is a primary source.

2.2 WHAT IMPACTS AND IMPULSES CITIES EVOLUTION

Cities urban evolution and urbanization is important when it come to grown economies, and that is why many countries encourage it. As a result, cities today are being challenged to keep pace with the largest wave of urban growth in history and the need to provide water, sanitation and power to all those people. There is always room for improvement, and a truly well-managed city never stops looking for opportunities to innovate. There are many factors that influence this evolution, those factors are:

- Surplus Resources -

“Cities grow wherever a society, or a group within it, gains control over resources greater than are necessary for the mere sustenance of life.” In ancient times these resources were acquired through subjugation of man by man. In modern times man has won over nature and extended his power. The extension of man’s power over nature, especially in the western countries, has been the primary condition of the modern growth of cities and city population.

- Industrialization and Commercialization -

The urban growth has also been greatly stimulated by the new techniques of production associated with industrial revolution. The invention of machinery, the development of steam power, and the application of huge capital in industrial enterprises led to the establishment of gigantic manufacturing plants which brought about the mobility

of immobile groups of workers hastening their concentration around a factory area. Cities now grow without much reference to the agricultural lands which a few years back was not possible.

- **Development of Transport and Communication -**
The development in methods of transportation and communication and the facilities which cities offer for satisfying the desire for communication also explain urban growth. In an industrial city the means of transport and communication are essentially developed. The city is connected not only with other parts in and outside of the country but through developed means of local transportation the different parts of the city as well are connected to each other.
- **Economic Pull of the City -**
Cities provide more opportunity for personal advancement than do the rural areas. Modern business and commerce pull young people to the cities where they are paid munificent salaries. People live in cities not because they like them as place of residence but because they can get jobs there. Employment opportunities are more in the city than in the village. This increased demand means that people can earn livelihood in a larger percentage in the cities. It is in the city that leaders, religious or educational, receive special and high recognition. In short, the possibilities of greater achievement and better living in the city account for a good deal for urban expansion.
- **Educational and Recreational Facilities -**
The schools in a city offer a better quality when it come to education because they are probably better equipped. Most training schools, colleges, and technical schools are urban. Most big libraries are situated in cities. Recreational facilities are available in cities. Amusement theatres and operas are urban. By making appeals to the feelings and play impulses of children and adults alike they draw them to the cities.

All of these points combined impulse immensely the urban evolution of a city. There are various articles that provide more information and other factors, for example [University, Mohita](#) and [Goldsmith et al. \(2018\)](#). In the [Figure 6](#) is the example of the urban evolution of New York.



Figure 6: Example of the urban evolution of New York.

2.3 IMPACT OF URBAN EVOLUTION

Even though study of the impact of urban evolution is not one of the objectives of this project, it is important to understand the power of urban evolution and its importance in the world. Even if it's not clear urban evolution affects the environments that surround it. For example urban environments have the potential to influence the evolution of species in numerous ways. Some of these effects are nonadaptive, and are largely driven by changes in gene flow between populations. But others result from selection pressures that are unique to cities, such as greater nighttime illumination and more-extreme temperatures than rural areas. There are several studies that confirm this for example [Offord \(2019\)](#). Now a days Urbanization is one of the most dominant Forces of Evolution [Phillips](#). "The evolution of most species will be affected either directly because they live in cities or indirectly as the effects of cities ripple outwards." In the Figure 7 is showed some events that can affect the evolution of species (Figure extracted from <https://www.the-scientist.com/features/cities-can-serve-as-cauldrons-of-evolution-65211>)).



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1	Air pollution may favor the adaptation of organisms to become more stress-resistant than their rural counterparts. There is some evidence that pollution might also increase the rate of genetic mutations.
2	Parks and green spaces not only offer potential habitats for species that have moved from the countryside, but may also provide corridors between different urban subpopulations and thus facilitate gene flow.
3	Human transport creates higher levels of habitat disturbance. But cars and other vehicles may also help disperse small organisms, potentially facilitating gene flow between different populations and increasing genetic diversity.
4	Nighttime illumination disrupts multiple aspects of organisms' biology, from sleep cycles to mating behavior. Long-term exposure to light at night may favor the evolution of lower light sensitivity, or even light avoidance.
5	Elevated temperature in cities—the result of heat absorption and radiation by buildings and asphalt—may drive the evolution of populations with higher heat tolerance, and lower cold tolerance, than their non-urban counterparts. However, reduced snow cover in cities could also favor cold-adaptation in some plant species.
6	Human food waste provides animals with a diet that is often high-sugar and high-fat. Some studies have found evidence of evolutionary adaptations associated with changes in metabolism to accommodate this diet.
7	Physical obstacles such as buildings and roads can fragment the habitats of urban species, potentially blocking gene flow among subpopulations and reducing genetic diversity.

Figure 7: Some events that might affect the evolution of species.

Other adaptive changes involve prototypical features of city life — pollution, for example. In the best known example, air pollution.

2.4 SIMILAR TOOLS

- The project MEMO

Aware of the growing restrictions on the availability of natural resources and the implications of urban growth over the territory and the environment, the MEMO Project seeks to contribute to a better understanding of the relationship between Urban Morphology and the metabolic behavior of the territory in order to support the development of guidelines for land-use planning that aim to optimize the use of natural resources. MEMO's main objective is developing a comparative analysis of Urban Metabolism of the Metropolitan Area of Lisbon (LMA), in three historical periods (1900-1950-2000), while assessing the relationship between the LMA Urban Morphology with the water and soil resources management, for each period of time under analysis. So, MEMO and the tool of this dissertation both study the Urban Morphology of a city but have different objectives, MEMO is focused in the evolution of resources like water, crops, farms, etc in order to support the development of guidelines for land-use planning that aims to optimize the use of natural resources. And our future tool is focused in the actual development of buildings, roads and other changes in cities. Resuming MEMO is focused on the evolution of resources while our tool is focused on the evolution of one the city itself. More information about the project MEMO can be found in <https://memoproject.wordpress.com/>. Is shown in Figure 8 a page of The project MEMO (Figure extracted from <http://arcst.tagus.ist.utl.pt/flexviewers/MEMO/>)).

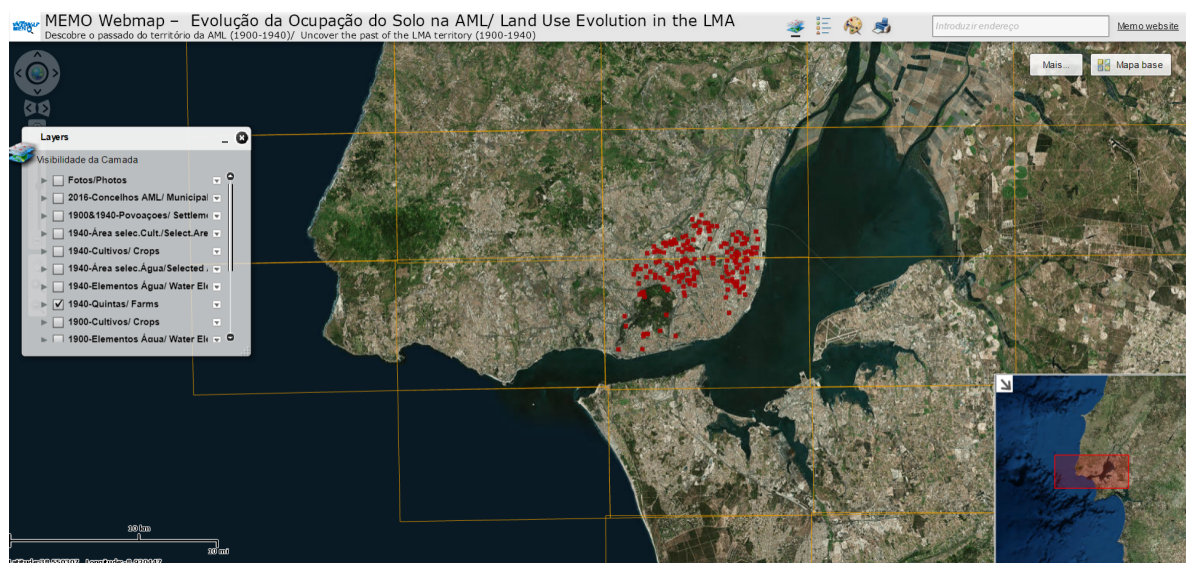


Figure 8: Example of a page of The project MEMO of farms that existed in 1940.

- ImagineRio

ImagineRio is a searchable digital atlas that illustrates the social and urban evolution of Rio de Janeiro, as it existed and as it was imagined. Views, historical maps, and ground floor plans –from iconographic, cartographic, and architectural archives– are located in both time and space while their visual and spatial data are integrated across a number of databases and servers, including a public repository of images, a geographic information system, an open-source relational database, and a content delivery web system. The relationship between the various project elements produces a web environment where vector, spatial, and raster data are simultaneously probed, toggled, viewed, and/or queried in a system that supports multiple expressions of diverse data sources. It is an environment where, for example, historians can visualize specific sites both temporally and spatially, where architects and urbanists can see proposed design projects in situ, where literary scholars can map out novels while visualizing their contexts, and where archaeologists can reconstruct complex stratigraphy's. Scaled down into a mobile version, the site allows tourists and residents to walk about town while visualizing the city as it once was as well as it was once projected. Rio de Janeiro's urban history is particularly well suited to being captured diachronically considering how much the city's natural environment, urban fabric, and self-representation have changed over time. To make Rio what it is today, hills were leveled, swamps drained, shorelines redrawn, and islands joined to the mainland, while its Tijuca Forest was first cleared due to the planting of coffee and charcoal extraction only to later be replanted for the protection of water sources. Such a changing physical and social landscape, with all its political consequences, lends itself to being spatially contextualized in a digital platform that illustrates the change of time. Comparing imagineRio doesn't have the document search and processing that the tool of this dissertation will have, is focused only on visual evolution(map). More information about ImagineRio can be found in <https://imagerio.org/#en>. Is shown in Figure 9 a page of imagineRio (Figure extracted from (<https://www.axismaps.com/projects/rio/>)).

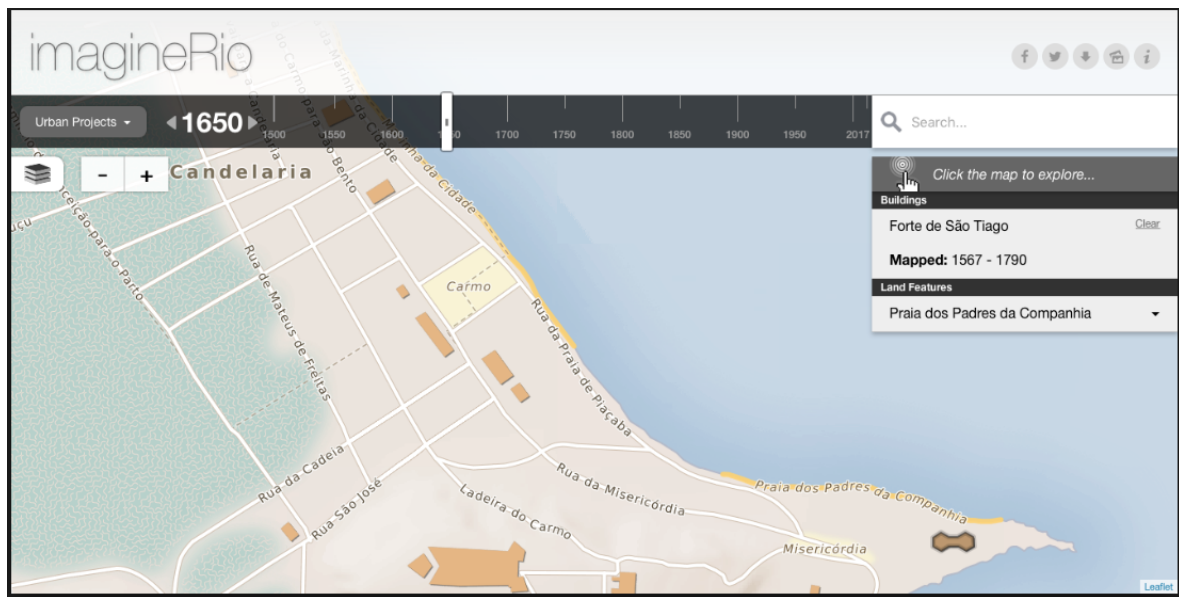


Figure 9: Example of one page of imagineRio.

2.5 SUMMARY

This chapter contains all the concepts that were important for a better understanding of the thesis theme as well for the work that would be developed next. In this chapter is also spoken about the impact of urban evolution to understand it's "power". It also contains some similar tools that were important to understand how this other projects were planned and made. The concepts were all collected after analyzing with attention the sources that were available in the archive of Fafe.

PROPOSED APPROACH

In this chapter is described the problems faced in the beginning of this project and what solutions were found to solve them. In this chapter is also described the ontologies built with all the concepts related to urban evolution that were found in documents related to the subject. Finally explains and shows the first version of the propose system architecture.

After learning about the subject of this project it was decided that the first move needed was to study all the sources of information identified (for example scriptures and minute books). With the objective to answer the following questions:

- What information is important?
- What information will the tool save?
- How the tool is going to save that information?

3.1 INFORMATION SOURCES

With the objective to define a path of work and solve all the questions a process of research was started. The first step was to analyze every type of documents in Fafe Municipal Archive. After analyzing the conclusion reached was that most of those documents were unreadable due to the writing (only people used to this type of documents were able to read them). Also, was possible to identify that these documents didn't followed any type of form and had a lot of information that was not necessary to urban evolution studies. Is important to highlight that these documents that were analyzed were considered the primary sources. Since the extraction of information directly from these sources was incapacitated due the fact they were unreadable, at that point it was decided that the main source to be considered would be a research on the minutes books and other documents made by Dr. Mónica Guimarães, worker of Fafe Municipal Archive. It is important to say that this research was composed

with all the information in all the documents(all the primary sources) in Fafe archive related to urban evolution between XIX and XX centuries. This research does not contain treated information, only contains original information but pre processed to remove the unwanted information that does not relate with urban evolution (gathered only transcripts). Resuming using this research removed the two problems found before that were, not being able to read all the information on the documents and the big amount of information not relevant in them. Note that this research was on digital format all information was easily read and contained only the information related with urban evolution. The primary sources present at Fafe Municipal Archive and that were analyzed in this process, were:

- Minute book (Example in Figure 10);
- Memories;
- Project Plans;
- Notary(Agreements, contracts, etc);
- Research on the book of minutes and others in the nineteenth and twentieth centuries (Example in Figure 11);
- Others.

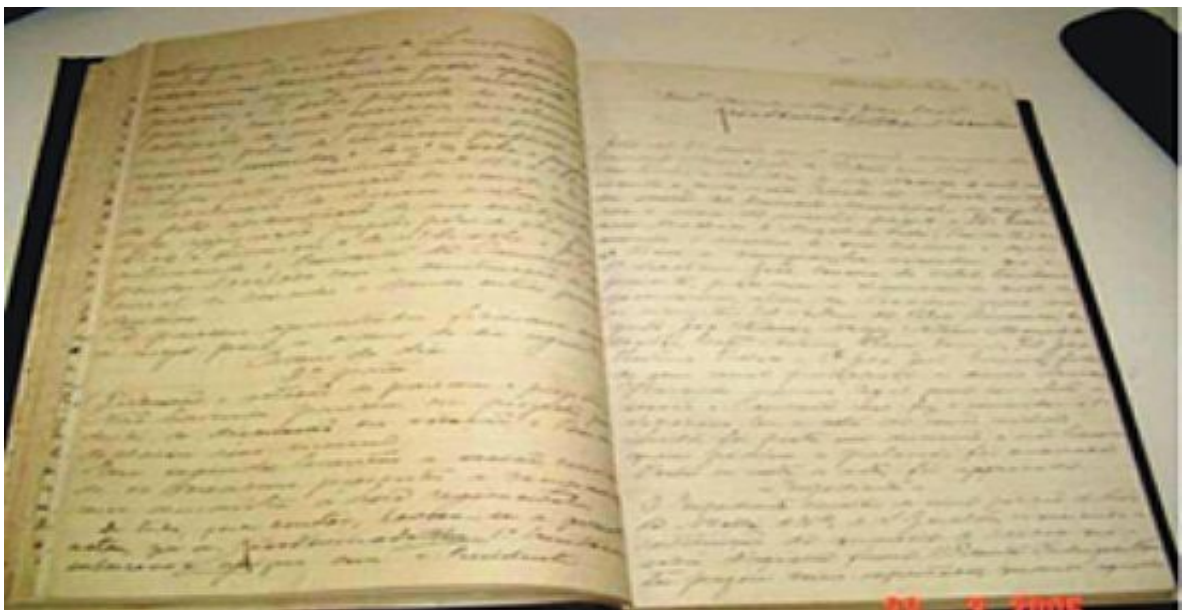


Figure 10: Example of one book of minutes.

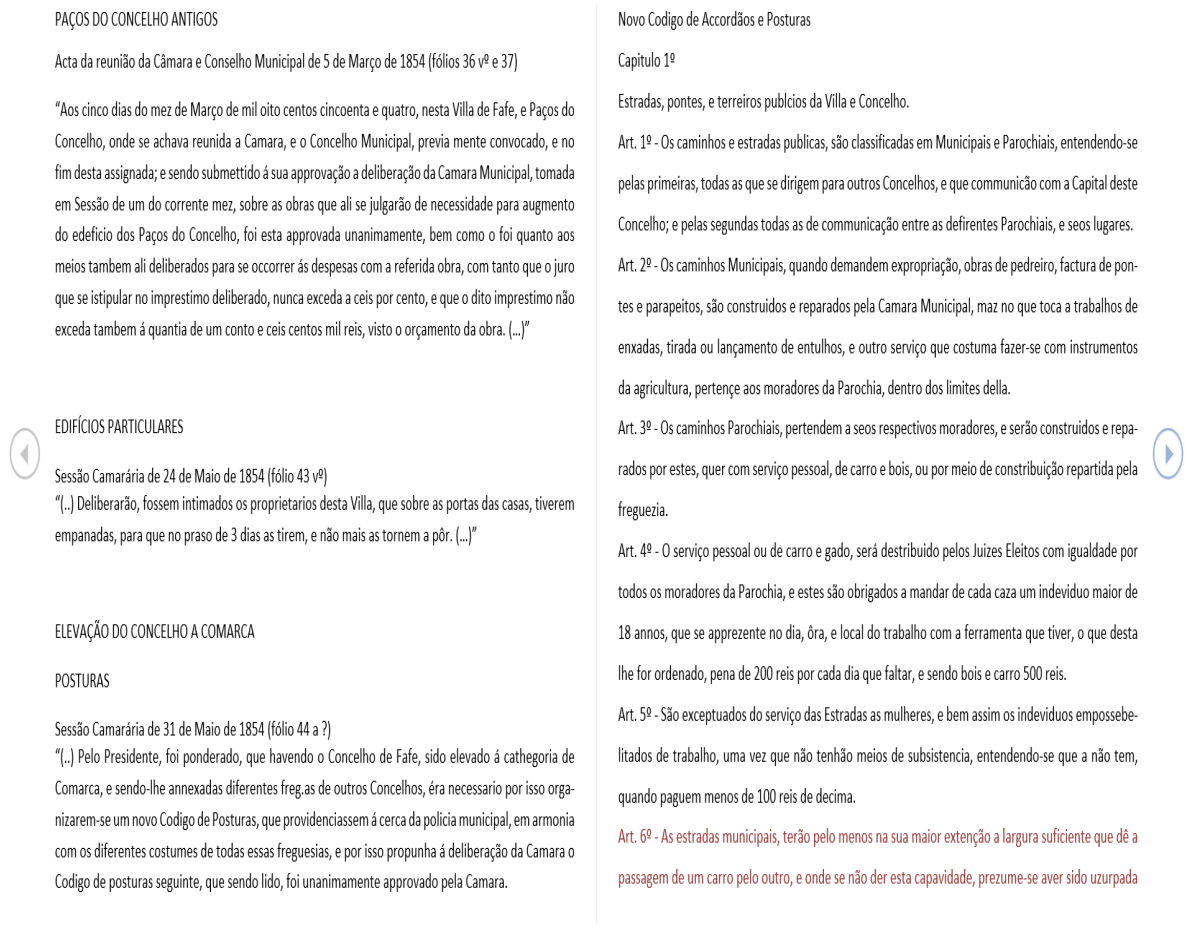


Figure 11: Example of one page of the research on the book of minutes in the nineteenth and twentieth centuries.

And for a better understanding of the information and the subject itself was provided secondary sources. These documents were created by specialists of the Fafe archive. Among these documents were:

- Catalog of public works (Example in Figure 12);
- Toponymy change tables (Example in Figure 13);
- Notes catalog;
- Others.

IDENTIFICAÇÃO		ÂMBITO E CONTEÚDO		
Código de referência	Título (v. se pertence ao âmbito e cont)	Datas (s)	Assunto	Freguesia
PT/MFAF/AMFAF/CMFAF-M-A/001/00001	<i>Projecto da rua do Largo de D. Carlos 1º à Igreja Paroquial</i>	1898	<p>Projeto de construção de uma rua entre o Largo de D. Carlos I (Estrada Real n.º 32) e a Igreja Paroquial (Ramal da Estrada Real n.º 32), passando pelo Largo da Feira Velha e pelo Largo do Concelho, onde cruza com a Estrada Distrital n.º 16. Este projeto serve de complemento ao projeto já elaborado para regularização geral do Largo da Feira Velha.</p> <p>Peças escritas: memória descritiva, medição de trabalhos (mapa de quantidades, mapa de expropriações, cálculos de volumes, distribuição de terras, medição de trabalhos, orçamento).</p> <p>Peças desenhadas: planta cadastral (escala 1/1000), perfis longitudinal e transversais, elaborada por Francisco. Leite Dourado, condutor de obras, datada de 19 de maio de 1898.</p>	Fafe
PT/MFAF/AMFAF/CMFAF-M-A/001/00002	<i>Projecto para regularização geral do Largo da Feira Velha e rua de comunicação para a Estrada Real N.º 32</i>	1898	<p>Projeto para regularização geral do Largo da Feira Velha e rua de comunicação para a Estrada Real n.º 32 tendo que, as condições atuais são péssimas, pois para além da irregularidade do terreno, é também grande a sua inclinação prejudicando assim os importantes mercados de gado suíno, que ali se realizam.</p> <p>Peças escritas: memória descritiva, condições de arrematação e caderno de encargos, medição de trabalhos (cálculos de volumes; distribuição de terras; pavimento, obras de arte e obras acessórias; expropriações e vedações, orçamento).</p> <p>Peças desenhadas: planta cadastral (escala 1/1000), perfis longitudinais e transversais, elaborada por Francisco Leite Dourado, condutor de obras, datada de 15 de março de 1898.</p>	Fafe
PT/MFAF/AMFAF/CMFAF-M-A/001/00003	<i>Projecto para alargamento de um muro e reforma de escadas do mesmo que se acha situado no Largo Municipal desta Villa (de Fafe),</i>	1891	Projeto para alargamento de um muro e reforma de escadas no Largo Municipal, regularização do terreno e empedramento da superfície do tabuleiro superior do dito muro e construção de um aqueduto para	Fafe

Figure 12: Example of one catalog, more specifically the catalog of public works.

PROPOSTAS DE ALTERAÇÃO TOPONÍMICA EM FAFE				
Data da proposta de alteração toponímica	DESIGNAÇÃO ANTERIOR	TOPONÍMICA REPUBLICANA	MOTIVO DA ATRIBUIÇÃO	
30.12.1889	Largo Municipal (travessa construída entre os prédios do comendador José António Vieira de Castro e José António da Costa) (rua que parte do Largo D. Pedro 5º para o lugar da Seara)	Largo D. Carlos 1º Rua Nova Rua da Seara		<p>"Deliberou-se o seguinte: Que o largo chamado municipal, d'ora avante se denomine de D. Carlos 1º. Que a travessa construída entre os prédios do comendador José António Vieira de Castro e José António da Costa, se denomine – da Rua Nova. Que a rua que parte do Largo D. Pedro 5º para o lugar da Seara se denomine da Seara."</p> <p>Fonte: Livro de actas da Câmara Municipal, Sessão de 30 de Dezembro de 1889, folha 13</p>
05.02.1890	Rua Formosa	Rua Serpa Pinto		<p>"Requerimentos: (...) O presidente propoz que se desse o nome do explorador Serpa Pinto à rua Formosa. – A Câmara aprovou por unanimidade esta proposta." (Sessão de 5 de Fevereiro de 1890; folha 18)</p> <p>Fonte: Livro de actas da Câmara Municipal, Sessão de 5 de Fevereiro de 1890, folha 18</p>
24.07.1907	(ramal da avenida da estação, como também a rua que se lhe segue)	Rua Soares Velloso		<p>"O presidente propoz que, em signal de regosijo pela inauguração e abertura da linha ferrea d'esta villa, à exploração pública e como homenagem ao fallecido António de Moura Soares Velloso, pelos serviços prestados para a realização de tão grande melhoramento, não só ao ramal da avenida da estação da mesma linha, como também à rua que se lhe segue, seja dado o nome de Soares Velloso. A Câmara aprovou esta proposta."</p> <p>Fonte: Livro de actas da Câmara Municipal, Sessão de 24 de Julho de 1907, folha 194</p>
03.11.1909	(avenida de acesso à estação do caminho de ferro)	Avenida Conselheiro José Luciano de Castro		<p>"(Outras deliberações) Resolveu-se, por proposta da presidência: Dar à avenida de acesso à estação do caminho de ferro o nome de «Avenida Conselheiro José Luciano de Castro», como homenagem a este eminente estadista;"</p>

Figure 13: Example of the document of toponymy change tables.

In conclusion, with the research on the minutes books and other documents of Fafe Municipal Archive as main source the two first questions (“What information is important?” and “What information will the tool save?”) made in the begin were answered, now the problem was to identify how to save the information. In the process of trying to find a solution it was imperial that first the concepts were organized and disposed in one or more ontologies.

3.2 ONTOLOGIES

In this Section it is possible to see two ontologies built with all the concepts related to urban evolution that were found in documents related to the subject. The reason behind the construction of these ontologies was the huge amount of terms/concepts found in the documents and because of this huge amount it was difficult to classify and group all the terms. So, the solution was to create ontologies to organize them and really define what terms were related and what terms were to ignore or were encompassed by others. Soon as the development of the first ontology started was realized that some terms should be separated to another ontology to receive a better organization. Summing up the terms about buildings, spaces and etc were on the first ontology (Figure 14) and the terms about legal base and deliberations were on the second ontology (Figure 15). In more detail, the ontology in Figure 14 describes all types of buildings classifying them in public buildings with private or public services and in private buildings with private or public services, also describes spaces in green spaces, circulation spaces and commercial spaces, and gives more details for each of them. The ontology in Figure 15 describes all the process of deliberations ,legal base, and notary describing every type of contract that the entities could do in result of the deliberations.

Side note, in the realization of these ontologies was needed the help of one specialist of Fafe archive to supervise and decide what terms were to ignore or had a better terminology. In the creation of the ontologies was needed to classify the concepts, relations, triples and instances and then use a processor that transformed that in an ontology. The processor used was <http://www.webgraphviz.com/>. Note that the concepts were separated in two ontologies but both ontologies can be connected to each other. These ontologies will be available in one link to allow a better analysis (<http://www4.di.uminho.pt/~gepl/UEF/ontologies>).

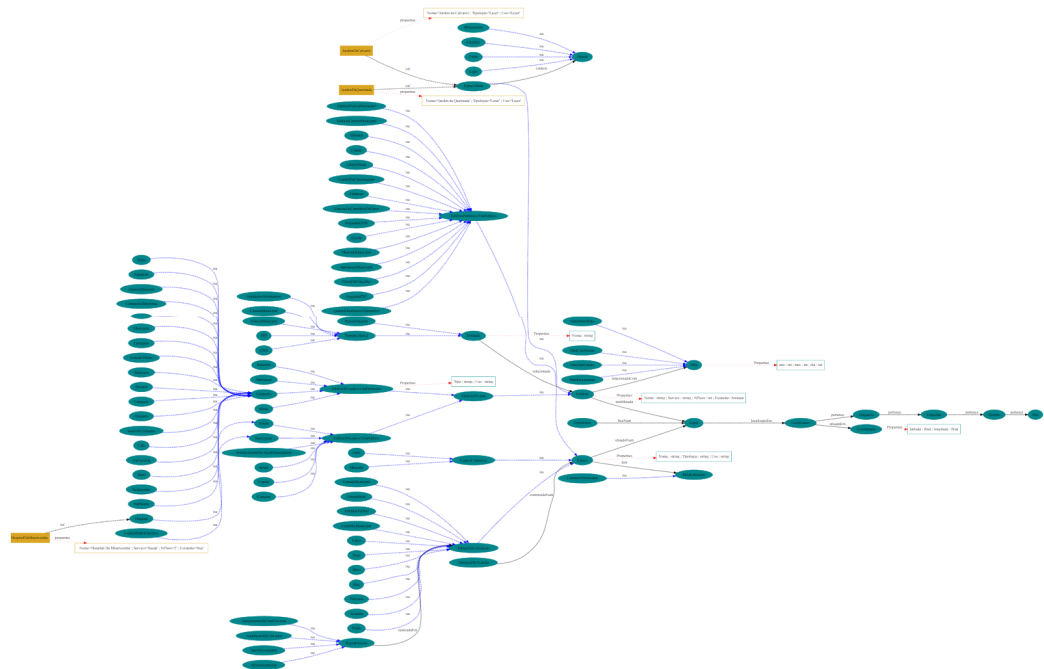


Figure 14: Ontology mainly focused on buildings and spaces

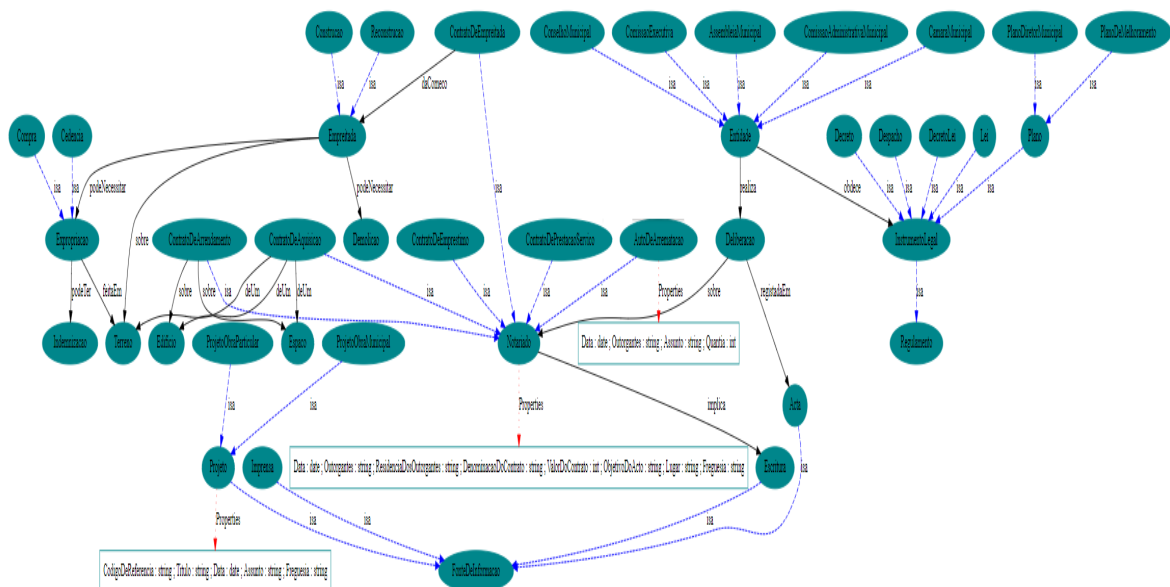


Figure 15: Ontology mainly focused on the legal base and deliberations

After the construction of the ontologies all the concepts were organized, so it was time to start thinking how the process/treatment of information would be made.

3.3 TREATMENT OF INFORMATION

To treat the information was considered two options, to use a database or to use XML. To solve this dilemma was necessary that the documents were evaluated. The conclusion reached was that for the research document all the information and detail in the texts were important so, the better way was to use XML for that specific case. To use XML, it is needed tags to mark. So, it was considered the ontologies to define the tags, since they had all the concepts related to the subject.

3.3.1 XML, eXtensible Markup Language

With the analysis of the documents was concluded that to treat information would be made use of XML. XML is a mark up language designed to store and transport data. XML was released in late 90's and it was created to provide an easy to use and store self describing data. XML is not a replacement for HTML and is designed to be self-descriptive, and also designed to carry data, not to display data. In XML is made use of tags, this tags are not predefined, they form the foundation of XML and define the scope of an element in XML. Finally XML is platform independent and language independent. The main features or advantages of XML are given below.

1. XML separates data from HTML If you need to display dynamic data in your HTML document, it will take a lot of work to edit the HTML each time the data changes.

With XML, data can be stored in separate XML files. This way you can focus on using HTML/CSS for display and layout, and be sure that changes in the underlying data will not require any changes to the HTML.

With a few lines of JavaScript code, you can read an external XML file and update the data content of your web page.

2. XML simplifies data sharing In the real world, computer systems and databases contain data in incompatible formats.

XML data is stored in plain text format. This provides a software- and hardware-independent way of storing data.

This makes it much easier to create data that can be shared by different applications.

3. XML simplifies data transport One of the most time-consuming challenges for developers is to exchange data between incompatible systems over the Internet.

Exchanging data as XML greatly reduces this complexity, since the data can be read by different incompatible applications.

4. XML simplifies Platform change Upgrading to new systems (hardware or software platforms), is always time consuming. Large amounts of data must be converted and incompatible data is often lost.

XML data is stored in text format. This makes it easier to expand or upgrade to new operating systems, new applications, or new browsers, without losing data.

5. XML increases data availability Different applications can access your data, not only in HTML pages, but also from XML data sources.

With XML, your data can be available to all kinds of "reading machines" (Handheld computers, voice machines, news feeds, etc), and make it more available for blind people, or people with other disabilities.

6. XML can be used to create new internet languages A lot of new Internet languages are created with XML. Example: XHTML, WSDL (for describing available web services), etc.

Note that, an XML document has a self descriptive structure. It forms a tree structure which is referred as an XML tree. The tree structure makes easy to describe an XML document.

A tree structure contains root element (as parent), child element and so on. It is very easy to traverse all succeeding branches and sub-branches and leaf nodes starting from the root. Check the example in Figure 16.

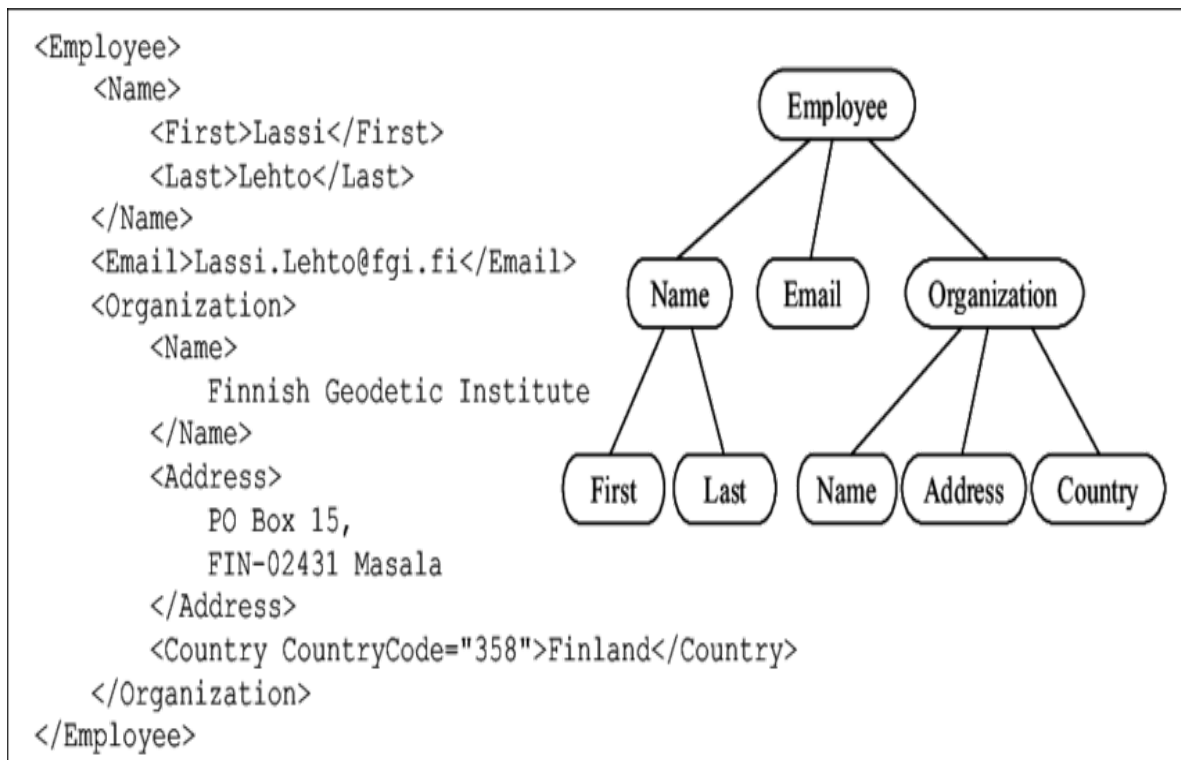


Figure 16: Example of one text with XML tags and it's tree-structure representation.

3.4 ARCHITECTURE

After answering all the three initial questions. Finally it was possible to build the first version of a propose to a system architecture of the tool. Shown in the Figure 17.

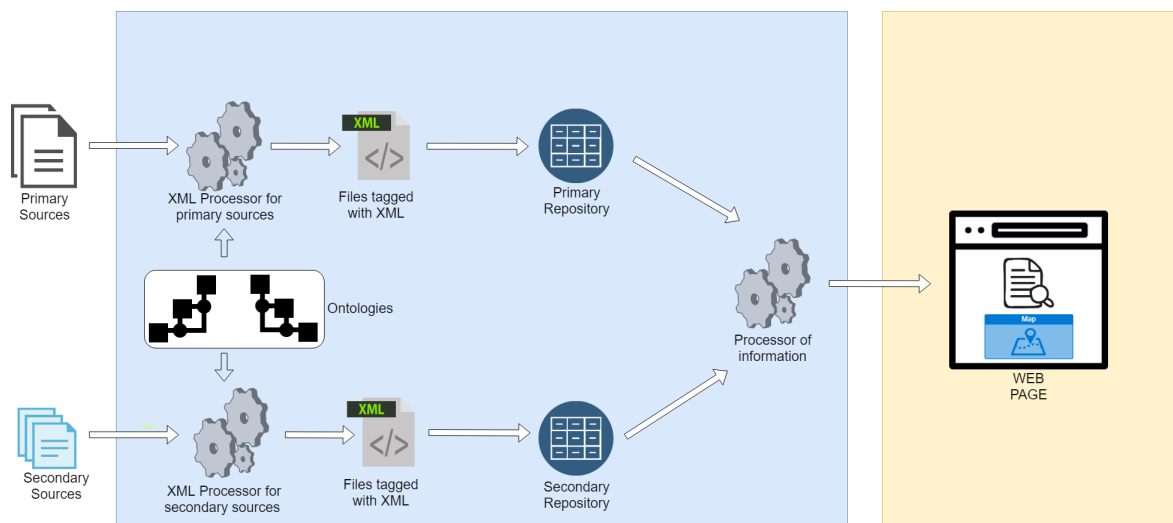


Figure 17: Architecture of the tool.

So in this tool the process starts by treating the information. If the document comes in a text format and with value and detail and it is a primary source that text will proceed to a XML processor, that given two ontologies will mark the text with XML tags and store it in a repository. If the document it is a secondary source it will do a similar process but as the format might be different the architecture distinguish primary sources and secondary sources. Then having the information treated the tool will be able to cross data and answer to the users interests, showing information that is searched (for example the user searches for a building like a church, so every text or document that mentions that church will somehow be displayed in the tool) and also will be available to show the information displayed in a map(showing for example given a public building/parcel the tool will display the changes that happened in that building/parcel through the years like constructions, upgrades, etc).

DEVELOPMENT

With the end of the bibliographic research and the analysis of the documents and registers, it was time to start dealing with the information and finally start the development of the tool. In this chapter, it is detailed all the steps made to handle the information and the development of the tool. Firstly it is explained the processment of information and how it is analyzed and tagged, explaining also the process of extraction of information from the annotated documents. Finally is shown how the tool was developed.

4.1 DOCUMENTS MARKUP

As previously stated to treat and process all the information in the documents it would be made use of XML. Firstly to use XML is required tags, declarations that will be used to mark the text. With that part done in the first phase of the work using the ontologies that were created, it was time to advance and start tagging the documents but before that as a good habit of XML it was necessary to define a method to validate and process the XML files. A XML file can be validated by 2 ways:

1. against DTD;
2. against XSD.

4.1.1 DTDs

So what is a DTD? DTD defines the structure and the legal elements and attributes of an XML document. A DTD consists of a set of statements, that are:

- !DOCTYPE note defines that the root element of this document is note
- !ELEMENT note defines that the note element must contain four elements:
"to,from,heading,body"
- !ELEMENT to defines the to element to be of type "#PCDATA"

- !ELEMENT from defines the from element to be of type "#PCDATA"
- !ELEMENT heading defines the heading element to be of type "#PCDATA"
- !ELEMENT body defines the body element to be of type "#PCDATA"

Using a DTD an application can use it to verify that XML data is valid, in other words checks if the XML data follows the structures/rules that were defined on these documents. In the Figure 18 is possible to see a example of one DTD.

```

<!ELEMENT Band (Name, (History | Awards)?, Member+,
                Instrument*)>
<!ELEMENT Member (Name, Role, Joined)>
<!ATTLIST Member BDate CDATA #REQUIRED
                Plays IDREF #IMPLIED>
<!ELEMENT Name (#PCDATA)>
<!ELEMENT Role (#PCDATA)>
<!ELEMENT History (#PCDATA)>
<!ELEMENT Awards (#PCDATA)>
<!ELEMENT Joined (EMPTY)>
<!ATTLIST Joined Year CDATA #REQUIRED>
<!ELEMENT Instrument (Description)>
<!ATTLIST Instrument Id ID #REQUIRED>
<!ELEMENT Description (#PCDATA)>

```

Figure 18: Example of one DTD.

4.1.2 XSD

An XML Schema is a language for expressing constraints about XML documents. There are several different schema languages in widespread use, but the main ones are Document Type Definitions (DTDs), Relax-NG, Schematron and W3C XSD (XML Schema Definitions). An XML schema is used to define the structure of an XML document. It is like DTD but provides more control on XML structure. A Schema can be used:

- to provide a list of elements and attributes in a vocabulary;
- to associate types, such as integer, string, etc., or more specifically such as hatsize, sock-colour, etc., with values found in documents;
- to constrain where elements and attributes can appear, and what can appear inside those elements, such as saying that a chapter title occurs inside a chapter, and that a chapter must consist of a chapter title followed by one or more paragraphs of text;

- to provide documentation that is both human- readable and machine-processable;
- to give a formal description of one or more documents.

Information in schema documents is often used by XML-aware editing systems so that they can offer users the most likely elements to occur at any given location in a document.

Checking a document against a Schema is known as validating against that schema; for a DTD, this is just validating, but for any other type of schema the type is mentioned, such as XSD Validation or Relax-NG validation.

Validating against a schema is an important component of quality assurance.

The Service Modeling Language (SML) provides a framework for relating multiple XSD documents to one or more documents in a single validation episode.

Since XSD supports associating data types with element and attribute content, it is also used for data binding, that is, for software components that read and write XML representations of computer programming-language objects. In the Figure 19 is possible to see a example of one XSD.

```
<?xml version="1.0"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:element name="brightstar">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="name" type="xs:string"/>
        <xs:element name="magnitude" type="xs:decimal"/>
        <xs:element name="distance" type="xs:integer"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

Figure 19: Example of one XSD.

4.1.3 DTD vs XSD

There are many differences between DTD (Document Type Definition) and XSD (XML Schema Definition). In short, DTD provides less control on XML structure whereas XSD (XML schema) provides more control. More differences in Figure 20.

No.	DTD	XSD
1)	DTD stands for Document Type Definition .	XSD stands for XML Schema Definition.
2)	DTDs are derived from SGML syntax.	XSDs are written in XML.
3)	DTD doesn't support datatypes .	XSD supports datatypes for elements and attributes.
4)	DTD doesn't support namespace .	XSD supports namespace .
5)	DTD doesn't define order for child elements.	XSD defines order for child elements.
6)	DTD is not extensible .	XSD is extensible .
7)	DTD is not simple to learn .	XSD is simple to learn because you don't need to learn new language.
8)	DTD provides less control on XML structure.	XSD provides more control on XML structure.

Figure 20: DTD vs XSD

4.1.4 Decision

Taking in account all the possible structures that could appear in the documents like declarations, deliberations, etc, was realized that the information on this structures were random, none of them really had a fix structure so, in this case it was not possible to use XSD because in XSD you have to define a order for the child elements (Point 5 in Figure 20). So as a way to validate and process the XML was used DTDs.

So the DTDs were elaborated taking in account all the possible structures and as said before the structures were random, without a fix structure, so it was necessary to elaborate DTDs that allowed a mixed content ("`<!ELEMENT note (#PCDATA|n|n+1|...|n+n))*>`"). In the Figure 21 is showed a example of a DTD.

```

<!ELEMENT Sessao (Deliberacao|Proposta|Requerimento)+>

<!-- DELIBERACOES -->

<!ELEMENT Deliberacao (
#PCDATA|
Justificacao|
InstrumentoLegal|
Data|
PessoaColetiva|PessoaSingular|
Lugar|Freguesia|Concelho|Distrito|Pais|
EspacoVerde|EspacoCirculacao|EspacoComercial|
InfraEstrutura|
EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|Habitacao|Misto|
ProjetoObraMunicipal|ProjetoObraParticular|
ContratoEmpreitada|ContratoDeAquisicao|ContratoDeEmprestimo|ContratoDeArrendamento|ContratoDePrestacaoServico|AutoDeArrematacao
)*>

<!ATTLIST Deliberacao
Estado (Aprovado|Reprovado|Desconhecido|EmTratamento) #REQUIRED
>

<!-- REQUERIMENTOS -->

<!ELEMENT Requerimento (
#PCDATA|
Justificacao|
Data|
PessoaColetiva|PessoaSingular|
EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|Habitacao|Misto|
EspacoVerde|EspacoCirculacao|EspacoComercial|
ProjetoObraMunicipal|ProjetoObraParticular|
Lugar|Freguesia|Concelho|Distrito|Pais
)*>

<!ATTLIST Requerimento
Estado (Aprovado|Reprovado|Desconhecido|EmTratamento) #IMPLIED
>

```

Figure 21: Example of a part of a DTD.

In total were elaborated six DTDs, for more detail check C. With the end of the definition of the DTDs, the process of tagging the documents started.

One example of a text with and without markup tags is shown in the text below and 22 and in the Figure 23. And in the Figure 24 the outline of the example.

PAÇOS DO CONCELHO ANTIGOS

Sessão extraordinária Camarária de 1 de Março de 1854 (fólio 36, 36 v^o) “Ao primeiro dia do mez de Março de mil oito centos cincoenta e quatro, nesta Villa de Fafe e Paços do Concelho, onde se achava reunida a Camara Municipal, previa mente convocada pelo Presidente della; ahi pelo mesmo foi exposto, que sendo de urgente necessidade augmentar se a casa do Tribunal das audiencias Judiciais, a qual no estado em que se acha, não tem espaço suficiente para acomodar o pessoal, e o auditorio como acaba de ser ponderado pelo Meretissimo Juis de Direito desta Comarca, e sendo igualmente necessario saptisfazer á requisição do Administrador do Concelho, para que esta Camara, lhe forneça uma casa aonde possa estabelecer-se a Secretaria da Administração respectiva, e não tendo esta Camara outro meio de saptisfazer a tão imperiozo dever, se não augmentar o edificio dos Paços do Concelho, de modo que possa dar capacidade para nelle se acomodarem as tres repartições, Judicial, Administrativa, e Municipal, por isso propunha á deliberação da Camara, o seg.e. Que o Tribunal das Audiencias Judiciais, fosse augmentado com a salla que serve para as Sessões da Camara, tirando-se-lhe a parede intermedia, de modo que fique em um salão com as comodidades necessarias ao fim a que é destinado. Que em continuação ao mesmo edeficio se fizesse uma nova sala para as Sessões da Camara, e por baxo desta um escriptorio, com gabinete para a Administração do Concelho. Que a entrada para todo o edeficio fosse mudada, de modo que a escada fosse dar á porta aonde sabria antigamente, ou acomodando-a de outra qual quer forma, mas de maneira, que nunca possa tolher o salão das audiencias Judiciais. Que não havendo pelo cofre Municipal meios para ocorrer a estas despesas, e não sendo conveniente subcarregar os contribuintes com a derrama necessaria em um anno, propunha por isso se obtivessem os meios necessarios por via de um emprestimo e que fossem hypothecados os foros do Concelho, e que se fosse amortisando a divida com o imposto de mais tres reis em cada arratel de carnes verdes de consumo. E entrando esta proposta em discussão, foi approvada pela Camara, e que para que ella tivesse effeito legal, deliberou-se convocasse o Conselho Municipal para o dia cinco do corrente, pelo meio dia, afim de tudo ser submettido á sua approvão. (...)”


```

<Sessao>
  <Proposta Estado="Aprovado">
    <Data Ano="1854" Mes="03" Dia="01" Tipo="Normal">"Ao primeiro dia do mez de Março de mil
    oito centos cincoenta e quatro</Data>, nesta Villa de <Freguesia>Fafe</Freguesia> e
    <EdificioPublicoComFimPublico Denominacao="PacosDoConcelho">Paços do
    Concelho</EdificioPublicoComFimPublico>, onde se achava reunida a <PessoaColetiva>Camara
    Municipal</PessoaColetiva>, previa mente convocada pelo
    <PessoaSingular>Presidente</PessoaSingular> della;<ProjetoObraMunicipal> ahi pelo mesmo
    foi exposto, que sendo de urgente necessidade<Construcao>augmentar se a casa do
      <EdificioPublicoComFimPublico Denominacao="Tribunal"> Tribunal das audiencias
      Judiciais</EdificioPublicoComFimPublico></Construcao> , <Justificacao>ao qual no
      estado em que se acha, não tem espaço suficiente para acomodar o
      pessoal</Justificacao>, e o auditorio como acaba de ser ponderado pelo
      <PessoaSingular Nome="Juiz de Direito" Norma="Juiz de Direito">Meretissimo Juis de Direito desta
      Comarca</PessoaSingular>, </ProjetoObraMunicipal>
    </Proposta>
    <Requerimento Estado="Aprovado"> e sendo igualmente necessario saptisfazer á requisição do
      <PessoaColetiva>Administrador do Concelho</PessoaColetiva>, <Justificacao>para que esta
      Camara, lhe forneça uma casa aonde possa estabelecer-se a <PessoaColetiva>Secretaria da
      Administração</PessoaColetiva>respectiva</Justificacao>, e não tendo esta Camara
      outro meio de saptisfazer a tão imperiozo dever,<ProjetoObraMunicipal> se não
      <Construcao>augmentar o <EdificioPublicoComFimPublico Denominacao="PacosDoConcelho"
      Norma="Camara Municipal">edificio dos Paços do Concelho</EdificioPublicoComFimPublico>, de modo que
      possa dar capacidade para nelle se acomodarem as tres repartições, Judicial,
      Administrativa, e Municipal,</Construcao></ProjetoObraMunicipal>
    </Requerimento>
  </Sessao>

```

Figure 22: Example of one text with XML tags - part 1.

```

<Proposta Estado="Aprovado"> por isso propunha á deliberação da Camara, o seg.e. Que o
  <EdificioPublicoComFimPublico Denominacao="Tribunal">Tribunal das Audiencias
  Judiciais</EdificioPublicoComFimPublico>,<ProjetoObraMunicipal>
  <Descricao>fosse augmentado com a salla que serve para as Sessões da Camara,
  tirando-se-lhe a parede intermedia, de modo que fique em um salão com as comodidades
  necessarias ao fim a que é destinado. Que em continuação ao mesmo edeficio se
  fizesse uma nova sala para as Sessões da Camara, e por baxo desta um escriptorio,
  com gabinete para a Administração do Concelho. Que a entrada para todo o edeficio
  fosse mudada, de modo que a escada fosse dar á porta aonde sabria antigamente, ou
  acomodando-a de outra qual quer forma, mas de maneira, que nunca possa tolher o
  salão das audiencias Judiciais.</Descricao> Que não havendo pelo cofre Municipal
  meios para ocorrer a estas despesas, e não sendo conveniente subcarregar os
  contribuintes com a derrama necessaria em um anno, </ProjetoObraMunicipal>
</Proposta>
<Proposta Estado="Aprovado">
  <Data Ano="1854" Mes="03" Dia="01" Tipo="Normal"/>
  <PessoaSingular>Administrador do Concelho</PessoaSingular> propunha por isso se
  <ContratoDeEmprestimo Outorgantes="Administrador do Concelho">obtivessem os meios
  necessarios por via de um emprestimo e que fossem hypothecados os foros do Concelho, e
  que se fosse amortisando a divida com o imposto de mais tres reis em cada arratel de
  carnes verdes de consumo.</ContratoDeEmprestimo>
</Proposta>
<Deliberacao Estado="Aprovado">
  <Data Ano="1854" Mes="03" Dia="01" Tipo="Normal"/> E entrando esta proposta em discussão,
  foi approvada pela Camara, e que para que ella tivesse efeito legal, deliberou-se
  convocasse o <PessoaColetiva>Conselho Municipal</PessoaColetiva> para o dia cinco do
  corrente, pelo meio dia, afim de tudo ser submettido á sua approvão. (...) </Deliberacao>
</Sessao>

```

Figure 23: Example of one text with XML tags - part 2.

- Sessao
- Proposta "Aprovado" "Ao primeiro dia do mez de Março de mil oito centos"
 - Data "1854" "Ao primeiro dia do mez de Março de mil oito centos
 - Freguesia Fafe
 - EdificioPublicoComFimPublico "PacosDoConcelho" Paços do Concelho
 - PessoaColetiva Camara Municipal
 - PessoaSingular Presidente
 - ProjetoObraMunicipal ahi pelo mesmo foi exposto, que sendo de urgente necessidade
 - Construcao aumentar se a casa do
 - Justificacao ao qual no estado em que se acha, não tem espaço suficiente
 - PessoaSingular "Juiz de Direito" Meretissimo Juis de Direito desta Comarca
 - Requerimento "Aprovado" e sendo igualmente necessario saptisfazer á requisição
 - PessoaColetiva Administrador do Concelho
 - Justificacao para que esta Camara, lhe forneça uma casa aonde possa
 - PessoaColetiva Secretaria da Administração
 - ProjetoObraMunicipal se não
 - Construcao aumentar o
 - EdificioPublicoComFimPublico "PacosDoConcelho" edificio dos Paços do Concelho
 - Proposta "Aprovado" por isso propunha á deliberação da Camara, o seg.e.
 - EdificioPublicoComFimPublico "Tribunal" Tribunal das Audiencias Judiciais
 - ProjetoObraMunicipal fosse augmentado com a salla que serve para as Sessões
 - Descricao fosse augmentado com a salla que serve para as Sessões
 - Proposta "Aprovado"
 - Data "1854"
 - PessoaSingular Administrador do Concelho
 - ContratoDeEmprestimo "Administrador do Concelho" obtivessem os meios necessarios por via de um
 - Deliberacao "Aprovado"
 - Data "1854"
 - PessoaColetiva Conselho Municipal

Figure 24: Outline of the example showed.

After processing and tagging a little amount of documents, as a way to test the XML data a small application was made with Angular. And to do that it was necessary to find a way to extract data from the markedup documents.

4.2 DATA EXTRATACTION, QUERY SYSTEM

To answer end user needs was necessary to built queries to extract data from the markedup documents. And to build this queries were taking in to account two different specifications, XQuerie and XPath.

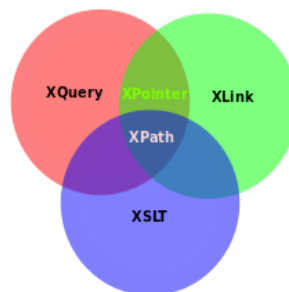


Figure 25: Graph with XML tecnologies.

4.2.1 XQuery

XQuery is a functional query language used to retrieve information stored in XML format. It is same as for XML what SQL is for databases. It was designed to query XML data. XQuery is built on XPath expressions. The as it is definition of XQuery given by its official documentation is as follows:

“XQuery is a standardized language for combining documents, databases, Web pages and almost anything else. It is very widely implemented. It is powerful and easy to learn. XQuery is replacing proprietary middleware languages and Web Application development languages. XQuery is replacing complex Java or C++ programs with a few lines of code. XQuery is simpler to work with and easier to maintain than many other alternatives.”

XQuery is a functional language which is responsible for finding and extracting elements and attributes from XML documents.

It can be used for following things:

- To extract information to use in a web service;
- To generates summary reports;
- To transform XML data to XHTML;
- Search Web documents for relevant information.

XQuery presents several advantages, in the list below are enumerated a few:

- XQuery can be used to retrieve both hierarchal and tabular data;
- XQuery is expression-oriented programming language with a simple type system;
- XQuery can be used to query web pages;
- XQuery can be used to transform XML documents into XHTML documents.

4.2.2 XPath

XPath is a language used to succinctly pinpoint exact XML nodes in a DOM. XPath is a major element in the XSLT standard. XPath can be used to navigate through elements and attributes in an XML document. In XPath, there are seven kinds of nodes: element, attribute, text, namespace, treated as trees of nodes. The topmost element of the tree is called the root element. XPath uses path expressions to select nodes or node-sets in an XML document. The node is selected by following a path or steps. An XPath expression returns either a node-set, a string, a Boolean, or a number.

4.2.3 XQuery vs XPath

There are many differences between XQuery and XPath. In the Figure 26 some differences are listed.

Index	XQuery	XPath
1)	XQuery is a functional programming and query language that is used to query a group of XML data.	XPath is a xml path language that is used to select nodes from an xml document using queries.
2)	XQuery is used to extract and manipulate data from either xml documents or relational databases and ms office documents that support an xml data source.	XPath is used to compute values like strings, numbers and boolean types from another xml documents.
3)	xquery is represented in the form of a tree model with seven nodes, namely processing instructions, elements, document nodes, attributes, namespaces, text nodes, and comments.	xpath is represented as tree structure, navigate it by selecting different nodes.
4)	xquery supports xpath and extended relational models.	xpath is still a component of query language.
5)	xquery language helps to create syntax for new xml documents.	xpath was created to define a common syntax and behavior model for xpointer and xslt.

Figure 26: XQuery vs XPath.

4.2.4 Decision

With the objective to navigate easily through XML, built simple queries and answer the end user needs for Urban evolution information, was decided to make use of XPath specification to built queries.

Example of one XPath-expression used in our context is that contains "Feira Velha" regardless of the path that is in. Check Listing 4.1.

```

"//*[text()
  [contains
    (translate
      (normalize-space(.), 'áâãäåèéëìíîïóôõöùúüçÇÀÁÂÃÄÅÆÇÈÉÊËÌÍÎÏÐÑÒÓÔÕÖÙÚÛÜÝÞÀÁÂÃÄÅÆÇÈÉÊËÌÍÎÏÐÑÒÓÔÕÖÙÚÛÜÝÞàáâãäåæçèéêëìíîïðñòóôõöùúûüýþÿ', '
      abcdefghijklmnopqrstuvwxyzaaaaaeieiiiooooouuuccaa '), ' removeAccents
      (angular.lowercase(Feira Velha))')
    ]
  ]
|
//*[ @Norma [contains
  (translate
    (normalize-space(.), 'áâãäåèéëìíîïóôõöùúüçÇÀÁÂÃÄÅÆÇÈÉÊËÌÍÎÏÐÑÒÓÔÕÖÙÚÛÜÝÞÀÁÂÃÄÅÆÇÈÉÊËÌÍÎÏÐÑÒÓÔÕÖÙÚÛÜÝÞàáâãäåæçèéêëìíîïðñòóôõöùúûüýþÿ', '
    abcdefghijklmnopqrstuvwxyzaaaaaeieiiiooooouuuccaa '), '
    removeAccents(angular.lowercase(Feira Velha))')
  ]
]"

```

Listing 4.1: Xpath querie example.

As showed in the example 4.1 was necessary to add to the queries:

- The box `//*[` Was used to search regardless of the path;
- The box `contains`, this function determines whether the first argument string contains the second argument string and returns boolean true or false;
- The box `translate`, this function evaluates a string and a set of characters to translate and returns the translated string. In this cased was used to remove the case and accentuation dependency;
- The box `normalize-space`, this function strips leading and trailing white-space from a string, replaces sequences of whitespace characters by a single space, and returns the resulting string;
- The operator `|`, to compute two node-sets. In this case was used to join two queries, the querie that checks the text and the querie that checks the norm (some words in these documents are written differently from what is considered correct in the actual days so it was necessary to add a attribute "norma" to add to tags in case it was necessary to correct some words);
- The function `removeAccents` was a function made to remove all accents from the user end is input.

With every search made by the user, the tool receives the input introduced and with that input makes a query as shown in the example 4.1. That query will be made to every markedup document in the repository. When the query finds a positive result, the tool saves that result so at the end of the process of search, it is returned to the user all the results that were found.

4.3 VISUALIZING THE INFORMATION, MAPS

4.3.1 *First approach*

With the query system done and with the objective to give the end user a visual exploration, maps were added to the search mechanism. For this purpose was made use of the Google maps platform and of the query system to recover every location from the documents. The Google Maps Platform is a set of APIs and SDKs that allows developers

to embed Google Maps into mobile apps and web pages, or to retrieve data from Google Maps. There are several offerings. Following the tutorial in <https://www.techrepublic.com/article/link-the-business-address-on-your-website-to-a-google-map/> was possible to add google maps to the website.

Since in these documents there are several ancient locations, streets, etc, the probability of the location being marked correctly on the map was relatively low so the system allows the user to move the graphic mark on the map, this feature is shown in Figure 27 and Figure 28. The proposed position is read and saved in the repository as the user's feedback on the real building location.



Figure 27: Example of the map using google API. Showing "citio da Igrª" marked.

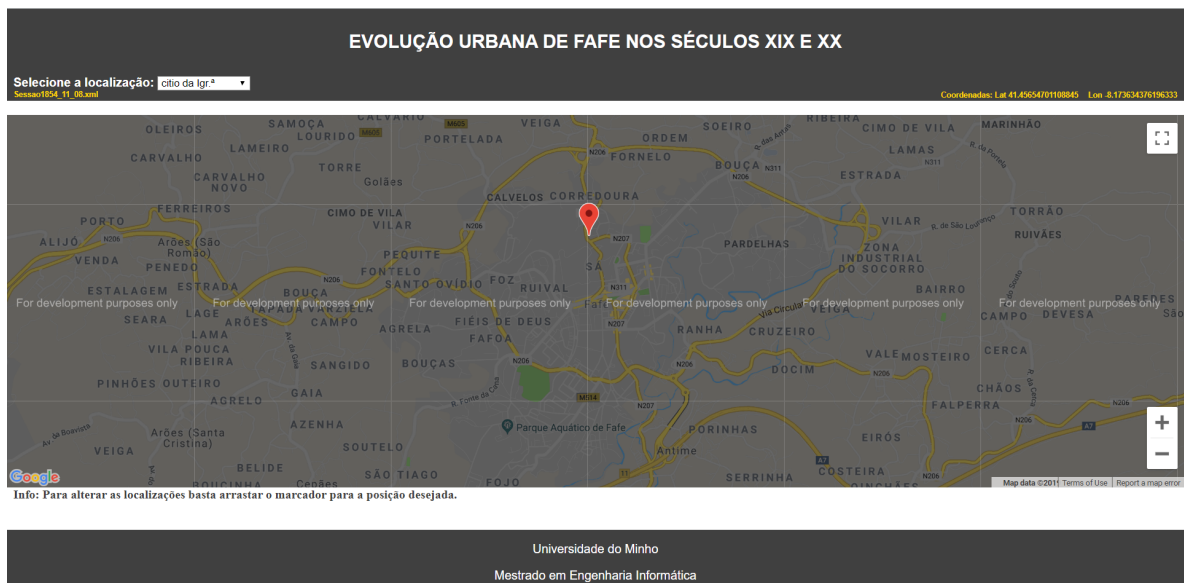


Figure 28: Example of the map using google API. Showing "citéo da Igrª" marked but moved by the user.

4.3.2 Second approach

With the objective to improve the precision, when it comes to old builds and streets, and restrict the map to city of Fafe was developed a different mechanism to pin point the locations on the map. To do this mechanism were needed three things:

- A library to use in the browser (which takes the client), which has the typical functions for displaying maps. The best library for the effect and the one that was used was OpenLayers (OpenLayers is an open-source, provided under the 2-clause BSD License, JavaScript library for displaying map data in web browsers as slippy maps. It provides an API for building rich web-based geographic applications similar to Google Maps and Bing Maps);
- To grab data and generate maps, was needed a map server, that implements the WMS service (A Web Map Service (WMS) is a standard protocol developed by the Open Geospatial Consortium in 1999 for serving georeferenced map images over the Internet. These images are typically produced by a map server from data provided by a GIS database). Typically the map server responds to GetMap requests. For this was used a Geoserver (which is written in JAVA and can be run through Tomcat, for example);
- And the most important, a map of the city of Fafe. See the Figure 29.

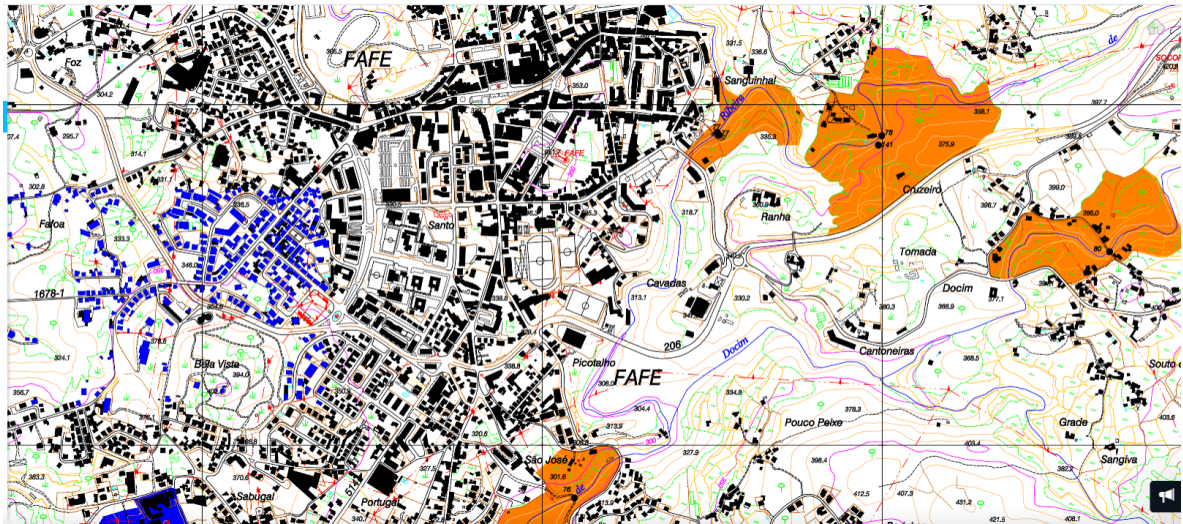


Figure 29: Map used in the new mechanism.

So to be able to do this approach was necessary to change the map is format that was in .dwg due to the incompatibility with GeoServer. So it was necessary to convert the map in to a .shp, that is the format accepted in GeoServer. To do this was used the application QGIS, and using the option export was possible to export one type of objects at a time (Points, Lines, Polygons and text) of each layer, one by one, to the format needed. After that it was necessary to install the GeoServer windows, tomcat and download a GeoServer web. Using the Tomcat was possible to make a connection to the GeoServer and from there was necessary configure it, as showed in the following steps. So it was necessary to:

1. Create a workspace for the maps;
2. Create a store directory where our files .shp were;
3. Create the layers, with the files .shp;
4. Create styles to applicate the right colors to the layers;
5. Create the layer group, that as the name says is a group of layers;
6. Adjust the group layers using GeoServer is layer preview;
7. And finally with all the previous steps done was possible to create a WMS service.

In the Figure 30 is showed a example of one getMap request to the GeoServer using the library OpenLayers.



Figure 30: Example of one getMap request to the WMS service.

4.4 TOPONYMY AND MORE DETAILED INFORMATION

Urban place names are a chronicle of the history of a given territory and its inhabitants. They are evidence of crucial changes occurring over a long period of time, especially in the borderland area. In each period the mechanisms of giving new names to town objects and of changing the existent ones were similar. They reflected the culture of the nation, important events, historical figures, ideas and values in a given historical period (for more information about that check [Ainiala and Vuolteenaho \(2009\)](#)). So it is normal that as the years go by streets names changed, making important that the information about these changes was recovered and treated so it can be used not only for the urban study but it is important to use the correct and current names when it comes to maps. So in order to do that a excel file with this changes was made, and when the search mechanism runs has access to that file in CSV.

To add more detailing and offer a better help to study urban evolution was added 4 tables with more detailed information.

- Toponymy table: In the case the search term is a circulation space will show the changes of names of that same circulation space;
- Public project table: Shows all public projects related to the searched term;

- Both last tables are about contracts (), showing both information of contracts made related to the term searched:
 - Instruments: Coming from the books of record of instruments drawn up outside the Note;
 - Notes: Coming from notebooks.

4.5 REVISITING THE ARCHITECTURE, FINAL VERSION

Due to the changes of directions and technologies along the work for this tool the architecture changed, as can be seen or understood throughout the reading of this document. In the Figure 31 is show the final version of the architecture.

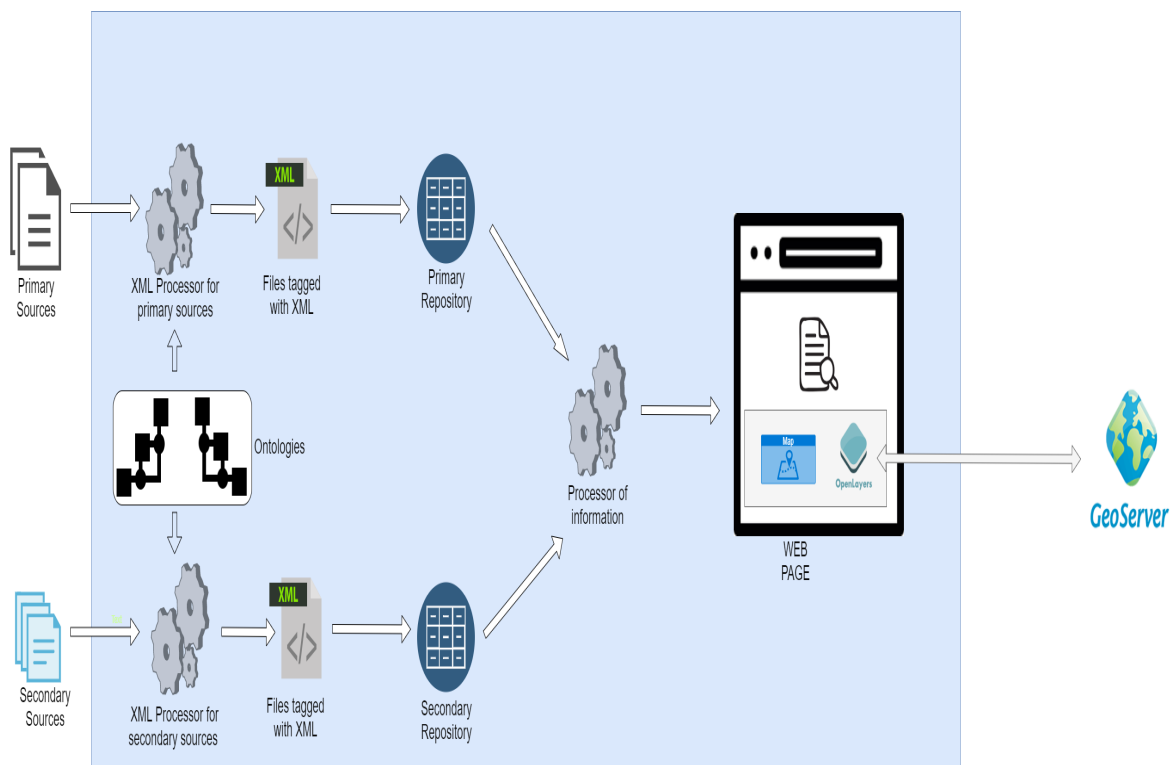


Figure 31: Current and final architecture of the tool.

Due to the change of the technologies related to the maps it was necessary to add a geoserver to store information about the maps(the layers, the styles, etc) and a library openlayers to communicate with the geoserver and send requests.

THE WEB FRONT-END

To illustrate the work done and to provide more details on the project in geral a website was created. The website is divided in 5 tabs. The first tab introduces and gives context about the project. In the second tab is presented the motivations, the objectives, etc to what led to the development of the project in case. In the third tab it is possible to see and analyze with more detail the ontologies created. In the fourth tab there is a mechanism that allows the user to study Fafe toponymy. And finally in the last tab and the most important reason for the construction of this website, the ontology-driven search mechanism can be tested. The visitor introduces a term that he wants to be searched and also can select a tag to filter the content searched. And in return the tool gives to the user the documents relative to what he searched, giving to the user the possibility to read any document returned and the possibility to see the returned content in a map. The search page is shown in Figure 36.

EVOLUÇÃO URBANA DE FAFE NOS SÉCULOS XIX E XX

Pesquisa: Paços Tag: Todas

Texto	Documento	Opção(1)	Opção(2)
"Ao primeiro dia do mez de Março de mil oito centos cincoenta e quatro, nesta Villa de Fafe e Paços do Concelho, onde se achava reunida a Camara Municipal, previa mente convocada pelo Presidente della; ali pelo mesmo foi exposto, que sendo de urgente necessidade augmentar se a casa do Tribunal das audiencias Judiciais , ao qual no estado em que se acha, não tem espaço sufficiente para acomodar o pessoal, e o auditorio como acaba de ser ponderado pelo Meretissimo Juis de Direito desta Comarca,	Sessao1854_03_01.xml	<input type="button" value="Ver Documento"/>	<input type="button" value="Ver Mapa"/>
augmentar o edificio dos Paços do Concelho, de modo que possa dar capacidade para nelle se acomodarem as tres repartições, Judicial, Administrativa, e Municipal,	Sessao1854_03_01.xml	<input type="button" value="Ver Documento"/>	<input type="button" value="Ver Mapa"/>
"Aos cinco dias do mez de Março de mil oito centos cincoenta e quatro, nesta Villa de Fafe, e Paços do Concelho, onde se achava reunida a Camara, e o Conselho Municipal, previa mente convocado, e no fim desta assignada; e sendo submettido á sua approvação a deliberação da Camara Municipal, tomada em Sessão de um do corrente mez, sobre as obras que ali se julgarão de necessidade para augmento do edificio dos Paços do Concelho, foi esta approvada unanimamente, bem como o foi quanto aos meios tambem ali deliberados para se occorrer ás despesas com a referida obra, com tanto que o juro que se estipular no emprestimo deliberado, nunca exceda a ceis por cento, e que o dito emprestimo não exceda tambem á quantia de um conto e ceis centos mil reis, visto o orçamento da obra. (...)"	Sessao1854_03_05.xml	<input type="button" value="Ver Documento"/>	<input type="button" value="Ver Mapa"/>
previa mente convocado, e no fim desta assignada; e sendo submettido á sua approvação a deliberação da Camara Municipal, tomada em Sessão de um do corrente mez, sobre as obras que ali se julgarão de necessidade para augmento do edificio dos Paços do Concelho	Sessao1854_03_05.xml	<input type="button" value="Ver Documento"/>	<input type="button" value="Ver Mapa"/>
um emprestimo ate a quantia de 1:6005000 reis, para o reparo e acrescimo da Casa dos Paços do Concelho, se procedesse quanto antes não só á mencionada obra, como igualmente a contrahir o referido emprestimo, devendo para estes dois fins fazerse o seguinte.	Sessao1854_08_08.xml	<input type="button" value="Ver Documento"/>	<input type="button" value="Ver Mapa"/>
contrahir um emprestimo ate a quantia de 1:6005000 reis, para o reparo e acrescimo da Casa dos Paços do Concelho, se procedesse quanto antes não só á mencionada obra, como igualmente a contrahir o referido emprestimo, devendo para estes dois fins fazerse o seguinte. Sumbetter á approvação do Ex.mo Conselho de Districto, que em vista do artº 4º da citada Carta de Lei, e attendendo á falta de concorrentes que esta localidade sente nas arrematações das obras publicas, deve a dita obra ser antes feita por administração, de que por meio de praça, para evitar que daquella falta de concorrencia já experimentada em outras occasiões, se tome a mesma obra muito mais cara. Que para se obter o emprestimo auctorizado no artº 1º da mesma Lei, se afixem desde já editais convocando aquellos que por menor juro e melhores condições queirão fazer o referido emprestimo	Sessao1854_08_30.xml	<input type="button" value="Ver Documento"/>	<input type="button" value="Ver Mapa"/>

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Figure 32: An example of the results obtained from a search, in this case "Paço".

As a first output, the search engine returns in textual format all documents that satisfy the query. Allowing the user to see the documents. Figure 33 illustrate this feature.

```

<Sessao>
  <Proposta Estado="Aprovado">
    <Data Ano="1854" Mes="03" Dia="01" Tipo="Normal">
      "Ao primeiro dia do mez de Março de mil oito centos cincoenta e quatro
    </Data>
    , nesta Villa de
    <Freguesia>Fafe</Freguesia>
    e
    <EdificioPublicoComFimPublico Denominacao="PacosDoConcelho">Paços do Concelho</EdificioPublicoComFimPublico>
    , onde se achava reunida a
    <PessoaColetiva>Camara Municipal</PessoaColetiva>
    , previa mente convocada pelo
    <PessoaSingular>Presidente</PessoaSingular>
    della;
    <ProjetoObraMunicipal>
      ahi pelo mesmo foi exposto, que sendo de urgente necessidade
    <Construcao>
      aumentar se a casa do
      <EdificioPublicoComFimPublico Denominacao="Tribunal">
        Tribunal das audiencias Judiciais
      </EdificioPublicoComFimPublico>
    </Construcao>
    ,
    <Justificacao>
      ao qual no estado em que se acha, não tem espaço suficiente para acomodar o pessoal
    </Justificacao>
    , e o auditorio como acaba de ser ponderado pelo
    <PessoaSingular Nome="Juiz de Direito" Norma="Juiz de Direito">
      Meretissimo Juis de Direito desta Comarca
    </PessoaSingular>
    ,
    </ProjetoObraMunicipal>
  </Proposta>
  <Requerimento Estado="Aprovado">...</Requerimento>
  <Proposta Estado="Aprovado">...</Proposta>
  <Proposta Estado="Aprovado">...</Proposta>
  <Deliberacao Estado="Aprovado">
    <Data Ano="1854" Mes="03" Dia="01" Tipo="Normal"/>
    E entrando esta proposta em discussão, foi approvada pela Camara, e que para que ella tivesse effeito legal, deliberou-se convocasse o
    <PessoaColetiva>Conselho Municipal</PessoaColetiva>
    para o dia cinco do corrente, pelo meio dia, afim de tudo ser submettido á sua approvão. (...)
  </Deliberacao>
</Sessao>

```

Figure 33: An example of the documents from the results obtained from a search, in this case "Paço".

Alguns detalhes

Toponimia				
Data	Designação Anterior	Designação Republicana	Motivo	Fonte
Sem resultados	Sem resultados	Sem resultados	Sem resultados	Sem resultados

Projetos publicos			
Identificação	Data	Título	Assunto
PT/MFAF/AMFAF/CMFAF- M-A/001/00056	1924	Reparação dos pavimentos da rua Magalhães Lima, conclusão dos posses da	Projetos de obras de regularização dos pavimentos do Largo compreendido entre as ruas de Serpa Pinto e Cândido dos Reis; Reparação dos pavimentos da rua Magalhães Lima; conclusão dos posses da

Notariado (Instrumentos)

Data	Nome dos Outorgantes	Residência dos Outorgantes	Denominação	Valor	Objeto	Lugar
1907.01.13	João Feio das Neves	Braga	Empréstimo	30.000\$00	alargamento e retificação da Rua da Corredoura;	

Notariado (Notas)

Data	Nome dos Outorgantes	Residência dos Outorgantes	Denominação	Valor	Objeto	Lugar
	Banco da Minho, na qualidade de gerentes				Construção do edificio dos Paços Municipais e repartições publicas do concelho; construção de uma avenida e ramal de ligação da vila com a estação do caminho-de-ferro; obras de	

Figure 34: An example of the extra details from the results obtained from a search, in this case "Paço".

A second and more interesting output, is the location on GeoServer map of the building referred to in the document selected for visualization. Figure 38 illustrate this feature.



Figure 35: A map displaying the result of a query searching for the building "Feira Velha".

Extra example:

EVOLUÇÃO URBANA DE FAFE NOS SÉCULOS XIX E XX

Pesquisa: Paços Tag: Todas

Texto	Documento	Opção(1)	Opção(2)
"Ao primeiro dia do mez de Março de mil oito centos cincoenta e quatro, nesta Villa de Fafe e Paços do Concelho, onde se achava reunida a Camara Municipal, previa mente convocada pelo Presidente della; ali pelo mesmo foi exposto, que sendo de urgente necessidade augmentar se a casa do Tribunal das audiencias Judiciais , ao qual no estado em que se acha, não tem espaço sufficiente para acomodar o pessoal, e o auditorio como acaba de ser ponderado pelo Meretissimo Juis de Direito desta Comarca,	Sessao1854_03_01.xml	<input type="button" value="Ver Documento"/>	<input type="button" value="Ver Mapa"/>
augmentar o edificio dos Paços do Concelho, de modo que possa dar capacidade para nelle se acomodarem as tres repartições, Judicial, Administrativa, e Municipal,	Sessao1854_03_01.xml	<input type="button" value="Ver Documento"/>	<input type="button" value="Ver Mapa"/>
"Aos cinco dias do mez de Março de mil oito centos cincoenta e quatro, nesta Villa de Fafe, e Paços do Concelho, onde se achava reunida a Camara, e o Conselho Municipal, previa mente convocado, e no fim desta assignada; e sendo submettido á sua approvação a deliberação da Camara Municipal, tomada em Sessão de um do corrente mez, sobre as obras que ali se julgarão de necessidade para augmento do edificio dos Paços do Concelho, foi esta approvada unanimamente, bem como o foi quanto aos meios tambem ali deliberados para se occorrer ás despesas com a referida obra, com tanto que o juro que se estipular no emprestimo deliberado, nunca exceda a ceis por cento, e que o dito emprestimo não exceda tambem á quantia de um conto e ceis centos mil reis, visto o orçamento da obra. (...)"	Sessao1854_03_05.xml	<input type="button" value="Ver Documento"/>	<input type="button" value="Ver Mapa"/>
previa mente convocado, e no fim desta assignada; e sendo submettido á sua approvação a deliberação da Camara Municipal, tomada em Sessão de um do corrente mez, sobre as obras que ali se julgarão de necessidade para augmento do edificio dos Paços do Concelho	Sessao1854_03_05.xml	<input type="button" value="Ver Documento"/>	<input type="button" value="Ver Mapa"/>
um emprestimo ate a quantia de 1:6005000 reis, para o reparo e acrescimo da Casa dos Paços do Concelho, se procedesse quanto antes não só á mencionada obra, como igualmente a contrahir o referido emprestimo, devendo para estes dois fins fazerse o seguinte.	Sessao1854_08_08.xml	<input type="button" value="Ver Documento"/>	<input type="button" value="Ver Mapa"/>
contrahir um emprestimo ate a quantia de 1:6005000 reis, para o reparo e acrescimo da Casa dos Paços do Concelho, se procedesse quanto antes não só á mencionada obra, como igualmente a contrahir o referido emprestimo, devendo para estes dois fins fazerse o seguinte. Sumbetter á approvação do Ex.mo Conselho de Districto, que em vista do artº 4º da citada Carta de Lei, e attendendo á falta de concorrentes que esta localidade sente nas arrematações das obras publicas, deve a dita obra ser antes feita por administração, de que por meio de praça, para evitar que daquella falta de concorrencia já experimentada em outras occasiões, se torne a mesma obra muito mais cara. Que para se obter o emprestimo autorizado no artº 1º da mesma Lei, se afixem desde já editais convocando aquellos que por menor juro e milliores condições queirão fazer o referido emprestimo	Sessao1854_08_30.xml	<input type="button" value="Ver Documento"/>	<input type="button" value="Ver Mapa"/>

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Figure 36: An example of the results obtained from a search, in this case "feira velha".

Alguns detalhes

Toponímia				
Data	Designação Anterior	Designação Republicana	Motivo	Fonte
Sem resultados	Sem resultados	Sem resultados	Sem resultados	Sem resultados

Notariado(Instumentos)						
Data	Nome dos Outorgantes	Residência dos Outorgantes	Denominação	Valor	Objeto	Lugar

Projetos publicos			
Identificação	Data	Título	Assunto
		Projectos de obras de regularização dos pavimentos do Largo compreendido entre os ruas de Serpa Pinto e Cândido dos Reis;	Projectos de obras de regularização dos pavimentos do Largo compreendido entre as ruas de Serpa Pinto e Cândido dos Reis; Reparação dos pavimentos da rua Magalhães Lima; conclusão dos posses da
PT/MFAF/AMFAF/CMFAF-M-A/001/00056	1924	Reparação dos pavimentos da rua	Avenida 5 de Outubro, em frente ao edifício das Paços do Concelho. Peças

Notariado(Notas)						
Data	Nome dos Outorgantes	Residência dos Outorgantes	Denominação	Valor	Objeto	Lugar
	Banco do Minho, na qualidade de gerentes				Construção do edifício dos Paços Municipais e repartições públicas do concelho; construção de uma avenida e ramal de ligação da vila com a estação do caminho-de-ferro; obras de	
1907.01.13	Jóão Feio das Neves	Braga	Empréstimo	30.000\$00	alargamento e retificação da Rua da Corredoura;	

Figure 37: An example of the extra details from the results obtained from a search, in this case “feira velha”.



Figure 38: A map displaying the result of a query searching for the building “Largo da Granja”.

Notice that the system also allows the admin to define manually coordinates. This function was added due to the high amount of old locations.

Finally due to changes in toponymy as discussed in Section 4.4 the system uses an algorithm to compute the list of names that a circulation space had along the years. Given a name and a date, this mechanism is shown in Figure 39.

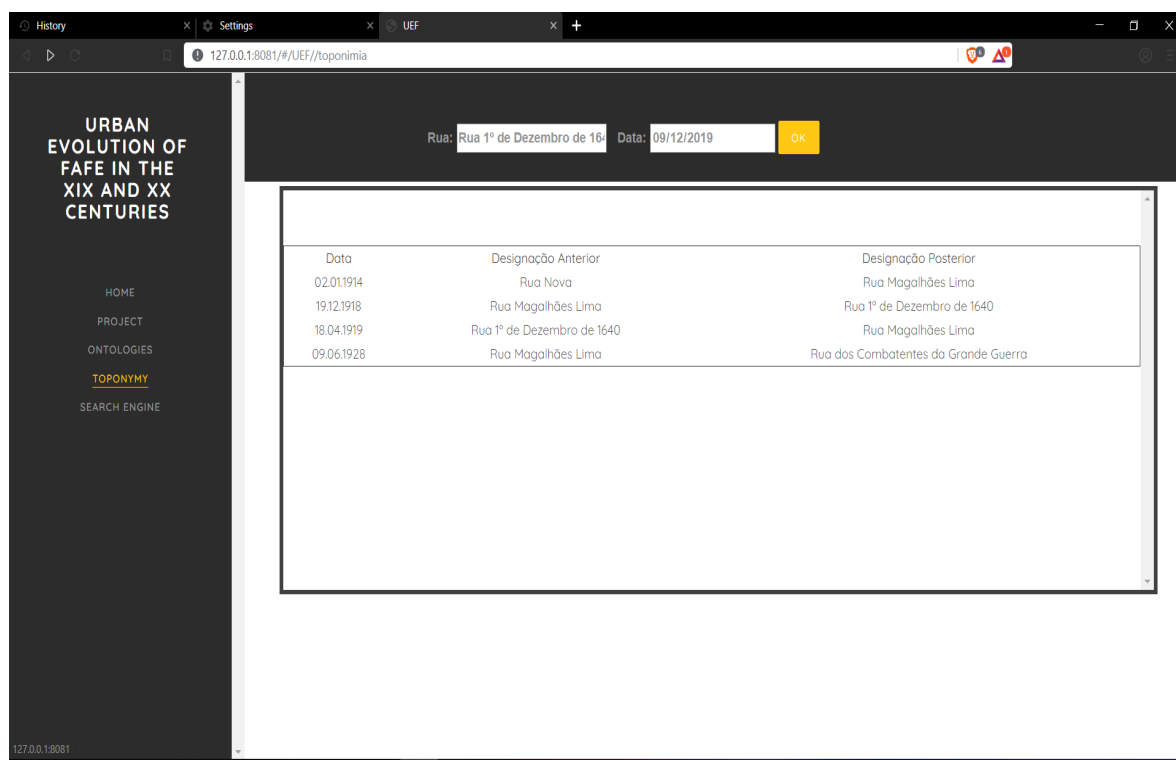


Figure 39: The list of toponyms when searching for "Rua 1º de Dezembro de 1640" and a random date.

On the first phase of the project was possible to verify that occasionally a street name would cause some confusion due its old naming. Returning the street names in chronological order the tool allows for the understanding of urban evolution.

CONCLUSION

This document discusses the development of a Web-based system to study the Urban Evolution of Fafe in the XIX and XX Centuries.

Human Beings love to collect, store and preserve documents for later exploration leading to the creation of Archives. Actually, to consult municipal archives' asset, seeking information in order to explore the knowledge implicit in their documents, is the main reason for the existence of those memory institutions. On the other hand, it is known that the movement of people from dispersed living to concentration in urban environments has a strong impact both in human civilization and in the environment. This statement motivates Social Science researchers to study the urban evolution of cities. In this context and having noticed that Fafe's Archive holds an important collection of municipal records (since XIX Century) concerning the application for authorization to construct or reconstruct private or public buildings, it came up to create a digital repository with those documents enabling their analysis. So, an information system would be developed around it for information retrieval and knowledge exploration; it was also desirable that the application provided features to visualize the information extracted in convenient ways, like positioning buildings over a map.

Derived from these ideas this project was created and was defined a list of goals to achieve and also a research hypotheses to prove.

In this document the work done to prove the research hypotheses was reported in detail to demonstrate that with the extraction of information from documents from the Municipal archive and crossing information using an ontology, it was possible to reconstruct the urban evolution of Fafe.

In the first chapter (Chapter 1) it was described the motivation behind this work, as well as its goals. Its main purpose was to identify the problem at hand and set up the objectives that should be accomplished.

The second chapter (Chapter 2) introduced the main concepts of Urban Evolution, explaining why it is important. It also described the current state of the art, focusing on the similar tools that exist.

The third chapter (Chapter 3) described the problems faced and the solutions found to fix them. Also explains the system architecture and the proposed approach, describing the construction of the tool, and defining the work flow and analyzing each step individually. In the fourth chapter (Chapter 4) it was outlined the technologies and major development steps, what choices were made, why and how they were implemented. In the fifth chapter (Chapter 5) it was illustrated the website created to show the work done and to provide more details on the project outcomes. The website developed can be accessed and tested at <http://www4.di.uminho.pt/~gepl/UEF/>.

So, in order to fulfill the first goal ("Create a repository to store the information about the different buildings"), it was necessary to study the subject first. And that was made in the Chapter 2. Also was necessary to analyze all the information sources (Section 3.1) and use ontologies (see 3.2) to eliminate the huge amount of terms/concepts found in the documents and because of this huge amount it was difficult to classify and group all the terms. So, the solution was to create ontologies to organize them and really define what terms were related and what terms were to ignore or were encompassed by others. After that was finally possible to start treating information as explained in Section 3.3. Initially was thought to use a database to store the information of the buildings etc. But that option was removed after the analysis of the documents due to the non fix structure of these sources (they didn't follow like a formulary structure) and the fact that these sources had value, meaning that all the document had importance to the study and not just a few pieces of it. So was concluded that the repository would be a directory file where all the files treated would be stored. The second goal ("Create a web interface to insert information of the buildings") was changed due to exactly what was said just now. There was no fix structure in the documents and the document itself had value to the study. And because of that at this point was decided that would be made use of XML to treat and process all the information in the documents. So instead of the tool processing these documents by itself by picking just a few fields from the sources like it was a formulary. The documents had to be processed by a specific person and stored in the repository. As explained in Section 3.3. The third goal ("Populate the repository with information") was made just after all DTDs and XML tags were defined. The DTDs were defined to validate and process the XML files (Section 4.1). The XML tags derived from the ontologies built. A few documents were marked up and stored in the repository. With the repository done and after having a few documents processed and stored it was time for the he fourth goal ("Allow users to search about information"). To achieve this goal was necessary to make queries to the system to extract information. As explained in Section 4.2. The last goal ("Make available the visualization of the buildings on the map (in different years)") was not fully achieved due to the lack of maps in the archive of Fafe it was not possible to make the visualization of the different maps along the years. But in the future if

the maps are found this feature can be easily added, following the steps described in the second approach in Section 4.3.2.

In this project were made a lot of contributions. Starting with the gathering of concepts made by analyzing and reading all the sources available for this project and presented at Chapter B. Using these terms was made other contribution, the ontologies built for this project presented at Chapter A that describes the urban evolution. They can be used for other projects and help people study the urban evolution. More broadly, it allows people to study all the concepts and relations that directly relate to this theme.

The various DTDs made (six DTDs in total) presented at Chapter C, these DTDs describe the possible structures of the sources with information related to urban evolution and can they be used to continue this project (to continue the markup) or they can be used in a similar project that deals with the same theme.

Also was added two extra features to the tool (see Section 4.4) that were not on the goals. The secondary sources information that appears in the search mechanism and the toponymy algorithm to compute the list of names that a circulation space had along the years. Given a name and a date, this mechanism is shown in Figure 39.

To built this algorithm was necessary to first gather all the toponymy name changes from all available sources, see Chapter D. Finally was also made a paper [Lameiras et al. \(2019\)](#) about the overall project and its outcomes was written, submitted to SLATE¹ accepted, and presented.

With the end of this project it is possible to verify that tool can be improved in the future. One possibility is to improve and finalize the last goal, if found the remaining maps needed to present for each year or decade its one map instead of showing always the current map of the city for every year. Other possibility is to create a new tab were different users of the tool can share resumes or other important information that the tool does not have. And this way the users can enrich the tool data and help each other. Other really nice idea for future work is if possible replace the current map with an interactive one, where the user can obtain information from each plot or building by clicking it for example (using Google technology, for example <https://maps.google.com>).

Other idea is when on the map page it would be interesting if when selected a building or street for example, in the left or right it would show other locations if they had that the selected building or street had in the different years.

These ideas are just a prove that this project as a lot of potential and can have a big impact not just nationally but internationally, because the approach followed and the architecture proposed can be applied to different cities in different countries.

¹ <http://drops.dagstuhl.de/opus/volltexte/2019/10883/>

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ONTOLOGIES

In this chapter is presented the ontologies where is possible to see all the concepts, relations and triples. Also, was defined some individuals. The first ontology describes all types of buildings classifying them in public buildings with private or public services and in private buildings with private or public services, also describes spaces in green spaces, circulation spaces and commercial spaces, and gives more details for each of them. The second ontology describes all the process of deliberations, legal base, and notary describing every type of contract that the entities could do in result of the deliberations.

A.1 ONTOURB ONTOLOGY

Ontologia OntoUrb

```
conceitos{ PessoaSingular ,
           PessoaColetiva ,
           Localizacao ,
           Distrito ,
           Pais ,
           Freguesia ,
           Lugar ,
           Toponimos ,
           Edificio[Nome:string , Servico:string , NPisos:int , Existente:boolean] ,
           EdificioPublico-c/FimPublico ,
           EdificioCamaraMunicipal ,
           Tribunal ,
           Cadeia ,
           CentroSaude ,
           CentralDeCamionagem ,
           Correios ,
           Financas ,
           EstacaoDeCaminhosDeFerro ,
           EsquadraGNR ,
           Escola ,
           EdificioPrivado-c/FimPublico ,
```

```

Saude ,
Iluminacao ,
AbastecimentoDeAguaESaneamento ,
EdificioPrivado ,
Hospital ,
EdificioPrivado-c/FimParticular[Tipo:string, Uso:string],
Habitacao ,
Comercio ,
Misto ,
Industria ,
Coordenada[latitude:float, longitude:float],
MercadoMunicipal ,
MatadouroMunicipal ,
CemiterioMunicipal ,
EspacoComercial ,
EspacoVerde ,
EspacoDeCirculacao ,
Ornato ,
InfraEstruturas ,
Data[ano:int, mes:int, dia:int],
DataAprovacao ,
DataInauguracao ,
DataDemolicao ,
DataConstrucao ,
Entidade[Nome:string],
Espaco[Nome:string, Tipologia:string, Uso:string],
Largo ,
Monumento ,
Chafariz ,
Fonte ,
Praca ,
PacosDoConcelho ,
EsquadraPSP ,
Feira ,
Mercado ,
%%   Requerente ,
Beco ,
Rua ,
Travessa ,
Avenida ,
Ponte ,
Lago ,
Igreja ,
Capela ,
Fazenda ,
Mercearia ,
Ferragem ,

```

```

LoucaEVIDros ,
Tabacaria ,
Docaria ,
Farmacia ,
Drogaria ,
SeleiroECorreeiro ,
Cafe ,
Ourivesaria ,
Hotel ,
Restaurante ,
Barbearia ,
Talho ,
Sapataria ,
AgenciaBancaria ,
CompanhiaMaritima ,
CentralHidroElectrica ,
Regularizacao ,
Aperfeicoamento ,
Aformoseamento ,
AlargamentoDeUmaTravessa ,
AmpliacaoDeUmLargo ,
AberturaDeAvenida ,
    %%Entidade ,
PSP ,
GNR ,
BombeirosVoluntarios ,
CamaraMunicipal ,
QuartelBombeirosVoluntarios ,
Concelho ,
PoliciaMunicipal ,
EdificioPoliciaMunicipal ,
EstradaMunicipal ,
EstradaReal ,
EstradaDistrital ,
CaminhoMunicipal ,
AdministracaoDoConselho ,
Reparticao ,
ReparticaoJudicial ,
ReparticaoAdministrativa ,
Presidente ,
SenadoMunicipal

}

individuos{ JardimDoCalvario ,
    JardimDaQueimada ,
HospitalDaMisericordia

```

```

}

relacoes{ temMorada,
    situadoNum,
    contem,
    localizadoEm,
    tem,
    possui,
    relacionadoCom,
    ficaNum,
    situadaEm,
    construidoNum,
    construidaNum,
    realizadaEm,
    pertence,
    reelecionada
}

}

triplos{
    CemiterioMunicipal =subclasse=> InfraEstruturas;
    MatadouroMunicipal =subclasse=> EdificioPublico-c/FimPublico;
    EdificioPoliciaMunicipal =subclasse=> EdificioPublico-c/FimPublico;
    MercadoMunicipal =subclasse=> EdificioPublico-c/FimPublico;
    EdificioCamaraMunicipal =subclasse=> EdificioPublico-c/FimPublico;
    PacosDoConcelho =subclasse=> EdificioPublico-c/FimPublico;
    EsquadraPSP =subclasse=> EdificioPublico-c/FimPublico;
    Cadeia =subclasse=> EdificioPublico-c/FimPublico;
    Igreja =subclasse=> EdificioPrivado-c/FimPublico;
    Capela =subclasse=> EdificioPrivado-c/FimPublico;
    Tribunal =subclasse=> EdificioPublico-c/FimPublico;
    CentralDeCamionagem =subclasse=> EdificioPublico-c/FimPublico;
    QuartelBombeirosVoluntarios =subclasse=> EdificioPublico-c/FimPublico;
    CentroSaude =subclasse=> EdificioPublico-c/FimPublico;
    Financas =subclasse=> EdificioPublico-c/FimPublico;
    Correios =subclasse=> EdificioPrivado-c/FimPublico;
    EstacaoDeCaminhosDeFerro =subclasse=> EdificioPublico-c/FimPublico;
    Escola =subclasse=> EdificioPublico-c/FimPublico;
    EsquadraGNR =subclasse=> EdificioPublico-c/FimPublico;
    Iluminacao =subclasse=> EdificioPrivado-c/FimPublico;
    CentralHidroElectrica =subclasse=>Iluminacao;
    AbastecimentoDeAguaESaneamento =subclasse=> EdificioPrivado-c/FimPublico;
    EdificioPublico-c/FimPublico =subclasse=> Edificio;
    EdificioPrivado=subclasse=> Edificio;
    EdificioPrivado-c/FimPublico =subclasse=> EdificioPrivado;
    EdificioPrivado-c/FimParticular =subclasse=> EdificioPrivado;
}

```



```

Saude =subclasse=> EdificioPrivado-c/FimPublico;
Hospital =subclasse=> Saude;
Habitacao =subclasse=> EdificioPrivado-c/FimParticular;
Comercio =subclasse=> EdificioPrivado-c/FimParticular;
    Fazenda =subclasse=>Comercio;
Mercearia =subclasse=>Comercio;
Ferragem =subclasse=>Comercio;
LoucaE Vidros =subclasse=>Comercio;
Tabacaria =subclasse=>Comercio;
Docaria =subclasse=>Comercio;
Farmacia =subclasse=>Comercio;
Drogaria =subclasse=>Comercio;
SeleiroECorreeiro =subclasse=>Comercio;
Cafe =subclasse=>Comercio;
Ourivesaria =subclasse=>Comercio;
Hotel =subclasse=>Comercio;
    Restaurante =subclasse=>Comercio;
Barbearia =subclasse=>Comercio;
Talho =subclasse=>Comercio;
    Sapataria =subclasse=>Comercio;
AgenciaBancaria =subclasse=>Comercio;
CompanhiaMaritima =subclasse=>Comercio;
Misto =subclasse=> EdificioPrivado-c/FimParticular;
Industria =subclasse=> EdificioPrivado-c/FimParticular;
EspacoVerde =subclasse=> Espaco;
EspacoComercial =subclasse=> Espaco;
EspacoDeCirculacao =subclasse=> Espaco;
Aformoseamento =subclasse=> Regularizacao;
Aperfeicoamento =subclasse=> Regularizacao;
AmpliacaoDeUmLargo =subclasse=> Regularizacao;
AlargamentoDeUmaTravessa =subclasse=> Regularizacao;
Monumento =subclasse=> Ornato;
Chafariz =subclasse=> Ornato;
Fonte =subclasse=> Ornato;
Lago =subclasse=> Ornato;
DataAprovacao =subclasse=> Data;
DataInauguracao =subclasse=> Data;
DataConstrucao =subclasse=> Data;
DataDemolicao =subclasse=> Data;
%% Requerente =subclasse=> Pessoa;
Mercado =subclasse=> EspacoComercial;
Feira =subclasse=> EspacoComercial;
Largo =subclasse=> EspacoDeCirculacao;
Praca =subclasse=> EspacoDeCirculacao;
Beco =subclasse=> EspacoDeCirculacao;
Travessa =subclasse=> EspacoDeCirculacao;
Avenida =subclasse=> EspacoDeCirculacao;

```

```

Rua =subclasse=> EspacoDeCirculacao;
Ponte =subclasse=> EspacoDeCirculacao;
PessoaSingular =subclasse=> Entidade;
PessoaColetiva =subclasse=> Entidade;
Presidente =subclasse=> PessoaSingular;
PSP =subclasse=> PessoaColetiva;
CamaraMunicipal =subclasse=> PessoaColetiva;
SenadoMunicipal =subclasse=> PessoaColetiva;
GNR =subclasse=> PessoaColetiva;
BombeirosVoluntarios =subclasse=> PessoaColetiva;
AdministracaoDoConselho =subclasse=> PessoaColetiva;
PoliciaMunicipal =subclasse=> PessoaColetiva;
Reparticao =subclasse=> PessoaColetiva;
ReparticaoJudicial =subclasse=> Reparticao;
ReparticaoAdministrativa =subclasse=> Reparticao;
EstradaMunicipal = subclasse=> EspacoDeCirculacao;
EstradaReal =subclasse=> EspacoDeCirculacao;
EstradaDistrital =subclasse=> EspacoDeCirculacao;
CaminhoMunicipal =subclasse=> EspacoDeCirculacao;

Edificio = temMorada => Lugar;
Espaco = situadoNum => Lugar;
EspacoVerde = contem => Ornato;
Lugar = localizadoEm => Localizacao;
Entidade = reelecionada => Edificio;
Edificio = relacionadoCom => Data;
Toponimos = ficaNum => Lugar;
Localizacao = situadaEm => Coordenada;
Espaco = tem => InfraEstruturas;
AberturaDeAvenida = construidaNum => Espaco;
Regularizacao = realizadaEm => EspacoDeCirculacao;
Localizacao =pertence => Freguesia;
Freguesia =pertence => Concelho;
Concelho =pertence => Distrito;
Distrito =pertence => Pais;

JardimDoCalvario =instancia=> EspacoVerde[Nome='Jardim do Calvario',
    Tipologia= 'Lazer', Uso= 'Lazer'];
JardimDaQueimada =instancia=> EspacoVerde[Nome='Jardim da Queimada',
    Tipologia= 'Lazer', Uso= 'Lazer'];
HospitalDaMisericordia =instancia=> Hospital [Nome='Hospital Da Misericordia
    ', Servico='Saude', NPisos='2', Existente='true']
}.

```

Listing A.1: Urban Ontology: Construction of the ontology that was exposed in Figure 14.

A.2 ONTOUBNDELIBERACOES ONTOLOGY

Ontologia OntoUbnDeliberacoes

```

conceitos{ Expropriacao ,
  Cedencia ,
  Compra ,
  Indemnizacao ,
  ContratoDeEmpreitada ,
  Construcao ,
  Reconstrucao ,
  Notariado[Data:date , Outorgantes:string , ResidenciaDosOutorgantes:string ,
    DenominacaoDoContrato:string , ValorDoContrato:int , ObjetivoDoActo:string ,
    Lugar:string , Freguesia:string] ,
  Entidade ,
  CamaraMunicipal ,
  ConselhoMunicipal ,
  ComissaoExecutiva ,
  AssembleiaMunicipal ,
  ComissaoAdministrativaMunicipal ,
  ContratoDeEmprestimo ,
  ContratoDeArrendamento ,
  ContratoDeAquisicao ,
  SenadoMunicipal ,
  Demolicao ,
  Empreitada ,
  Deliberacao ,
  FonteDeInformacao ,
  Imprensa ,
  Escritura ,
  Projeto[CodigoDeReferencia:string , Titulo:string , Data:date , Assunto:
    string , Freguesia:string] ,
  AutoDeArrematacao[Data:date , Outorgantes:string , Assunto:string , Quantia:
    int] ,
  InstrumentoLegal ,
  Decreto ,
  Despacho ,
  DecretoLei ,
  PlanoDeMelhoramento ,
  PlanoDiretorMunicipal ,
  Regulamento ,
  Lei ,
  Edificio ,
  Terreno ,
  ContratoDePrestacaoServico ,
  Espaco ,
  ProjetoObraMunicipal ,

```

```

    ProjetoObraParticular ,
    Acta ,
    Plano ,
    PessoaColetiva ,
    PessoaSingular

}

relacoes{ realiza ,
    faz ,
    realizadaEm ,
    feitaEm ,
    feitoEm ,
    feitoCom ,
    paraRealizar ,
    paraFazer ,
    sobre ,
    deUm ,
    contem ,
    podeTer ,
    obdece ,
    intervem ,
    podeRealizar ,
    prestacaoDe ,
    aquisicaoDe ,
    podeNecessitar ,
    registadaEm ,
    daComeco ,
    implica

}

triplos{PessoaColetiva =subclasse=> Entidade;
    PessoaSingular =subclasse=> Entidade;
    CamaraMunicipal =subclasse=> PessoaColetiva;
    ConselhoMunicipal =subclasse=> PessoaColetiva;
    ComissaoExecutiva =subclasse=> PessoaColetiva;
    AssembleiaMunicipal =subclasse=> PessoaColetiva;
    ComissaoAdministrativaMunicipal =subclasse=> PessoaColetiva;
    SenadoMunicipal =subclasse=> PessoaColetiva;
    Imprensa =subclasse=> FonteDeInformacao;
    Escritura =subclasse=> FonteDeInformacao;
    Projeto =subclasse=> FonteDeInformacao;
    Compra =subclasse=> Expropriacao;
    Cedencia =subclasse=> Expropriacao;
}

```

```

Construcao =subclasse=> Empreitada;
Reconstrucao =subclasse=> Empreitada;
Decreto =subclasse=> InstrumentoLegal;
DecretoLei =subclasse=> InstrumentoLegal;
Despacho =subclasse=> InstrumentoLegal;

Lei =subclasse=> InstrumentoLegal;
PlanoDeMelhoramento =subclasse=> Plano;
PlanoDiretorMunicipal =subclasse=> Plano;
Plano =subclasse=> InstrumentoLegal;
InstrumentoLegal =subclasse=> Regulamento;
Acta =subclasse=> FonteDeInformacao;
ProjetoObraMunicipal =subclasse=> Projeto;
ProjetoObraParticular =subclasse=> Projeto;
ContratoDeEmprestimo =subclasse=> Notariado;
ContratoDeArrendamento =subclasse=> Notariado;
ContratoDeAquisicao =subclasse=> Notariado;
ContratoDePrestacaoServico =subclasse=> Notariado;
ContratoDeEmpreitada =subclasse=> Notariado;
AutoDeArrematacao =subclasse=> Notariado;

Entidade =realiza=> Deliberacao;
ContratoDeEmpreitada =daComeco=> Empreitada;
Deliberacao =sobre=> Notariado;
Empreitada =podeNecessitar=> Demolicao;
Expropriacao =feitaEm=> Terreno;
ContratoDeArrendamento =sobre=> Espaco;
ContratoDeArrendamento =sobre=> Edificio;
ContratoDeAquisicao =deUm=> Terreno;
ContratoDeAquisicao =deUm=> Espaco;
ContratoDeAquisicao =deUm=> Edificio;
Empreitada =podeNecessitar=> Expropriacao;
Empreitada =sobre=> Terreno;
Expropriacao =podeTer=> Indemnizacao;
Entidade =obdece=> InstrumentoLegal;
Deliberacao =registadaEm=> Acta;
Notariado =implica=>Escritura

}.

```

Listing A.2: Legal Base and deliberations Ontology: Construction of the ontology that was exposed in Figure 15.

B

TERMS TABLE

B.1 TERMS TABLE, THE FINAL VERSION

Table with all the terms that were found in the sources and the tags that they will be marked with. Also, they have colors to distinguish what ontology mentions them.

TABELA DE TERMOS – MESTRADO TESE EVOLUÇÃO URBANA DE FAFE NOS SÉC. XIX E XX

Termo:	Marcar como:						
Legenda:	<table border="1"> <tr> <td><u>Ontologia Edificados</u></td> <td></td> </tr> <tr> <td><u>Ontologia Deliberações</u></td> <td></td> </tr> <tr> <td><u>Ambas</u></td> <td></td> </tr> </table>	<u>Ontologia Edificados</u>		<u>Ontologia Deliberações</u>		<u>Ambas</u>	
<u>Ontologia Edificados</u>							
<u>Ontologia Deliberações</u>							
<u>Ambas</u>							
Acta	Acta						
Abastecimento de Água e Saneamento	Edifício – EdifícioPrivado - EdifícioPrivadoComFimPublico - AbastecimentoDeÁguaESaneamento						
Assembleia Municipal	Entidade - PessoaColetiva - AssembleiaMunicipal						
Auto de arrematação	Notariado - AutoDeArrematacao						
Aperfeiçoamento	Regularização - Aperfeiçoamento						
Administração do conselho	Entidade – PessoaColetiva - AdminsitracaoDoConselho						
Aformoseamento	Regularização - Aformoseamento						
Alargamento de uma travessa	Regularização - AlargamentoDeUmaTravessa						
Ampliação do Largo	Regularização - AmpliaçãoDoLargo						
Abertura de uma avenida	AberturaDeUmaAvenida						
Avenida	Espaço - Espaço de Circulação - Avenida						
Agência Bancária	Edifício – EdifícioPrivado - EdifícioPrivadoComFimParticular – Comercio - AgenciaBancaria						
Beco	Espaço - Espaço de Circulação - Beco						
Barbearia	Edifício – EdifícioPrivado - EdifícioPrivadoComFimParticular – Comercio Barbearia						
Bombeiros Voluntários	Entidade – PessoaColetiva - BombeirosVoluntarios						
Coordenada	Coordenada						
Construção	Empreitada - Construção						
Cadeia	Edifício - Edifício público com fim público - Cadeia						
Caminho Municipal	Espaço - Espaço de Circulação - CaminhoMunicipal						
Contrato de Arrendamento	Notariado - ContratoDeArrendamento						
Contrato de Aquisição	Notariado - ContratoDeAquisição						
Contrato de Empreitada	Notariado - ContratoDeEmpreitada						
Contrato de Empréstimo	Notariado - ContratoDeEmpréstimo						
Contrato de Prestação Serviço	Notariado - ContratoDePrestaçãoServiço						
Comercio	Edifício – EdifícioPrivado - EdifícioPrivadoComFimParticular - Comercio						
Companhia Marítima	Edifício – EdifícioPrivado - EdifícioPrivadoComFimParticular – Comercio CompanhiaMaritima						
Conselho Municipal	Entidade - PessoaColetiva - ConselhoMunicipal						

TABELA DE TERMOS – MESTRADO TESE EVOLUÇÃO URBANA DE FAFE NOS SÉC. XIX E XX

Comissão Executiva	Entidade - PessoaColetiva - ComissãoExecutiva
Comissão de Administração Municipal	Entidade - PessoaColetiva - ComissãoDeAdministraçãoMunicipal
Cedência	Expropriação – Cedência
Compra	Expropriação - Compra
Câmara Municipal	Entidade – PessoaColetiva - CamaraMunicipal
Café	Edifício – EdifícioPrivado – EdifícioPrivadoComFimParticular – Comercio Café
Concelho	Concelho
Correios	Edifício – Edifício Privado - Edifício privado com fim público - Correios
Central de Camionagem	Edifício - Edifício público com fim público - Central de Camionagem
Centro de saúde	Edifício - Edifício público com fim público - Centro de saúde
Central Hidro - Elétrica	Edifício – Edifício Privado com fim público – Iluminação - Central Hidroelétrica
Capela	Edifício – EdifícioPrivado – EdifícioPrivadoComFimPublico - Capela
Cemitério Municipal	Infraestrutura – CemitérioMunicipal
Chafariz	Ornato – Chafariz
Distrito	Distrito
Deliberação	Deliberação
Drogaria	Edifício – EdifícioPrivado – EdifícioPrivadoComFimParticular – Comercio Drogaria
Doçaria	Edifício – EdifícioPrivado – EdifícioPrivadoComFimParticular – Comercio Docaria
Data	Data (ano + mês + dia) por seculos/décadas
Data de Inauguração	Data – Data de Inauguração
Data de Abertura	Data – Data de Abertura
Data de Demolição	Data – Data de Demolição
Data de Aprovação	Data – Data de Aprovação
Demolição	Demolição
Decreto Lei	InstrumentoLegal - DecretoLei
Decreto	InstrumentoLegal - Decreto
Despacho	InstrumentoLegal - Despacho
Edifício	Edifício
Edifício público com fim publico	Edifício - Edifício publico com fim publico
Edifício privado	Edifício - Edifício privado
Edifício privado com fim particular	Edifício – Edifício Privado - Edifício privado com fim particular
Espaço	Espaço
Espaço comercial	Espaço – EspacoComercial
Espaço de circulação	Espaço - EspacoDeCirculacao
Espaço verde	Espaço - EspacoVerde

TABELA DE TERMOS – MESTRADO TESE EVOLUÇÃO URBANA DE FAFE NOS SÉC. XIX E XX

Edifício privado com fim publico	Edifício – Edifício Privado - Edifício privado com fim publico
Edifício Câmara Municipal	Edifício - Edifício público com fim público - Edifício Câmara Municipal
Edifício Policia Municipal	Edifício - Edifício público com fim público - Edifício Policia Municipal
Escola	Edifício - Edifício públicos com fim público - Escola
Expropriação	Expropriação
Empreitada	Empreitada
Esquadra GNR	Edifício - Edifício público com fim público - Esquadra GNR
Esquadra PSP	Edifício - Edifício público com fim público - Esquadra PSP
EstradaMunicipal	Espaço - Espaço de Circulação – EstradaMunicipal
EstradaDistrital	Espaço - Espaço de Circulação – EstradaDistrital
EstradaReal	Espaço - Espaço de Circulação – EstradaReal
Estação caminhos de ferro	Edifício - Edifício público com fim público - Estação caminhos de ferro
Escritura	FonteDelInformacao – Escritura
Entidade	Entidade
Ferragem	Edifício – EdifícioPrivado – EdifícioPrivadoComFimParticular – Comercio Ferragem
Feira	Espaço - Espaço Comercial - Feira
Finanças	Edifício - Edifício público com fim público - Finanças
Fazenda	Edifício – EdifícioPrivado – EdifícioPrivadoComFimParticular – Comercio Fazenda
Freguesia	Freguesia
Fonte	Ornato – Fonte
Fontes de Informação	FontesDelInformacao
Farmácia	Edifício – EdifícioPrivado – EdifícioPrivadoComFimParticular – Comercio Farmacia
GNR	Entidade – PessoaColetiva - GNR
Hote	Edifício – EdifícioPrivado – EdifícioPrivadoComFimParticular – Comercio Hotel
Hospital	Edifício – Edifício Privado - Edifício privado com fim público – Saúde - Hospital
Hospital da Misericórdia (INSTÂNCIA)	Edifício – Edifício Privado - Edifício privado com fim público – Saúde - Hospital
Habitação	Edifício – EdifícioPrivado – EdifícioPrivadoComFimParticular -Habitação
Igreja	Edifício – EdifícioPrivado – EdifícioPrivadoComFimPublico - Igreja
Imprensa	FonteDelInformacao - Imprensa

TABELA DE TERMOS – MESTRADO TESE EVOLUÇÃO URBANA DE FAFE NOS SÉC. XIX E XX

Indústria	Edifício – EdifícioPrivado – EdifícioPrivadoComFimParticular -Industria
Indemnização	Indemnização
Iluminação	Edifício – EdifícioPrivado – EdifícioPrivadoComFimPublico - Iluminacao
Instrumento Legal	InstrumentoLegal
Infraestruturas	Infraestruturas
Jardim do Calvário (INSTÂNCIA)	Espaço - Espaço Verde
Jardim da Queimada (INSTÂNCIA)	Espaço - Espaço Verde
Lugar	Lugar
Lei	Instrumento Legal - Lei
Louça e Vidros	Edifício – EdifícioPrivado – EdifícioPrivadoComFimParticular – Comercio - LoucaE Vidros
Largo	Espaço - Espaço de Circulação - Largo
Lago	Ornato – Lago
Localização	Localização
Mercearia	Edifício – EdifícioPrivado – EdifícioPrivadoComFimParticular – Comercio - Mercearia
Monumento	Ornato – Monumento
Matadouro Municipal	Edifício - Edifício público com fim público - Matadouro Municipal
Mercado Municipal	Edifício - Edifício público com fim público - Mercado Municipal
Misto	Edifício – EdifícioPrivado – EdifícioPrivadoComFimParticular - Misto
Mercado	Espaço - Espaço Comercial - Mercado
Notariado	Notariado
Ornato publico (estatuas, fontes, chafarizes, ...)	Ornato
Ourivesaria	Edifício – EdifícioPrivado – EdifícioPrivadoComFimParticular – Comercio - Ourivesaria
Ponte	Espaço - Espaço de Circulação – Ponte
Presidente	Entidade – PessoaSingular -Presidente
Pessoa Coletiva	Entidade -PessoaColetiva
Pessoa Singular	Entidade -PessoaSingular
Praça	Espaço - Espaço de Circulação – Praça
Polícia Municipal	Entidade – PessoaColetiva - Polícia Municipal
Paços do Concelho	Edifício - Edifício público com fim público - Paços do Concelho
PSP	Entidade – PessoaColetiva - PSP
Pais	Pais
Projeto	FontesDeInformacao-Projeto
Projeto Obra Particular	Projeto – ProjetoObraParticular
Projeto Obra Municipal	Projeto - ProjetoObraMunicipal
Plano	InstrumentoLegal - Plano
Plano de Melhoramento	Plano - PlanoDeMelhoramento
Plano Diretor Municipal	Plano - PlanoDiretorMunicipal

TABELA DE TERMOS – MESTRADO TESE EVOLUÇÃO URBANA DE FAFE NOS SÉC. XIX E XX

Quartel Bombeiros Voluntários	Edifícios públicos com fim público - Bombeiros Voluntários
Rua	Espaço - Espaço de Circulação - Rua
Restaurante	Edifício – Edifício Privado – Edifício Privado Com Fim Particular – Comercio - Restaurante
Reconstrução	Empreitada - Reconstrução
Repartição (Judicial, administrativa, etc...)	Entidade – Pessoa Coletiva - Reparticao
Repartição Judicial	Entidade – Pessoa Coletiva - Reparticao - Reparticao Judicial
Repartição Administrativa	Entidade – Pessoa Coletiva - Reparticao - Reparticao Administrativa
Reparticao Municipal	
Regulamento	Instrumento Legal - Regulamento
Regularização	Regularização
Saúde	Edifício – Edifício Privado – Edifício Privado Com Fim Público - Saude
Sapataria	Edifício – Edifício Privado – Edifício Privado Com Fim Particular – Comercio - Sapataria
Senado	Entidade – Pessoa Coletiva - Senado
Seleiro e Correio	Edifício – Edifício Privado – Edifício Privado Com Fim Particular – Comercio - Seleriro E Correio
Secretaria Administracao	
Travessa	Espaço - Espaço de Circulação - Travessa
Talho	Edifício – Edifício Privado – Edifício Privado Com Fim Particular – Comercio - Talho
Topónimos	Topónimos
Tabacaria	Edifício – Edifício Privado – Edifício Privado Com Fim Particular – Comercio - Tabacaria
Terreno	Terreno
Tribunal	Edifício - Edifícios públicos com fim público - Tribuna

B.2 TERMS TABLE, COMPLETE VERSION

Discarded items, that were not used because of its terminology, similarity to other terms, or because they simply weren't necessary.

TABELA DE TERMOS – MESTRADO TESE EVOLUÇÃO URBANA DE FAFE NOS SÉC. XIX E XX

Auto	
Apresentação	
Assunto	
Aula	
Alargamento de uma área	
Associação	
Artigo	
Autorizações	
Alteração de projetos	
Arrematação	
Administração	
Área	
Avaliações	
Abertura	
Alteração de nomes de edifícios	
Banca	
Banco	
Cidade	
Casa	
Convocação	
Contribuições	
Circular	
Cidadão	
Campo	
Código	
Condição	
Comissão	
Comunicados	
Comemorações	
Custo	
Considerações	
Criação	
Compartições	
Concursos	
Declaração	
Decreto	
Descrição de um espaço ou edifício	
Delegação	
Documentos	
Despesa	
Deferimentos	
Empresa	
Encarregado	
Edificação	
Estatuto	
Encerramentos	
Funções	
Feriado	
Firmas	
Fundações	

TABELA DE TERMOS – MESTRADO TESE EVOLUÇÃO URBANA DE FAFE NOS SÉC. XIX E XX

Gratificações	
Horas	
Hospício	
Instalações	
Inauguração	
Instituto	
Junta	
Localidade	
Licitações	
Lado (norte, sul, ...)	
Mês	
Memória	
Moção	
Monte	
Ministério	
Melhoramentos	
Necessidade	
Nascentes	
Negociante	
Notificações	
Ofício	
Programa	
Prédios	
Permuta	
Prazo	
Propriedade	
Profissão	
Passagem	
Proposta	
Proprietário	
Prolongamento	
Parque	
Preço	
Publicações	
Pagamentos	
Pavimentação	
Quina	
Quintal	
Retificação	
Residência	
Reparações	
Reuniões Ordinárias	
Sessão ordinária	
Sessão ordinária camarária	
Sessão camarária	
Supressão	
Santo	
Templo	
Testemunho	
Testemunha	

TABELA DE TERMOS – MESTRADO TESE EVOLUÇÃO URBANA DE FAFE NOS SÉC. XIX E XX

Traçado	
Transferências	
Vila	
Verba	
Vendas	
Zonas	

DTDS

In this chapter all the DTDs that were built to define the specific markup dialects to be used in each project family of documents are presented. Those DTDs were also used by the XML processors to validate the annotated documents before the data extraction phase.

C.1 SESSIONSDTD

DTD that represents the sessions made by the entities to discuss projects, buildings, constructions, etc.

```
<!ELEMENT Sessao (Deliberacao|Proposta|Requerimento)+>

<!-- DELIBERACOES -->

<!ELEMENT Deliberacao (
#PCDATA|
Justificacao|
InstrumentoLegal|
Data|
PessoaColetiva|PessoaSingular|
Lugar|Freguesia|Concelho|Distrito|Pais|
EspacoVerde|EspacoCirculacao|EspacoComercial|
InfraEstrutura|
EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
Habitacao|Misto|
ProjetoObraMunicipal|ProjetoObraParticular|
ContratoEmpreitada|ContratoDeAquisicao|ContratoDeEmprestimo|
ContratoDeArrendamento|ContratoDePrestacaoServico|AutoDeArrematacao
)*>

<!ATTLIST Deliberacao
Estado (Aprovado|Reprovado|Desconhecido|EmTratamento) #REQUIRED
>
```

```

<!-- REQUERIMENTOS -->

<!ELEMENT Requerimento (
#PCDATA|
Justificacao|
Data|
PessoaColetiva|PessoaSingular|
EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
    Habitacao|Misto|
EspacoVerde|EspacoCirculacao|EspacoComercial|
ProjetoObraMunicipal|ProjetoObraParticular|
Lugar|Freguesia|Concelho|Distrito|Pais
)*>
<!ATTLIST Requerimento
Estado (Aprovado|Reprovado|Desconhecido|EmTratamento) #IMPLIED
>

<!-- PROPOSTAS -->

<!ELEMENT Proposta (
#PCDATA|
Data|
Justificacao|
PessoaColetiva|PessoaSingular|
ProjetoObraMunicipal|ProjetoObraParticular|
EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
    Habitacao|Misto|
EspacoVerde|EspacoCirculacao|EspacoComercial|
InfraEstrutura|
ContratoEmpreitada|ContratoDeAquisicao|ContratoDeEmprestimo|
    ContratoDeArrendamento|ContratoDePrestacaoServico|AutoDeArrematacao|
Lugar|Freguesia|Concelho|Distrito|Pais
)*>
<!ATTLIST Proposta
Estado (Aprovado|Reprovado|Desconhecido|EmTratamento) #IMPLIED
>

<!-- PROJETOS -->
<!ELEMENT ProjetoObraMunicipal (
#PCDATA|
Justificacao|
Descricao|
EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
    Habitacao|Misto|
EspacoVerde|EspacoCirculacao|EspacoComercial|
InfraEstrutura|
PessoaColetiva|PessoaSingular|

```



```

Construcao|Reconstrucao|
Demolicao|
Lugar|Freguesia|Concelho|Distrito|Pais
)*>
<!ATTLIST ProjetoObraMunicipal
Orcamento CDATA #IMPLIED
>

<!ELEMENT ProjetoObraParticular (
#PCDATA|
Justificacao|
Descricao|
EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
Habitacao|Misto|
EspacoVerde|EspacoCirculacao|EspacoComercial|
InfraEstrutura|
PessoaColetiva|PessoaSingular|
Construcao|Reconstrucao|
Demolicao|
Lugar|Freguesia|Concelho|Distrito|Pais
)*>
<!ATTLIST ProjetoObraParticular
Orcamento CDATA #IMPLIED
>

<!-- DATA -->

<!ELEMENT Data (#PCDATA)>
<!ATTLIST Data
Ano CDATA #REQUIRED
Mes CDATA #REQUIRED
Dia CDATA #REQUIRED
Tipo (DataDemolicao|DataInauguracao|DataAprovacao|DataContrucao|Normal) #IMPLIED
>

<!-- ENTIDADE -->

<!ELEMENT PessoaColetiva (#PCDATA)>
<!ATTLIST PessoaColetiva
Norma CDATA #IMPLIED
Nome CDATA #IMPLIED
>
<!ELEMENT PessoaSingular (#PCDATA)>
<!ATTLIST PessoaSingular
Norma CDATA #IMPLIED
Nome CDATA #IMPLIED
>

```

```

<!-- LOCALIZACAO -->

<!ELEMENT Freguesia (#PCDATA)>
<!ELEMENT Concelho (#PCDATA)>
<!ELEMENT Distrito (#PCDATA)>
<!ELEMENT Pais (#PCDATA)>
<!ELEMENT Lugar (#PCDATA) >
<!ATTLIST Lugar
Norma CDATA #IMPLIED
Nome CDATA #IMPLIED
>

<!-- ESPACOS -->

<!ELEMENT EspacoVerde (
#PCDATA|
Ornato|
InfraEstrutura
)*>
<!ATTLIST EspacoVerde
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
Tipologia CDATA #IMPLIED
Uso CDATA #IMPLIED
>

<!ELEMENT EspacoCirculacao (
#PCDATA|
InfraEstrutura
)*>
<!ATTLIST EspacoCirculacao
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
Tipologia CDATA #IMPLIED
Uso CDATA #IMPLIED
Denominacao (EstradaMunicipal|EstradaReal|EstradaDistrital|CaminhoMunicipal|Beco|
Rua|Travessa|Avenida|Ponte|Largo|Praca) #REQUIRED
>

<!ELEMENT EspacoComercial (#PCDATA|
InfraEstrutura
)*>
<!ATTLIST EspacoComercial
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
Tipologia CDATA #IMPLIED
Uso CDATA #IMPLIED

```

```

Denominacao (Feira|Mercado) #REQUIRED
>

<!ELEMENT Ornato (#PCDATA)>
<!ATTLIST Ornato
Norma CDATA #IMPLIED
Denominacao (Monumento|Fonte|Lago|Chafariz) #REQUIRED
>

<!ELEMENT Regularizacao (#PCDATA|EspacoCirculacao)*>
<!ATTLIST Regularizacao
Tipo (Aperfeicoamento|Aformoseamento|AlargamentoDeUmaTravessa|AmpliacaoDeUmLargo)
#REQUIRED
>

<!-- EDIFICIOS -->

<!ELEMENT EdificioPublicoComFimPublico (#PCDATA)>
<!ATTLIST EdificioPublicoComFimPublico
Norma CDATA #IMPLIED
Servico CDATA #IMPLIED
NPisos CDATA #IMPLIED
Existe (Sim|Nao) #IMPLIED
Denominacao (QuartelBombeirosVoluntarios|EsquadraPSP|PacosDoConcelho|
MatadouroMunicipal|MercadoMunicipal|Escola
|EstacaoDeCaminhosDeFerro|Financas|CentralDeCamionagem|CentroDeSaude|Cadeia|
Tribunal|EdificioCamaraMunicipal|
EdificioPoliciaMunicipal) #REQUIRED
>

<!-- EDIFICIOS PRIVADOS COM FIM PARTICULAR
Industria, Comercio, Habitacao, Misto -->
<!ELEMENT Industria (#PCDATA)>
<!ATTLIST Industria
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
Servico CDATA #IMPLIED
NPisos CDATA #IMPLIED
Existe (Sim|Nao) #IMPLIED
>

<!ELEMENT Comercio (#PCDATA)>
<!ATTLIST Comercio
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
Servico CDATA #IMPLIED
NPisos CDATA #IMPLIED
Existe (Sim|Nao) #IMPLIED

```

```

Denominacao (Fazenda|Mercearia|Ferragem|LoucaE Vidros|Tabacaria|Docaria|Farmacia|
  Drogaria|SeleiroECorreiro|Cafe|Ourivesaria|
Hotel|Restaurante|Barbearia|Talho|Sapataria|AgenciaBancaria|CompanhiaMaritima) #
  REQUIRED
>

<!ELEMENT Habitacao (#PCDATA)>
<!ATTLIST Habitacao
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
Servico CDATA #IMPLIED
NPisos CDATA #IMPLIED
Existe (Sim|Nao) #IMPLIED
>

<!ELEMENT Misto (#PCDATA)>
<!ATTLIST Misto
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
Servico CDATA #IMPLIED
NPisos CDATA #IMPLIED
Existe (Sim|Nao) #IMPLIED
>

<!ELEMENT EdificioPrivadoComFimPublico (#PCDATA)>
<!ATTLIST EdificioPrivadoComFimPublico
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
Servico CDATA #IMPLIED
NPisos CDATA #IMPLIED
Existe (Sim|Nao) #IMPLIED
Denominacao (AbastecimentoDeAguaESaneamento|Igreja|Capela|Correios|Saude|
  Iluminacao) #REQUIRED
>

<!-- NOTARIADO -->

<!ELEMENT ContratoDeAquisicao (
#PCDATA|
InstrumentoLegal|
Data
)*>
<!ATTLIST ContratoDeAquisicao
Outorgantes CDATA #REQUIRED
ResidenciaDosOutorgantes CDATA #IMPLIED
DemonicacaoDoContrato CDATA #IMPLIED

```

```

ValorDoContrato CDATA #IMPLIED
ObjetivoDoAto CDATA #IMPLIED
Lugar CDATA #IMPLIED
Freguesia CDATA #IMPLIED
>
<!ELEMENT ContratoEmpreitada (#PCDATA|
Data|
InstrumentoLegal|
Construcao|Reconstrucao|
Demolicao
)*>
<!ATTLIST ContratoEmpreitada
Outorgantes CDATA #REQUIRED
ResidenciaDosOutorgantes CDATA #IMPLIED
DemonicaoDoContrato CDATA #IMPLIED
ValorDoContrato CDATA #IMPLIED
ObjetivoDoAto CDATA #IMPLIED
Lugar CDATA #IMPLIED
Freguesia CDATA #IMPLIED
>
<!ELEMENT ContratoDeEmprestimo (#PCDATA|
Data|
InstrumentoLegal|
EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
Habitacao|Misto|
EspacoVerde|EspacoCirculacao|EspacoComercial|
PessoaColetiva|PessoaSingular|
Construcao|Reconstrucao|
Demolicao
)*>
<!ATTLIST ContratoDeEmprestimo
Outorgantes CDATA #REQUIRED
ResidenciaDosOutorgantes CDATA #IMPLIED
DemonicaoDoContrato CDATA #IMPLIED
ValorDoContrato CDATA #IMPLIED
ObjetivoDoAto CDATA #IMPLIED
Lugar CDATA #IMPLIED
Freguesia CDATA #IMPLIED
>
<!ELEMENT ContratoDeArrendamento (#PCDATA|
InstrumentoLegal|
Data
)*>
<!ATTLIST ContratoDeArrendamento
Data CDATA #REQUIRED
Outorgantes CDATA #REQUIRED
ResidenciaDosOutorgantes CDATA #IMPLIED

```

```

DemonicaoDoContrato CDATA #IMPLIED
ValorDoContrato CDATA #IMPLIED
ObjetivoDoAto CDATA #IMPLIED
Lugar CDATA #IMPLIED
Freguesia CDATA #IMPLIED
>
<!ELEMENT ContratoDePrestacaoServico (#PCDATA|
Data|
InstrumentoLegal
)*>
<!ATTLIST ContratoDePrestacaoServico
Outorgantes CDATA #REQUIRED
ResidenciaDosOutorgantes CDATA #IMPLIED
DemonicaoDoContrato CDATA #IMPLIED
ValorDoContrato CDATA #IMPLIED
ObjetivoDoAto CDATA #IMPLIED
Lugar CDATA #IMPLIED
Freguesia CDATA #IMPLIED
>
<!ELEMENT AutoDeArrematacao (#PCDATA|
Data|
InstrumentoLegal
)*>
<!ATTLIST AutoDeArrematacao
Data CDATA #REQUIRED
Outorgantes CDATA #REQUIRED
ResidenciaDosOutorgantes CDATA #IMPLIED
DemonicaoDoContrato CDATA #IMPLIED
ValorDoContrato CDATA #IMPLIED
ObjetivoDoAto CDATA #IMPLIED
Lugar CDATA #IMPLIED
Freguesia CDATA #IMPLIED
>

<!-- EMPREITADA -->

<!ELEMENT Construcao (#PCDATA|Expropriacao|
EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
Habitacao|Misto|
EspacoVerde|EspacoCirculacao|EspacoComercial|
Lugar|Freguesia|Concelho|Distrito|Pais)*>
<!ELEMENT Reconstrucao (#PCDATA|Expropriacao|
EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
Habitacao|Misto|
EspacoVerde|EspacoCirculacao|EspacoComercial|
Lugar|Freguesia|Concelho|Distrito|Pais)*>

```

```

<!-- EXPROPRIACAO -->

<ELEMENT Expropriacao (#PCDATA|Indeminizacao)*>

<!-- INDEMINIZACAO -->

<ELEMENT Indeminizacao (#PCDATA)>
<!ATTLIST Indeminizacao
Valor CDATA #REQUIRED
>

<!-- DEMOLICAO -->
<ELEMENT Demolicao (#PCDATA)>

<!-- JUSTIFICACAO -->
<ELEMENT Justificacao (#PCDATA|
EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
Habitacao|Misto|
EspacoVerde|EspacoCirculacao|EspacoComercial|PessoaColetiva|PessoaSingular)* >

<!-- Descricao -->
<ELEMENT Descricao (#PCDATA|
EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
Habitacao|Misto|
EspacoVerde|EspacoCirculacao|EspacoComercial)*>

<!-- INSTRUMENTO LEGAL -->
<ELEMENT InstrumentoLegal (#PCDATA)>
<!ATTLIST InstrumentoLegal
Tipo (Decreto|DecretoLei|Despacho|Lei|PlanoMelhoramento|PlanoDiretorMunicipal) #
REQUIRED
>

<!-- Infraestrutura -->

<ELEMENT InfraEstrutura (#PCDATA)>
<!ATTLIST InfraEstrutura
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
>

```

Listing C.1: DTD that represents the sessions made by the entities.

C.2 MEMORYDTD

DTD that represents a memory, where someone describes a old building or a space.

```
<?xml version="1.0" encoding="UTF-8"?>

<!ELEMENT Memoria (#PCDATA|
Data|
Descricao|
Regularizacao|
PessoaColetiva|PessoaSingular|
ProjetoObraMunicipal|ProjetoObraParticular|
Lugar|Freguesia|Concelho|Distrito|Pais)*>

<!-- PROJETOS -->

<!ELEMENT ProjetoObraMunicipal (#PCDATA|
Descricao|
Regularizacao|
EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
    Habitacao|Misto|
EspacoVerde|EspacoCirculacao|EspacoComercial|
InfraEstrutura|
PessoaColetiva|PessoaSingular|
Construcao|Reconstrucao|
Demolicao
)*>
<!ATTLIST ProjetoObraMunicipal
Orcamento CDATA #IMPLIED
>

<!ELEMENT ProjetoObraParticular (#PCDATA|
Descricao|
EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
    Habitacao|Misto|
EspacoVerde|EspacoCirculacao|EspacoComercial|
InfraEstrutura|
PessoaColetiva|PessoaSingular|
Construcao|Reconstrucao|
Demolicao
)*>
<!ATTLIST ProjetoObraParticular
Orcamento CDATA #IMPLIED
>

<!-- DATA -->
```



```

<!ELEMENT Data (#PCDATA)>
<!ATTLIST Data
Ano CDATA #IMPLIED
Mes CDATA #IMPLIED
Dia CDATA #IMPLIED
Tipo (DataDemolicao|DataInauguracao|DataAprovacao|DataContrucao|Normal) #IMPLIED
>

<!-- ENTIDADE -->

<!ELEMENT PessoaColetiva (#PCDATA)>
<!ATTLIST PessoaColetiva
Norma CDATA #IMPLIED
Nome CDATA #IMPLIED
>
<!ELEMENT PessoaSingular (#PCDATA)>
<!ATTLIST PessoaSingular
Norma CDATA #IMPLIED
Nome CDATA #IMPLIED
>

<!-- LOCALIZACAO -->

<!ELEMENT Freguesia (#PCDATA)>
<!ELEMENT Concelho (#PCDATA)>
<!ELEMENT Distrito (#PCDATA)>
<!ELEMENT Pais (#PCDATA)>
<!ELEMENT Lugar (#PCDATA)>
<!ATTLIST Lugar
Norma CDATA #IMPLIED
Nome CDATA #IMPLIED
>

<!-- ESPACOS -->

<!ELEMENT EspacoVerde (#PCDATA|Ornato|
InfraEstrutura)*>
<!ATTLIST EspacoVerde
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
Tipologia CDATA #IMPLIED
Uso CDATA #IMPLIED
>
<!ELEMENT EspacoCirculacao (#PCDATA|Regularizacao|
InfraEstrutura)*>
<!ATTLIST EspacoCirculacao
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED

```

```

Tipologia CDATA #IMPLIED
Uso CDATA #IMPLIED
Denominacao (EstradaMunicipal|EstradaReal|EstradaDistrital|CaminhoMunicipal|Beco|
  Rua|Travessa|Avenida|Ponte|Largo|Praca) #REQUIRED
>

<!ELEMENT EspacoComercial (#PCDATA|
  InfraEstrutura)*>
<!ATTLIST EspacoComercial
  Norma CDATA #IMPLIED
  Nome CDATA #REQUIRED
  Tipologia CDATA #IMPLIED
  Uso CDATA #IMPLIED
  Denominacao (Feira|Mercado) #REQUIRED
>

<!ELEMENT Ornato (#PCDATA)>
<!ATTLIST Ornato
  Norma CDATA #IMPLIED
  Denominacao (Monumento|Fonte|Lago|Chafariz) #REQUIRED
>

<!ELEMENT Regularizacao (#PCDATA|EspacoCirculacao)*>
<!ATTLIST Regularizacao
  Tipo (Aperfeicoamento|Aformoseamento|AlargamentoDeUmaTravessa|AmpliacaoDeUmLargo)
  #REQUIRED
>

<!-- EDIFICIOS -->

<!ELEMENT EdificioPublicoComFimPublico (#PCDATA)>
<!ATTLIST EdificioPublicoComFimPublico
  Norma CDATA #IMPLIED
  Servico CDATA #IMPLIED
  NPisos CDATA #IMPLIED
  Existe (Sim|Nao) #IMPLIED
  Denominacao (QuartelBombeirosVoluntarios|EsquadraPSP|PacosDoConcelho|
  MatadouroMunicipal|MercadoMunicipal|Escola
  |EstacaoDeCaminhosDeFerro|Financas|CentralDeCamionagem|CentroDeSaude|Cadeia|
  Tribunal|EdificioCamaraMunicipal|
  EdificioPoliciaMunicipal) #REQUIRED
>

<!-- EDIFICIOS PRIVADOS COM FIM PARTICULAR
  Industria, Comercio, Habitacao, Misto -->
<!ELEMENT Industria (#PCDATA)>
<!ATTLIST Industria

```

```

Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
Servico CDATA #IMPLIED
NPisos CDATA #IMPLIED
Existe (Sim|Nao) #IMPLIED
>

<!ELEMENT Comercio (#PCDATA)>
<!ATTLIST Comercio
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
Servico CDATA #IMPLIED
NPisos CDATA #IMPLIED
Existe (Sim|Nao) #IMPLIED
Denominacao (Fazenda|Mercearia|Ferragem|LoucaEvidros|Tabacaria|Docaria|Farmacia|
Drogaria|SeleiroECorreiro|Cafe|Ourivesaria|
Hotel|Restaurante|Barbearia|Talho|Sapataria|AgenciaBancaria|CompanhiaMaritima) #
REQUIRED
>

<!ELEMENT Habitacao (#PCDATA)>
<!ATTLIST Habitacao
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
Servico CDATA #IMPLIED
NPisos CDATA #IMPLIED
Existe (Sim|Nao) #IMPLIED
>

<!ELEMENT Misto (#PCDATA)>
<!ATTLIST Misto
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
Servico CDATA #IMPLIED
NPisos CDATA #IMPLIED
Existe (Sim|Nao) #IMPLIED
>

<!ELEMENT EdificioPrivadoComFimPublico (#PCDATA)>
<!ATTLIST EdificioPrivadoComFimPublico
Norma CDATA #IMPLIED
Nome CDATA #REQUIRED
Servico CDATA #IMPLIED
NPisos CDATA #IMPLIED
Existe (Sim|Nao) #IMPLIED

```

```

Denominacao (AbastecimentoDeAguaESaneamento|Igreja|Capela|Correios|Saude|
  Iluminacao) #REQUIRED
>

<!-- EMPREITADA -->

<!ELEMENT Construcao (#PCDATA|Expropriacao|
  EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
  Habitacao|Misto|
  EspacoVerde|EspacoCirculacao|EspacoComercial|
  Lugar|Freguesia|Concelho|Distrito|Pais)*>
<!ELEMENT Reconstrucao (#PCDATA|Expropriacao|
  EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
  Habitacao|Misto|
  EspacoVerde|EspacoCirculacao|EspacoComercial|
  Lugar|Freguesia|Concelho|Distrito|Pais)*>

<!-- EXPROPRIACAO -->

<!ELEMENT Expropriacao (#PCDATA|Indeminizacao)*>

<!-- INDEMINIZACAO -->

<!ELEMENT Indeminizacao (#PCDATA)>
<!ATTLIST Indeminizacao
  Valor CDATA #REQUIRED
>

<!-- DEMOLICAO -->
<!ELEMENT Demolicao (#PCDATA)>

<!-- Descricao -->
<!ELEMENT Descricao (#PCDATA|
  EdificioPublicoComFimPublico|EdificioPrivadoComFimPublico|Industria|Comercio|
  Habitacao|Misto|
  EspacoVerde|EspacoCirculacao|EspacoComercial)*>

<!-- Infraestrutura -->

<!ELEMENT InfraEstrutura (#PCDATA)>
<!ATTLIST InfraEstrutura
  Norma CDATA #IMPLIED
  Nome CDATA #REQUIRED
>

```

Listing C.2: DTD that represents a memory.

C.3 TOPONYMYDTD

DTD that represents the changes of street names made over the years.

```

<!ELEMENT QuadroToponimia (Toponimo)+>

<!ELEMENT Toponimo (Data,DesignacaoAnterior,ToponiamiaRepublicana,
    MotivoAtribuicao?, Fonte)>

<!-- DATA -->
<!ELEMENT Data (#PCDATA)>
<!ATTLIST Data
Ano CDATA #REQUIRED
Mes CDATA #REQUIRED
Dia CDATA #REQUIRED
>

<!-- DESIGNACAO ANTERIOR -->
<!ELEMENT DesignacaoAnterior (#PCDATA)>

<!-- TOPONIAMIA REPUBLICANA -->
<!ELEMENT ToponiamiaRepublicana (#PCDATA)>

<!-- MOTIVO ATRIBUICAO -->
<!ELEMENT MotivoAtribuicao (#PCDATA)>

<!-- FONTE -->
<!ELEMENT Fonte (#PCDATA)>

```

Listing C.3: DTD that represents the changes of street names.

C.4 PUBLICWORKSDTD

DTD that represents projects and works made by public entities.

```

<!ELEMENT CatalogoProjetosObrasPublicas (ProjetoObraPublica)+>

<!ELEMENT ProjetoObraPublica (Identificacao, Titulo, Data, Assunto)>

<!-- ÇÃIDENTIFICACAO -->
<!ELEMENT Identificacao (#PCDATA)>

<!-- TITULO -->
<!ELEMENT Titulo (#PCDATA)>

```

```

<!-- DATA -->
<!ELEMENT Data (#PCDATA)>
<!ATTLIST Data
Ano CDATA #REQUIRED
Mes CDATA #IMPLIED
Dia CDATA #IMPLIED
>

<!-- ASSUNTO -->
<!ELEMENT Assunto (#PCDATA)>

```

Listing C.4: DTD that represents projects and works made by public entities.

C.5 NOTARYDTD

DTD that represents contracts made by entities (for example: loan contracts, construction contracts, etc).

```

<!ELEMENT CatalogoNotariado (ContratoNotariado)+>

<!ELEMENT ContratoNotariado (Data, NomeOutorgantes, MoradaOutorgantes,
    Denominacao, Valor?, Objeto, Lugar)>

<!-- DATA -->
<!ELEMENT Data (#PCDATA)>
<!ATTLIST Data
Ano CDATA #REQUIRED
Mes CDATA #REQUIRED
Dia CDATA #REQUIRED
>

<!-- NOME DOS OUTORGANTES -->
<!ELEMENT NomeOutorgantes (#PCDATA)>

<!-- ÊRESIDNCIA DOS OUTORGANTES -->
<!ELEMENT MoradaOutorgantes (#PCDATA)>

<!-- ÇADENOMINAO DO CONTRATO -->
<!ELEMENT Denominacao (#PCDATA)>

<!-- VALOR DO CONTRATO -->
<!ELEMENT Valor (#PCDATA)>

<!-- OBJECTO DO ACTO -->
<!ELEMENT Objeto (#PCDATA)>

```

```
<!-- LUGAR -->
<!ELEMENT Lugar (#PCDATA)>
```

Listing C.5: DTD that represents contracts made by entities.

C.6 CONTRACTSAVULSODTD

DTD that represents single contracts.

```
<!ELEMENT CatalogoContratosAvulsos (ContratoAvulso)+>

<!ELEMENT ContratoAvulso (Identificacao, Designacao, ValorDoContrato,
    DataAdjudicacao, DataContrato, Observacao?)>

<!-- ÇÃIDENTIFICAO DO EMPREITEIRO OU FORNECEDOR -->
<!ELEMENT Identificacao (#PCDATA)>

<!-- ÇÃDESIGNAO DO FORNECIMENTO OU EMPREITADA -->
<!ELEMENT Designacao (#PCDATA)>

<!-- VALOR DO CONTRATO -->
<!ELEMENT ValorDoContrato (#PCDATA)>

<!-- DATA DE ÇÃADJUFICAO -->
<!ELEMENT DataAdjudicacao (#PCDATA)>
<!ATTLIST DataAdjudicacao
    Ano CDATA #REQUIRED
    Mes CDATA #REQUIRED
    Dia CDATA #REQUIRED
>

<!-- DATA DO CONTRATO -->
<!ELEMENT DataContrato (#PCDATA)>
<!ATTLIST DataContrato
    Ano CDATA #REQUIRED
    Mes CDATA #REQUIRED
    Dia CDATA #REQUIRED
>

<!-- ÇÃOBSERVAO -->
<!ELEMENT Observacao (#PCDATA)>
```

Listing C.6: DTD that represents single contracts.

D

TOPONYMY

In this chapter is presented the table made to record all the streets names change. This table was made in excel and after transformed in to a CVS file.

```
DATA;DESIGNAO ANTERIOR;NOVA DESIGNAO ;
00.00.0000;Rua do Portal;Rua do Maia ;
30.12.1889;Largo Municipal;Largo D. Carlos 1;
05.02.1890;Rua Formosa;Rua Serpa Pinto;
13.10.1910;Largo D. Carlos I;Praa da Repblica;
13.10.1910;Avenida Jos Luciano de Castro;Avenida 5 de Outubro;
13.10.1910;Rua do Prncipe Real;Rua Theofilo Braga;
13.10.1910;Rua D. Maria Pia;Rua Cndido dos Reis;
13.10.1910;Rua D. Luiz I;Rua Miguel Bombarda;
13.10.1910;Rua D. Pedro V;Rua Machado dos Santos;
13.10.1910;Travessa D. Pedro V;Rua Francisco Ferrer;
02.12.1910;Largo do Conselheiro Ferreira de Mello;Largo Ferreira de Mello;
02.12.1910;Travessa Conselheiro Ferreira de Mello;Travessa Ferreira de Mello;
02.12.1910;Largo Municipal;Praa da Repblica;
19.10.1911;Praa D. Pedro V;Praa Albino dOliveira Guimares;
04.12.1913;Largo da Feira Velha;Praa da Liberdade;
02.01.1914;Rua de Santa Eullia;Rua Joo Chrisstomo;
02.01.1914;Rua Nova;Rua Magalhes Lima;
26.02.1914;Avenida 5 de Outubro;Avenida Pa-Vieira;
26.02.1914;Praa da Repblica;Praa 5 de Outubro;
26.02.1914;Praa da Liberdade;Praa da Repblica;
26.02.1914;Largo da Granja;Praa da Liberdade;
24.02.1917;Largo do Santo;Praa do Brasil;
24.02.1917;Rua do Picotalho;Rua Jos Summavielle Soares;
09.06.1917;Rua de Baixo;Rua Lus de Cames;
09.06.1917;Rua da Cisterna;Rua dos Aliados;
24.01.1918;Rua 14 de Maio;Parque Sidnio Pais;
24.01.1918;Rua Francisco Ferrer;Rua 8 de Dezembro;
19.12.1918;Rua Magalhes Lima;Rua 1 de Dezembro de 1640;
18.04.1919;Rua 1 de Dezembro de 1640;Rua Magalhes Lima;
18.04.1919;Parque Sidnio Pais;Parque 1 de Dezembro de 1640;
18.04.1919;Rua 8 de Dezembro;Rua Francisco Ferrer;
18.04.1919;Avenida Pa-Vieira;Avenida 5 de Outubro;
```


18.04.1919;Praa da Repblica;Praa do Brasil;
 18.04.1919;Praa 5 de Outubro;Praa da Repblica;
 18.04.1919;Praa do Brasil;Largo 9 de Abril;
 09.06.1928;Rua Magalhes Lima;Rua dos Combatentes da Grande Guerra;
 09.06.1928;Rua Francisco Ferrer;Rua Magalhes Lima;
 02.11.1931;Rua Francisco Ferrer;Travessa Monsenhor Vieira de Castro;
 24.05.1938;Praa do Brasil;Praa da Repblica;
 24.05.1938;Praa da Repblica;Praa Oliveira Salazar;
 24.05.1938;Avenida 5 de Outubro;Avenida General Carmona;
 24.05.1938;Rua Miguel Bombarda;Rua Marechal Gomes da Costa;
 07.02.1966;Rua Cndido dos Reis;Rua Doutor Henrique Cabral;
 06.06.1967;Rua Machado Santos;Rua Paulo Sexto;
 03.06.1974;Praa Oliveira Salazar;Praa 25 de Abril;
 03.06.1974;Avenida General Carmona;Avenida 5 de Outubro;
 03.06.1974;Rua Marechal Gomes da Costa;Rua General Humberto Delgado;
 03.06.1974;Rua Henrique Cabral;Rua Major Miguel Ferreira;
 03.06.1974;Avenida Arantes e Oliveira;Rua das Foras Armadas;
 03.06.1974;Praceta Baltazar Rebelo de Sousa;Praceta 1 de Maio;
 03.06.1974;Rua Paulo VI;Rua Joo XXIII;
 03.06.1974;Rua da Seara;Rua Dr. Maximinos de Matos;
 21.03.1975;Largo 9 de Abril;Rua dos Bombeiros Voluntrios;
 06.03.1978;Rua de cima da Arcada;Rua Antnio Saldanha;
 03.04.1978;Rua Antnio Ferrari;Rua Afonso Costa;
 03.04.1978;Rua do Maia;Rua Antnio Srgio;

Listing D.1: Table with all the streets names change.