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SEMANTIC INTEGRATION SHARING FOR E-GOVERNMENT DOMAINS ONTOLOGY: DESIGN AND IMPLEMENTATION USING OWL

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ABSTRACT

Integrating information system in any domain for E-government is facing several problems, such as structural and semantic sharing in similar information for applications and services. In addition, representation across heterogeneous organizations. In this aspect, the semantic web played a dynamic role in sharing and managing knowledge sharing. Therefore, e-government services need to modeling, re-engineering governmental sharing, and processing to provide information delivery according to the citizen and locations. Semantic Web technology based on the ontology has brought promising solutions to the above engineering problems. This paper is ongoing for previous work presents a framework for generating semantic model ontologies in OWL syntax from a government service domain. However, current works employing OWL ontologies in e-government to the Semantic Web viewer, which implemented semantic sharing integration for e-government domains (Civil information, Health information, Education Information) ontology, which present the case of the State of Kuwait interoperability integration. The domain ontology is created using ontology knowledge-based editor Protégé and OWL-Viz. Thus facilitating to improve the knowledge sharing so that citizens can take more knowledge benefits from the e-government sharing. In addition, the ontology will be useful in the knowledge sharing of semantic e-government integration, and semantic Web applications. Thus facilitating the design of e-government systems that can be easily integrated and maintained. Web Protégé ontology can be easily sharing with a distributed group of users who can engage in collaborative authoring activities from wherever they happen to be logged in.

Keywords: *E-government; Semantic Web; Domain ontology; Services; Framework; owl; Integration; Citizens; Kuwait e-government; OWL-Viz; Protégé*

1. INTRODUCTION

Over the past few years, an increasing amount of scholarly attention has been focus on citizen adoption of e-government. In order to ensure that relevant studies were not missing, the search terms remained broad. These were 'factors influencing e-government adoption', 'citizen adoption of e-government', perceptions on e-government', 'e-government trustworthiness', 'impact of citizen satisfaction on e-government' and 'e-government adoption in developing countries' [1].

The development of an efficient e-Government for offering information and electronic services (e-services) to citizen and enterprise is the main objective of many Governments [2].Ontologies are widely used in disciplines such as software engineering, databases, artificial intelligence, and many more [3]. In these fields, developers use ontologies to represent knowledge in a manner that can be automatically processed by a machine.

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The e-government change is brought expansion and adoption based on communities, citizen, businesses and public administrations. In most countries, it has generally seen as a four-step process: presence phase, interaction phase, transaction phase and transformation phase [1].

The interest in semantic technologies within the e-government model where proved by the huge number of existing projects focusing on the exploitation of semantic knowledge for e-government. In addition, the Semantic Web provides integration for ontology-based framework, searching and sharing data drawn from various sources [4]. In this filed, Tim Berners-Lee 2006 introduced semantic Web architecture, which contains eight layers [5]. The Resource Description Framework (RDF) and Ontology are considering the most important layers of this structure.

The goal for Accessing e-government is to facilitate citizen access to the Public Administration (PA) services. This is to be establishing by making service browsing, discovery, and execution easier and more effective. In addition, many e-government applications run by using various web services available online. Where one web service is not enough to fulfill the user requirements, the integration of e-government web services is need. Therefore, the Semantics platform provides the capability to model and represent the knowledge within a given domain by means of explicit formalization of key domain concepts.

On the other hand, in the semantic web, information is representing in a machine-readable format, to make e- government processes fully automated. It can be achieve with help of ontological descriptions of web services. Considering the heterogeneous and distributed nature of the e-Government domain, which semantics effectively used as a common related platform for describe the processes and services as transparent for end users (citizens and/or businesses).

The information sharing issue of e-government can be resolved by using Web Service well and conveniently. Web services goals to achieve interoperability between web servers by using existing technologies; this has done by building blocks to enable integration of web services that are name as composition constructs. Composition constructs have two essential types in service composition [6].Web Service application in e-government enhances the current deployment and decrease the cost of information integration [7].

Ontology is a formal, explicit specification of a shared conceptualization of some domain knowledge (in Gruber 1993). It is a valid description of domain knowledge; the domain members agree to follow the ontology for describing domain concepts, also used to represent the viewpoint of citizens in the application; thus, making it easier for them to navigate through the different services and administrations, such as life events, procedures and services [8].

The generation of Ontologies is an important activity to enable semantic data integration. Efficiency in data integration can be achieves by ontologies. Data integration system aims to provide uniform access to a set of heterogonous data sources and to free the user from the need to know about how data is structure at the sources and how it is to be reconciled in order to answer queries. Data integration is mostly achieved using one of the three approaches: Application Integration (mediation), database federation and data warehousing [9].

The core idea of the Semantic Web is to make information (available on the web) understandable not only by humans but also by machines. Semantic Web builds an additional layer on top of the existing World Wide Web.

In this aspect, manual and automatic developing there are two types of develops ontology process. This process aims to build the domain ontology in semi-automatic or automatic process. In addition, the kinds of build ontology are ‘specific domain ontology’, which represents the specific meaning of terms as interpreted in the specific domain. The second is ‘upper or Top-Level ontology’, which represents the public concepts that are the same across all knowledge domains [10].

Ontology formation helps a range of applications that deliver the right information at the right time to make better-informed decisions, throughout the lifecycle of discovery and development of various applications such as marketing. Thus, a range of semantic technologies, based on ontologies, enable the proper integration of knowledge in a way that is reusable by several applications across governance or business; from discovery to corporate affairs, more details as in [11].

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The rest of paper organized as follows: Section 2 reviews the related work. Section 3 shows the present the e-government of Kuwait. Section 4 discusses the semantic integration e-government framework and domains ontology used. Section 5 displays the case study for Kuwait e-government services integration. The conclusion is explained in section 6.

2. RELATED WORK

Over the past few years, an increasing amount of researches attention has been focus on citizen adoption of e-government. The study Carter and Bélanger [12] present an integrated model for study citizen adoption of e-government services in the USA, which captures individuals' perceptions of technology adoption characteristics and trustworthiness. The model integrates constructs from various fields: information systems, sociology and public administration.

Many e-government projects have being developed and various approaches have proposed for the design and the development of the architecture, which will help deliver e-government services to citizens. The e-gov project [13] proposes the architecture, which enables 'one-stop government'. In order to describe the services, a markup language (GovML) has been developed [14]. GovML defines a set of metadata to describe public administration services and life events.

In [15] authors proposed design and implementation of an e-government Web service platform. This platform supports functionalities and modules of a Web service-based portal, which plays the role of an online intermediary. The service search module is a channel to make government services available, online address change service is also presented in [16].

The EU-PUBLI.com project [3] defines a Unitary European Network Architecture. It presents a middleware solution to connect heterogeneous systems of different public administrations to enable service-based cooperation between public administrations. The FASME project [17] focuses on supporting citizen mobility across European countries by the integration of administrative processes. In order to satisfy this objective, a smart card has provided to citizens for the storage of all personal information and documents. Services have delivered through dedicated kiosks.

The project named ONTOGOV in [18] is developing a platform that will facilitate the consistent composition, reconfiguration and evolution of e-government services. The e-POWER project [19] has employed knowledge modeling techniques for inferences like consistency check, harmonization and consistency enforcement in legislation. The SmartGov project [20] developed a knowledge-based platform to assist public sector employees in generating on-line transaction services.

In his work, Vincent [21] presented a framework for generating semantic model ontologies in OWL syntax from a government service domain. He did this by first analyzing government services and then contracting domain ontology to get its semantic content to facilitate the design of e-government systems. This resulted in the provision of a usable framework for semantic knowledge representation in e-government processes.

Paper [22] presented an ontological approach to illustrate how e-services could be derive from citizens' needs expressed in the form of simple phrases for e-government service integration. This done by using a semantic objective and a service discovery technique. The derived e-service ontologies represented in OWL and the Web Service Modeling Language (WSML).

Muthaiyah and Kershberg in [23] proposed another ontological approach for semantic interoperability in e-government by using a shared hierarchal ontology. They organized knowledge at different levels by local ontologies. Mapping described a semantic bridging process methodology; the integration and merging of local ontologies have represented in OWL syntax.

In [24], e-government services presented, in the form of a customer-oriented e-government Web portal hosted on an intelligent platform. This achieved by presenting the notion of an intelligent document and a Life Event service, both of which are semantically modeled with the OWL ontology to enable services and related public administrations' interoperability. These allow automatic services composition, advanced searching mechanisms and better usability from the user's point of view.

A software engineering platform proposed by [25] for development and management e-government services namely ONTOGOV. The ONTOGOV platform practices Semantic Web technologies using

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OWL-S and Web Service Modeling Ontology (WSMO) to build eight kinds of ontologies, describing the e-government domain, which include organizational ontology, legal ontology, profile ontology, domain ontology, web service orchestration ontology, service ontology, life-event ontology and life-cycle ontology. The public administrators use these ontologies to describe and compose its services. The life-cycle ontology has used to achieve the maintenance of e-services (and the software components) and service ontology integration done by web service is orchestration ontology [26].

In [27], a multilevel abstraction of life-events for e-government services integration has presented. They define a life-event as a collection of actions required to deliver a public service, satisfying the requirements of a citizen in a real-life scenario. The model used three kinds of ontologies: e-government ontology, regulatory ontology and service ontology. These ontologies have represented in OWL to allow the integration of dynamic services via semantic searching and matching of concepts [15].

Study [26] presented ontology-based approach for semantic interoperability in e-government. An E-government Business Ontology (EG-BOnt) has used to describe the business process of e-government services. Each business process has described in terms of its output, input, logical relations and resource constraints with other related businesses. Afterwards, each class of the EG-BOnt has defined using the OWL language for its strong semantic and logic relation expressiveness [28].

In [29], Graph databases are shortly making inroads into real existence from research laboratories; many social networking enterprises like Twitter, Facebook, and Google have already adopted years ago. Recently the technology- no longer solely the scientific data but additionally the internet and many special kinds of statistics can be modeled as a graph.

In [30], large scales of facts are produced through social networking websites, facts servers daily. Digital traces are also left through customers on web space. These records can be very useful if it is extracted and analyzed properly. This massive scale of information i.e. big facts can't be processed with usual computing. Management of this massive quantity of records is very time ingesting.

In [31], use POWER program that support a systematic translation of (new) legislation within the Dutch Tax and Customs Administration (DTCA). The result of this research, will able to improve the standard of enforcement and reduce the time required for implementing changes in legislation and rules with notice and report anomalies within.

3. E-GOVERNMENT OF KUWAIT

The site of the government in Kuwait is not different from any other government in the world. Kuwait Government Online (KGO) portal presents its services to all Kuwait citizens, residents, visitors, government and civil sectors. The Government of Kuwait approved the National e-Governance aims of making all Government services accessible to the common man and ensures efficiency, transparency and reliability of such services at affordable costs to realize the basic needs of the common man. The Government of Kuwait has been taking numerous initiatives to put Kuwait on the information technology by introducing various initiatives in Kuwait towards the adoption and usage of e-government.

The success of e-government in Kuwait is not only dependent on government support but also on the citizens' acceptance. There are various challenges of adopting e-government in Kuwait, which include administrative problems, technological challenges, infrastructural problems, lack of trust on online services, security concerns and the digital divide. Apart from these challenges, there are many social challenges such as language barriers, low IT literacy, and low user friendliness of government websites, inability to access internet and lack of awareness in citizens.

The challenges of adopting e-government raise the question of how Kuwait can make the e-government projects more effective to provide her citizens efficient, effective and transparent access to public services that the citizens deserve. Which factors influence the intentions of citizens to use e-government services?

4. SEMANTIC INTEGRATION SERVICES FOR E-GOVERNMENT FRAMEWORK

Figure 1 shows the semantic based services framework for e-government. It is consisting of Health Information domain, Civil Information domain, Education information domain, and services ontology layer. The protégé tool used to develop the ontologies.

The semantic integration framework starts with an e-government service domain as an input.

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Domain experts and different information sources consulted to describe the process of the domain. Domain ontology is then built to capture the relevant concepts, activities, tasks, regulations and relationships between all the constituents of the e-government service domain.

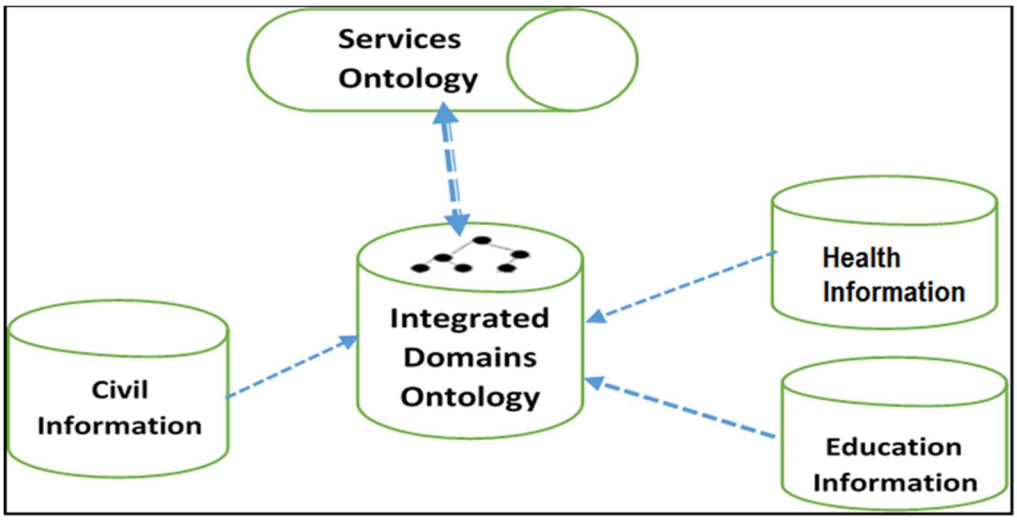

Figure1: Semantic Services Integration For E-Government Framework

Services ontology is a set of ontologies in the government, which considered in this work. The ontologies developed for the Education information ontology, health information ontology, and civil information ontology.

Transactional satisfaction leads to overall satisfaction of the customer, which in turn, can induce adoption [32]. To measure citizen adoption, items are adapted from Al Hujran et al. [33].

The citizen's belief or expectation the trust government will perform a particular action important to him/her in the absence of his or her control over the government's performance'. According to [34] the attributes of 'trust in government' are honesty, truthfulness, helpfulness and competency. Considering these attributes, the items for this construct are adapted accordingly from the previous researches [35].

Good working Government in order to availability of resources, functioning governance processes, Consensus on drivers for e-Government, Political support & leadership.

Table 1 shows the three domains for information sharing, which are education information, civil information, and health information. These domains are sharing in many field of information as in the following table. Our approach present semantic integration for these domains. The first step is developing the ontology for each domain by ontology knowledge-based editor Protégé. Then integrated without duplicate in the OWL file.

Table 1: The Information Sharing For Education, Health, And Civil Information

Domains	Duplicate	Not Duplicate
Ministry of Education	Nationally No. Name Birthdate nationality Gender Birthdate place	School level Study level School region School city Year Courses No. school place
Civil information	Nationally No. Name Birthdate nationality gender	City Region Tel.No Address Type of house unite

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Ministry of Health	Nationally No. Name Birthdate nationality gender Blood type	Registration center Religions Type of Birthdate Father Information Mother Information

4.1. Domains Ontologies Implementation

Figure 2 shows the sample domain ontology that we have developed for the e-government in the OWL (Web Ontology Language) language. The methodology we have followed to build the domains includes the phases: First, Ontology Extraction Phase, which extracts the concepts from knowledge sources. Second, Ontology Design and Integration process, which design the required models to build a unified and ontology domains mentioned in our e-government framework. Third, the Ontology Verification Phase, which verifies the ontology concepts by domain experts. Fourthly, the Ontology Implementation Phase, which represents the ontology using the OWL language.

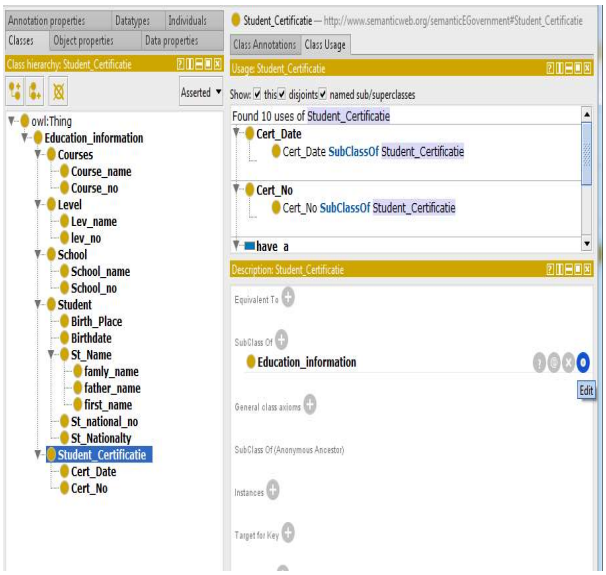

Figure2: Sample Of Domain Ontology

The ontology structure have designed, which depends on the main classes that has extracted from the previous phase. The Design models of the ontology have represented using the UML (Unified Modeling Language) language. The Verification Phase: In this phase, the domain experts have consulted to review all vocabulary in the ontology to removes the duplicates, and to validate the main classes and individuals related to the classes. Moreover, in this phase the experts can be add or edit the classes in the tree.

The domains ontology implemented by using OWL, which is the standard language for the semantic web. The input for this phase is the main concepts, which represented in the design phase. The protégé-OWL editor version 4.3 [36] has been exploited to implement the ontology.

Classes, individual, and properties for integration domains ontologies

The domain ontology consists of three main classes' civil information, health information, and Education, which each class contain sub-classes. The vocabulary contains more than 215 words. Words in hierarchy linked with components via ontological semantic relations. Semantic relationship synonyms used (in the protégé is named "same individual as" such as the individual student has synonyms names such as citizen. Figure 3 shows the classes in the ontology, and Figure 4shows the individuals for the integrated domain ontology. Figure 5displays the graph ontology of the classes with the individuals

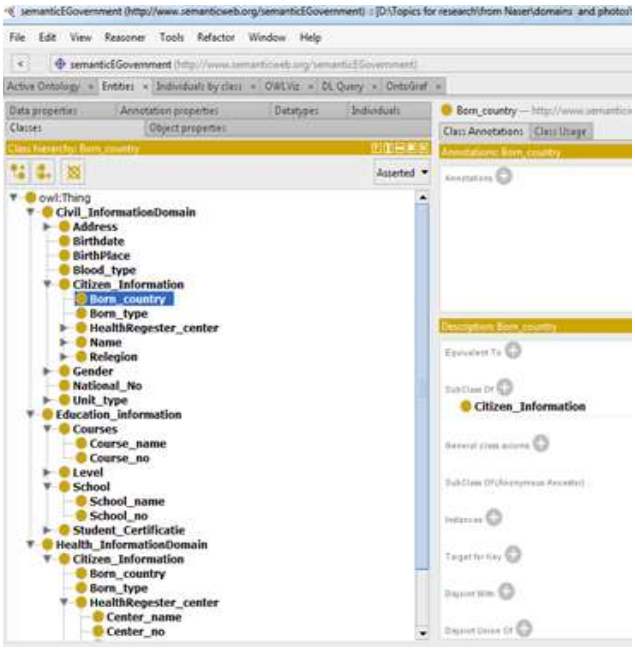

Figure3: Classis Of The Integrated Domains Ontology

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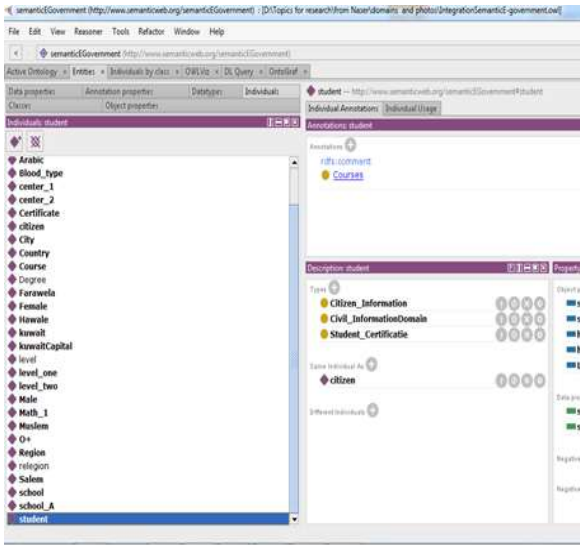

Figure4: Individuals For The Integrated Domain Ontology

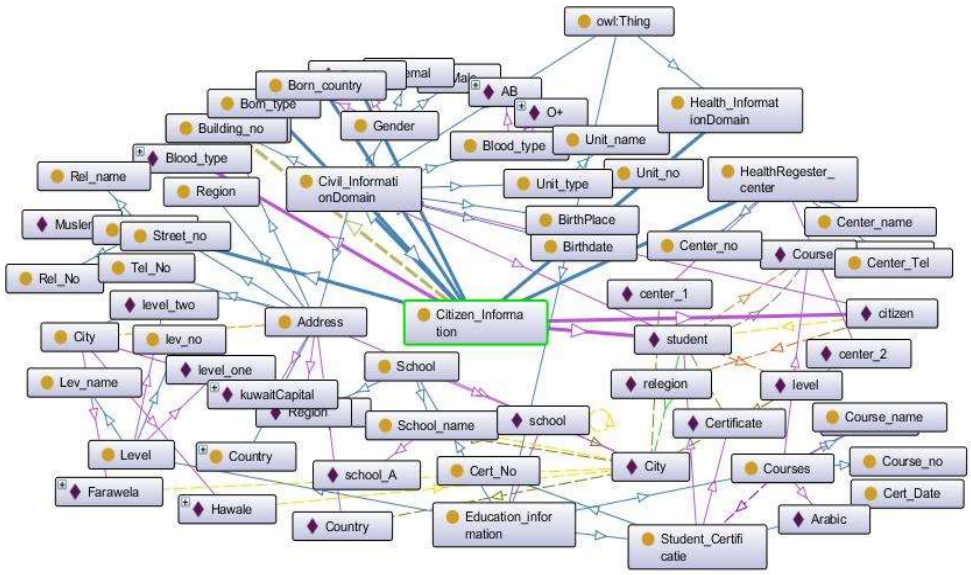

Figure5: Sample Of Graph Ontology Classes With Individual

Figure 6 and Figure 7 shows the sample of hierarchal for the ontology by using OWLViz. OWLViz is designed and integrated to be used with the protégé owl-editor; it enables class hierarchies in OWL Ontology to be viewing and incrementally navigated, allowing comparison of the asserted class hierarchy and the inferred class hierarchy. In the order to develop the proposed ontology, the process has been done through a comprehensive examination for source of componential analysis.

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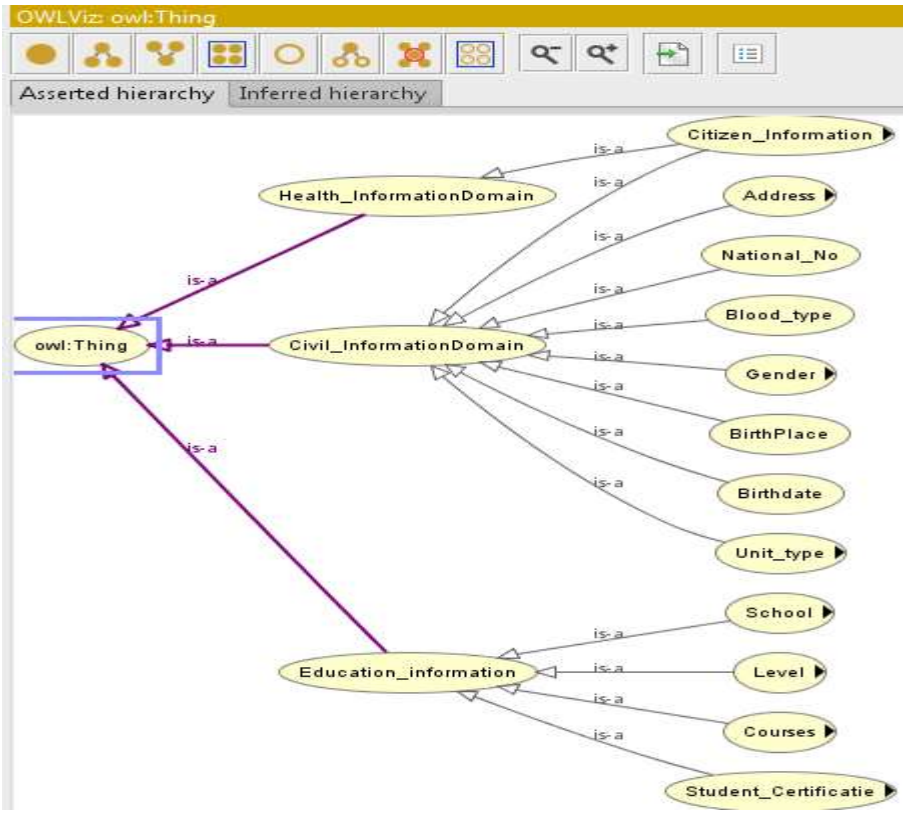

Figure6: Sample Of Graph Visualization Of The Hieratical Ontology

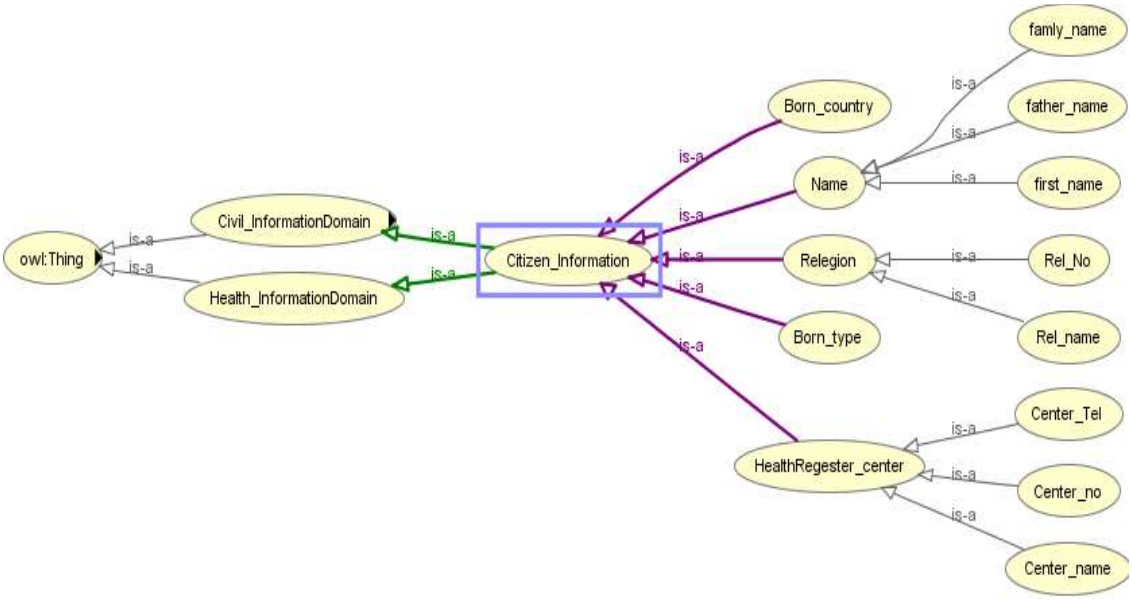

Figure7: Sample RDF Represent Synonym In Domain Ontology

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5. CASE STUDY: SEMANTIC INTEGRATION IN THE KUWAIT E-GOVERNMENT

Approval proposed framework aimsto integrates the semantic building ontologies of e-government. In this case, we applied the approach of semantic framework e-government of Kuwait e-government. The case study contains three ontologies as shown above. The first one is the health ontology, which includes citizen information from the ministry of health; the second is for the education information for the citizen in the ministry of education, and for the civil information. The protégé was used for develop the domain ontology. Table 2 displays the object property for the individual student in the ontology. Figure 6shows sample of the RDF file represent the synonym of citizen in domain ontology.

Figure 7 display as ample RDF file for the relation information in the ontology of the citizen information in the education ministry.

Table 2: Sample Individual With The Object Property

Individual	Object property assertion
Student	**Same individual** As: Citizen **studies_a** Course **has_a**level **live_in**city

```
<SameIndividual>
<owl: NamedIndividual
rdf:about="http://www.semanticweb.or
g/semanticEGovernment#student">
<owl: NamedIndividual
rdf:about="http://www.semanticweb.or
g/semanticEGovernment#citizen">
</SameIndividual>
<SameIndividual>
<NamedIndividual IRI="#citizen"/>
<NamedIndividual IRI="#student"/>
</SameIndividual>
```

Fig 6: Sample RDF Represent Synonym In Domain Ontology

```
<ObjectPropertyAssertion>
<ObjectProperty IRI="#is_a"/>
<NamedIndividual IRI="#Hawale"/>
<NamedIndividual IRI="#City"/>
</ObjectPropertyAssertion>
<ObjectPropertyAssertion>
<ObjectProperty IRI="#is_in"/>
<NamedIndividual IRI="#Hawale"/>
<NamedIndividual IRI="#kuwait"/>
</ObjectPropertyAssertion>
```

Fig7: Sample Of Object Property RDF File Represent In Ontology

6. DISCUSSION

Building OWL ontology from e-government domain as confirmed in this work as an important step towards the development of Semantic-based applications. This e-government applications, which have potential to perform semantic inference and reasoning over the OWL ontologies and facilitate software components integration and interoperability.

Semantic technique advantages for government services is the capability formally describe meaning and context of the services. Traditional as well as electronic ones provided as electronic forms or as web services, without the necessity to modify the services themselves.

In addition, achieving semantic integration services is a challenge of Kuwait e-Government based semantic. The proposed approach for framework and implementation aims to build domains ontology for Kuwait e-Government. Moreover, many platforms as Java API, .NET, ASP and so forth, exist for developing Semantic Web services application based on OWL ontologies [37][38].

To explain, we consider a set of concepts from the education, civil, and health domain where a set of information and services has developed for citizens.

- Domain concept = {Perform, Place, etc.}
- Service Concept = {Managed-Individual, Service-Control, etc.}

For instance, the usage context of Service-Control has defined through their relationships with

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the type of imported information (citizen). The Governmental features will be added using concept from the developed ontologies. The functional features: will describe through OWL-S elements (Profile, Process, etc.).

The protégé ontology editor used to build our ontology, so this tool verifies both the syntactic and semantic qualities. The social quality concern of the ontology when is published in the open domain, for instance, the numbers of other ontologies that link to it. According to the [39], there are two steps included in the evaluation:

Step 1-Semantic analysis: This phase is response to identifying the componential method and semantic relations between concepts. Evaluate how the ontology can present the word meaning (formulae and relations).

Step 2- Semantic Application: Test the ontology on the remaining Place nouns, which not used during the design, and test it on new words from a new semantic filed, then observes to what range the model can expand them. Evaluate the lexical, vocabulary, or data layer, the focus is on the concepts, instances etc. which in the ontology and the vocabulary used to explain the concepts.

7. CONCLUSION

In this paper, we present a framework for generating semantic model ontologies in OWL syntax from a government service domain. In addition, current works employ OWL ontologies in e-government to the Semantic Web viewer, which implemented semantic sharing integration for e-government domains (Civil information, health information, education) ontology. The case of State of Kuwait e-government integration is presented. The domain ontology is created with the knowledge-based editor Protégé. In addition the domain ontology hieratical implemented in the OWL-VIZ analysis. It is extremely handy to be able to point a Web browser to an appropriate server and to begin editing. Like a Google doc. Thus facilitating to improve the knowledge sharing so that citizens can take more knowledge benefits from the e-government sharing.

We have developed a set of specific ontologies that match the Kuwait E-government requirements, which are civil information, health information, and education. The current research focusing on Semantic Web development, in the e-government paradigm, does not refer to any existing ontology development methodology. The e-government specific ontology models that they have developed or the ontology-based solutions for e-government services integration have discussed. There is a lack of existing governmental services types, and the need dramatically change (re-engineer) the way governmental services are presented to the end user, is explained. The e-government services need to provide information where format and methods of delivery adapt according to the users and situations.

Moreover, to demonstrate how our approach is efficient, we have proposed ontological model for constructing semantic model ontologies in OWL Web Service Standard for e-government applications that represents a big challenge in the Kuwait e-Government.

The knowledge sharing for semantic based framework will be use simple ontology engineering techniques (modeling and representation techniques) to capture the semantic content of an e-government service, this makes the framework easy to understand and user-friendly, the platform employed includes protégé to create and import the OWL ontology. Web Protégé ontology can be easily sharing with a distributed group of users who can engage in collaborative authoring activities from wherever they happen to be logged in.

REFERENCES

[1] Gupta, Kriti Priya, Swati Singh, and Preeti Bhaskar. "Citizen adoption of e-government: a literature review and conceptual framework." Electronic Government, an International Journal 12.2 (2016): 160-185.

[2] Dombeu, Jean Vincent Fonou, and Magda Huisman. "Combining ontology development methodologies and semantic web platforms for e-government domain ontology development." arXiv preprint arXiv:1104.4966 (2011).

[3] C.A Welty, "Ontology Research," AI Magazine, Vol. 24, No. 3, pp.11-12, 2003.

The EU-PUBLI.con Project: http://www.eu-publi.com

[4] F. Garc, R. Mart, J. M. Go, and R. Valencia-garc, Applying intelligent agents and semantic web services in eGovernment environments, J. Knowl. Eng., vol. 28, no. 5, 2011

[5] T. Berners-Lee, Linked DataDesign Issues, W3C, 2006.

[6] Rodrigo Mantovaneli Pessoa, Eduardo Silva, Marten van Sinderen, Dick A. C. Quartel, and Lus Ferreira Pires. 2008. Enterprise interoperability with SOA: Survey of service composition approaches. In EDOC Workshops. 238251.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

[7] W. Ning, B. He, L. Hui, W. Xuehua, and W. Yanzhang, The Application of Web Service Technology in Government Information Resources Sharing System, 2009 IEEE/WIC/ACM Int. Jt. Conf. Web Intell. Intell. Agent Technol., vol. 3, pp. 373376, 2009.

[8] http://what-when-how.com/information-science-andtechnology/semantic-web-in-e-government-information-science/ (Accessed Date Aug 2017)

[9] Lacroix Z and Crichlow T (2003), Bioinformatics: Managing Scientific Data, Morgan Kaufman

[10] S. Zaidi, A Cross-language Information Retrieval Based on an Arabic Ontology in the Legal Domain, Proceedings Int. Conf. Signal-Image Technol. Internet-Based Syst., pp. 8691, 2005.

[11] Drumm, Christian. "Integrating eGovernment Services using Semantic Web Technologies." In AAAI Spring Symposium: Semantic Web Meets eGovernment, pp. 10-13. 2006.

[12] Carter, Lemuria, and France Bélanger. "The utilization of e-government services: citizen trust, innovation and acceptance factors." Information systems journal 15.1 (2005): 5-25.

[13] eGOV ProjectWebsite: http://www.egovproject.org

[14] Kavadias G., Tambouris E.: GovML: A Markup Language for Describing Public Services and Life Events. Working Conference on Knowledge Management in Electronic Government, 2003.

[15] Fadhel, Ben Jafar, and Mamadou Tadiou Kone. "An eGovernment Web Services Platform on the Semantic Web." In EGOV (Workshops and Posters), pp. 143-149. 2005.

[16] J. Vincent, F. Dombeu, J. F. Dombeu, and M. Huisman, A Framework for Semantic Model Ontologies Generation for E-government Applications, ICDS 2011, Fifth, no. c, pp. 152158, 2011.

[17] The FASME Project: http://www.fasme.org/index-org.html

[18] OntoGov Project Website: http://www.ontogov.com

[19] Van Engers T., Patries J.M., Kordelaar J., Den Hartog J., Glasseee E. (2002). Available at http://lri.jur.uva.nl/epower/

[20] SmartGov Project: http://www.smartgovproject.org

[21] Dombeu, Jean Vincent Fonou, and Magda Huisman. "Combining ontology development methodologies and semantic web platforms for e-government domain ontology development." arXiv preprint arXiv:1104.4966 (2011).

[22] P. Salhofer, B. Stadlhofer and G. Tretter, Ontology Driven E- government, Electronic Journal of E-government, Vol. 7, No. 4, pp. 415-424, 2009.

[23] S. Muthaiyah and L. Kerschberg, Achieving Interoperability in Egovernment Services with two Modes of Semantic Bridging: SRS and SWRL, Journal of Theoretical and Applied Electronic Commerce Research, Vol. 3, No. 3, pp. 52-63, December, 2008.

[24] L.M.A. Sabucedo, L.E.A. Rifon, F. Corradini, A. Polzonetti and B. Re, Knowledge-based Platform for E-government Agents: A Web-based Solution Using Semantic Technologies, Journal of Expert Systems with Applications, Elsevier Inc., Vol. 2010, No. 37, pp. 3647-3656, 2010.

[25] D. Apostolou, L. Stojanovic, T.P. Lobo, J.C. Miro and A. Papadakis Con- figuring E-government Services Using Ontologies, IFIP International Federation for Information Processing, Springer Boston, Vol. 2005, No. 189, pp. 1571-5736, 2005.

[26] Y. Xiao, M. Xioa and H. Zhao, An Ontology for E-government Knowledge Modelling and Interoperability, In Proceedings of IEEE International Conference on Wireless Communications, Networking and Mobile Computing, (WiCOM 2007), Shanghai, pp. 3600-3603, 21-25 September, 2007.

[27] F. Sanati and J. Lu, Multilevel Life-event Abstraction Framework for E-government Service Integration, In Proceedings of the 9th European Conference on E-government 2009 (ECEG 2009), London, UK, pp. 550- 558, 29-30 June, 2009.

[28] J. Vincent, F. Dombeu, J. F. Dombeu, and M. Huisman, A Framework for Semantic Model Ontologies Generation for E-government Applications, ICDS 2011, Fifth, no. c, pp. 152158, 2011.

[29] Patil, N.S, P Kiran, N.P Kavya, and Patel K. M. Naresh. "A Survey on Graph Database Management Techniques for Huge Unstructured Data." International Journal of Electrical and Computer Engineering. 8.2 (2018): 1140-1149. Print.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

[30] Bathla, Gourav, Himanshu Aggarwal, and Rinkle Rani. "A Novel Approach for Clustering Big Data Based on Mapreduce." International Journal of Electrical and Computer Engineering (ijece). 8.3 (2018): 1711. Print.

[31] Aritonang, E.M, S Wahjuni, K.B Seminar, and O.W Purbo. "Modeling Ontology and Semantic Network of Regulations in Customs and Excise." Telkomnika (telecommunication Computing Electronics and Control). 15.4 (2017): 1934-1942. Print.

[32] Shankar, V., Smith, A.K. and Rangaswamy, A. (2003) 'Customer satisfaction and loyalty in online and offline environments', Journal of Research in Marketing, Vol. 20, pp.153–175.

[33] Al Hujran, O., Aloudat, A. and Altarawneh, I. (2013) 'Factors influencing citizen adoption of e-government in developing countries: the case of Jordan', International Journal of Technology and Human Interaction, Vol. 9, No. 6, pp.1–19

[34] Alsaghier, H. and Ford, M. (2009) 'Conceptualizing citizen's trust in e-government: application of Q methodology', Electronic Journal of E-Government, Vol. 7, No. 4, pp.295–310.

[35] Carter, L. and Bélanger, F. (2005) 'The utilization of e-government services: Citizen trust, innovation and acceptance factors', Information Systems Journal, Vol. 15, No. 1, pp.5–25.

[36] Protégé,http://protege.stanford.edu
Saekow and C. Boonmee, "A Practical Approach to Interoperability Practical Implementation Support (IPIS) for E-government Interoperability," Electronic Journal of E-government, Vol. 7, No. 4, pp. 403-414, 2009.

[37] Al-Yahya, Maha, et al. "An ontological model for representing semantic lexicons: an application on time nouns." Arabian Journal for Science and Engineering 35.2 2010

[38] Zhang, C., Wang, H., Cao, L., Wang. W. and Xu, F., 2016. A hybrid term–term relations analysis approach for topic detection. Knowledge-Based Systems, Issue 93, pp. pp.109-120

[39] H. Knublauch, M. Horridge, M. Musen, A. Rector, R. Stevens, N. Drummond, P. Lord, N.F. Noy, J. Seidenberg and H. Wang, "The Prot´eg´e OWL Experience," Workshop - OWL: Experiences and Directions (OWLED-2005), Galway, Ireland, November, pp. 1-11, 2005.