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Modeling an ontology for public E-Government Services in Albania

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Abstract.

Providing electronic public services by government web portals in Albania has been one of the key governance challenges. This goal is achieved by e-Albania, operating as a centralized web application that allows citizens to utilize public online services that focus on their quotidian demands. Citizens' search for services is often spontaneous and directly related to their life events, so it is necessitated to find a method to conform this search to the corresponding service. In this paper, we discuss semantic web technologies, and we propose an ontology named OntoAL, designed to meet the governing structure adequately in Albania. The primary intention is to build a tool that searches the ontology to provide meaningful and accurate results for the public service even when the input is not precisely defined according to the represented public service. The integration of this tool into the government e-Albania web portal would facilitate user experience by willingly providing more frequent use of the established services related to their life events. Another application of the knowledge obtained by the ontology could be in the process of alteration or addition of new services in e-Albania.

Keywords: Ontology, semantic search, E-Government, public services, OntoAL.

1. Introduction

The use of public online services by citizens and businesses is still at the initial phase in Albania, despite significant investment by the government to create online platforms that offer a variety of services divided into different categories. These categories attempt to lead the citizen to choose the services suitable for his dilemmas. E-Albania government portal nowadays offers over 1344 services from which 782 addressed for citizens, 813 provided to businesses, and 93 services provided to public administration employees. As citizens are more oriented towards their life events, sometimes they encounter challenges in determining which service will respond to their needs. They are more likely to search for their life events such as the birth of a child or marriage. As discussed by (Leben et al., 2004), the life-event approach considers government operation from the perspective of everyday life and customers' needs rather than the internal structure and needs of the government.

Web semantics technologies enable a clear understanding of the data and logical relationships that exist between them by applying reasoning skills based on the inference rules. If we consider ontologies in knowledge modeling, by performing text analysis on the input of the user and searching the ontology, we could classify by reasoning on the concepts that belong to the intended service or services for the user. In this paper, we focus on modeling public government online services in Albania by designing an ontology named OntoAL, which models domain government knowledge like:

- The Government Structure.
- Institutions.
- Services offered by Institutions.
- The citizens or businesses requirements.
- The documentation procured for the services.
- Public services categories.
- Laws, Regulations, and Instructions

This ontology will help Albanian citizens get an answer to their problems and also guide employees who model future public services to design them closer to the life events of citizens. Future advances in the documentation or the laws can be reflected in the services because we can quickly explore which services get affected by a change in a particular law. Another advantage is the ability to share data and knowledge among employees in public administration.

2. Previous Work

In (Goudos et al., 2006) authors discuss the problem of matching citizen's needs with available public services and provide a solution based on Governance Enterprise Architecture (GEA) object models and web semantics technologies. In (Corradini et al., 2008) authors present an ontology e-GovQoS, to specify "quality model" for digital e-Government services suitable for quality evaluation, monitoring, discovery, selection, and composition. The increase of the quality allows service integration for citizens and the competence increasing of Public Administrations.

An Ontology of life-events in public administration and integration of this domain is included in (Bercic & Vintar, 2004) using the SUO-KIF language for the description of life-events. In (Salhofer et al., 2012) authors create a prototype system based on GEA model that analyses the axioms based on user input, these Intelligent electronic systems that know the current context they are running in, greatly simplify interaction with public agencies and back-office business processes.

A deep understanding and analysis are described in (Knut et al., 2010) when recent developments of architecture, technology, and semantics can have a significant influence on the progress of e-government. They address barriers in e-government like finding services and information, process design and implementation of maintenance and change of services, and they also note the importance of reference models and lifecycle management for e-government services published in (Knut et al., 2006).

In (Bettahar et al., 2009), they present a multilingual ontology to improve the modeling of a semantic coherence allowing the interoperability of different modules of environments dedicated to e-Government platforms. They introduce a simplified syntax, SOL, allowing a developing multilingual centralized ontology. Among the other benefits, the ontology expert can update an ontology according to modifications proposed by domain experts as discussed by (Tambouris et al., 2002). Some of the problems that may arise from adapting transaction services are complexity in creating e-forms or difficulties in interoperability and many other aspects. They present a knowledge-based platform that supports the whole transaction services lifecycle, tackling the various issues that impede the widespread of transaction services.

3. Ontologies

The term ontology originates from philosophy (Antoniou et al., 2012). In that context, it is used as the name of a subfield of philosophy, namely, the study of the nature of existence (the literal translation of the Greek word Οντολογια), the branch of metaphysics concerned with identifying, in the most general terms, the kinds of things that actually exist, and how to describe them.

As discussed by (Chandrasekaran et al., 1999), today ontology can be part of every domain so has grown beyond philosophy and in (Theocharis & Tsihrintzis, 2012) more recently the concept of ontology is spread in areas such as intelligent information integration, cooperative information systems, information retrieval, electronic commerce, and knowledge management. In some cases according to (Guarino, 1998), the term "ontology" is just a fancy name denoting the result of usual activities like conceptual analysis and domain modeling, carried out by means of standard methodologies.

In the discussion of (Bench-Capon, 2012), ontologies typically contain representations and descriptions of:

- The types of objects found in the domain;
- The attributes which these objects may have;
- The relationships which these objects may enter into;
- Values that the attributes may have for particular types;
- Axioms, constraining the above.

There are some viewpoints in the categorization of ontologies such as (Guarino, 1998) or (Abecker et al., 1998), in (Abecker et al., 1998) the types of ontologies are explained as follows:

- The information ontology describes the different kinds of information resources with their structure and format properties. The vocabulary for the information resource meta-models comes from the information ontology.
- The enterprise ontology defines the context in which information resources are used and generated. The top-level of the enterprise ontology defines a meta-model for processes or organizational structure.
- The domain ontology defines concepts modeling the content of information resources and services. It is evident that in particular, the domain ontology is specific for each new application area.

At present, as explained by (Antoniou et al., 2012) the essential ontology languages for the web are the following:

- RDF Schema is a vocabulary description language for describing properties and classes of RDF resources, with semantics for generalization hierarchies of such properties and classes. Besides, domain and range of properties may be defined.
- OWL is a richer vocabulary description language for describing properties and classes, such as relations between classes (e.g., disjointness), cardinality (e.g., "exactly one"), equality, richer typing of properties, characteristics of properties (e.g., symmetry), and enumerated classes.

4. Modeling the ontology OntoAL

There are a lot of similar approaches of e-Gov. ontologies. Our model is based on GEA service model (Wang et al., 2007) and (Goudos et al., 2006) ontology. Regardless, there are some meaningful changes in modeling the classes and the relationships that exist, because we wanted to accustom to the organizational structure of governance in our country. To model the ontology, we used Protégé for its simple graphical interface and also for its expertise to control the consistency of ontology using different reasoners.

The information was mainly sourced from e-Albania website, but we also considered other government applications and legal knowledge. Figure 1 shows the graph of the ontology classes partly for visualization purposes. Our prime ontology is in the Albanian language since e-Albania is a web portal offering services in the Albanian language, but we have made a similar approach in English for demonstration intentions described in the Figure below:

Figure 1. The graph of the proposed ontology *OntoAL*

Some of the classes are:

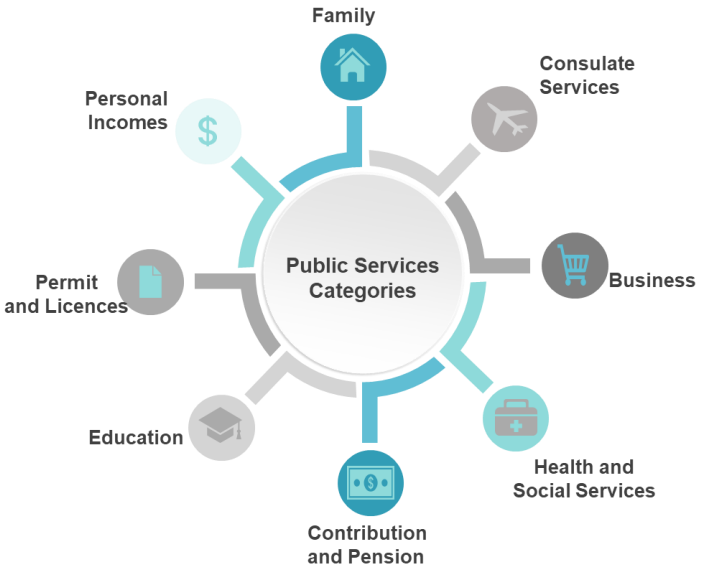
- PublicServices contains various individuals related to public services (such as Application for invalidity pension, Application for family pension closure in case of work started and Certificate of payments contribution by the individual).
- GovernmentEntities with the subclasses of PoliticalEntities and EntitiesOfThe PublicAdministration.
- The class EntitiesOfThePublicAdministration has two subclasses TheCentral Administration and TerritorialAdministration.
- TheCentralAdministration has seven subclasses: AutonomousAgencies, Ministries, OtherInstitutions,InstitutionsUnderTheMinistries,PrimeMinisterOffice, ServiceProviderUnits, ThePrefectsAdministration.
- Documentation For each service, there is a list of documentation to be submitted in order to obtain a service such as identity card, marriage certificate, family certificate.

Public services are based on laws, rules, decisions, or regulations. For this reason, we designed a class *Legislature* that has two subclasses: *LegalActs* and *NormativeActs*. In *LegalActs*, is created the subclass *Laws*, and in *NormativeActs*, we define the subclasses *Instructions*, *Decisions*, and *Regulations*. Another class containing the institutions responsible for the drafting of laws is *LegislativeBranch*, and also the class containing the institutions that assure law enforcement is *JudicialBranch*. Referring to the recent changes in the Judicial Branch in Albania some of the individuals of the class *JudicialBranch* are *Appeal Court, Supreme Court, District Court, Administrative Courts, High Prosecutorial Council, and The High Judicial Council*.

For classes and attributes, some limitations determine the values that are allowed. So most of the classes of this ontology are disjointed with each other. For example, individuals associating in *PublicService* class cannot be part of the class *Laws*. Consequently, *Public Services* ∩ *Laws* = Ø, besides this class, public services are disjoint also with other classes. Relationship *"isServiceOf"* is the inverse relationship to *"hasService"* so we can formally express that "Application for Invalidity Pension" *isServiceOf* "Social Insurance Institute" as well as the "Social Insurance Institute" *hasService* "Application for Invalidity Pension." The service has a "*different individuals*" attribute with other services. Also, a fundamental part of the service is the documentation that is required. Object property "*needDocumentation*" connects the public service with the Documentation class. Where domain for this attribute would be *PublicServices* and Range would be *Documentation*.

In e-Albania, services have been categorized according to their application field. Therefore the class *PublicServiceType* is created in the ontology that contains individuals illustrated in the following Figure 2:

Figure 2. Some of the categories of public services according to e-Albania



The service "Application for Building Permit, for new buildings or extensions to Local Government Units" resigns in the category of "Permit and Licenses" and is connected with the object property "*isServiceType*." Some other attributes of the data type for the service are *service name*, *service purpose*, *service provider*, *service time validity*, *service costs*, and *procedure steps*. Different queries are performed using Jena Fuseki SPARQL endpoint, based on the combinations of the user input searching on annotations for each service in forms of labels and comments that describe the service only in different expressions.

As our future work, we aim to enrich more the ontology and make it feasible to learn from user experience by automatically modifying the ontology depending feedback we obtain from the user. Additionally, we tend to incorporate text analysis on user input in order to return results even if the input is written in natural language so that services will be displayed based on a coefficient of text similarity between the user input and our ontology information.

5. Conclusion

In this paper, we presented the modeling of an ontology that is based on GEA ontology but has undergone in some modifications such as adding new classes, combining object properties and data type properties, and modifying connections to suit the governmental and administrative structures in Albania properly. The goal of modeling this ontology is its use to translate public services into life events so the citizen can easily find services even if they are not modeled as their life events. We perform queries through Jena Fuseki SPARQL endpoint to get all the possible services associated with the input of the user. To gain a profound result, we intend to advance the algorithm to perform a more detailed text analysis for the Albanian language and to transform the ontology automatically by including the user quests depending on his service ranking.

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