A novel geo-context model for mobile learning and self-adaptability of Web services

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Abstract. Thanks to development of technology and Web has reached its peak. It touched almost every domain especially the learning. We notice a huge change has occurred in the methodology and means of information especially in the usage of mobile dispositive. Thus, its necessary that we model the mo-bile learning domain so that we can specialize the needs and the modeling rea-lization. In this domain both the context and the geographic position of a mo-bile learning represent the two principal concepts for modeling a mobile learning situation. Our original research is focus on the ontological modeling of a geo-localized context of a mobile learning. Self adaptability of Web services to the context are a solution for the integration of distributed, autonomous, and heterogeneous information systems. Thus impacts can resolve many problems in different system based on service oriented architecture and Web services. We are interested in the study of a certain number of context learning models without forgetting the models of geo-ontology. We suggest a model that allows describing at the same time the context and the geographic position. This model can be integrated in the mobile learning environment and it leads to the semantic description and reuse of information. We show the reasoning and validation of our approach in an archaeological geo-location case study based on self adaptability of Web services to the context.

1 Introduction

The world is always changing, we see the emergence of new technologies for information and communication that mixture between mobile technology and new teaching methods. These technologies give individuals the opportunity to choose when and where they want to learn and thus meet the learners' mobility needs. Thus the adoption of these new technologies will help to rethink education and to meet the demands of our university or school life today. That is

why we spend a formal classical education in a class to another at distance (E-Learning) to arrive at a new form of education that can overcome traditional barriers of time, local and the learning environment. This form is called mobile learning or M-Learning. Mobile learning is the new form of teaching in a mobile context where the learner is moving from one place to another at any time. Besides that mobile devices used for M-Learning we find the mobile learning environments that can replace the table, the book, or even as live chats between students and their teachers. Fur-thermore, another important aspect of mobile learning is related to the movement of learners between different places, thus having different geographic coordinates allow its geographical location. As has been the mobility of learning it and the environment are linked to mobile training, also learning it, capacity of devices, activities, etc. is possible oil change in the course of time and the place. That is, learning context can change at all times. In our research work Felhi and Akaichi (2012a) ,Felhi and Akaichi (2012b), we presented a proposal to a self-adaptable Web services (Web-Services, 2004) to the context based on workflow (Workflow, 2006) by presenting the functional and technical architecture. In this architecture we have given differ-ent features in terms of the needs of self-adaptability offered by the integration of workflow, which allows the management rules (Rules, 2010) and a kind of security and administration of Web services. This solution which can offer management rules that deal with business logic. Business logic can help in the development and optimization of these assemblies sepa-rating the events produced by the components of Web services. So the adoption of this new technology, will contribute to rethink education and to face up requests of our university or school life at present. For this, we cross of a definite classical education in a class to another with hindsight (E-Learning) to the point of arriving at one news form education which can exceed the traditional barriers of time, of place and of learning environment. This form is called mobile Learning or M-Learning. In this article, we present our geo-context ontology which describe the geographical posi-tion of learning it as well as in learning context in a mobile environment with its different components in a learning situation on the basis of the semantic treatment of different infor-mation and showing his validation based on self adaptability of Web services to the context. The rest of this paper is organized as follows: in section 2, we start with a description so a scenario that identifies the general framework of our learning situation, in section 3, we re-view previous research on treatment models of context in mobile learning and self adaptability of Web services to the context. In section 4 we present our approach for geo-context ontology. In Section 5 we illustrate our solution by feasibility in an archaeological geo-location case study. Finally, we summarize our work and discuss future research in Section 6.

2 M-Learning Geo-located scenario

To define a clear framework, we propose a scenario of a mobile learning situation where students use a learning environment (blog, social network or other ...) to share and exchange information between them. Three students in 2nd year of master research in archeology, want to make their mini project on archaeological tourist zone in Tunisia. Each student visiting an archaeological zone located in a different city to the one visited by his colleagues, that is to say, the students will be movable relative to the learning contexts. These students will each equipped with a mobile device to share and receive information and to be able to specify their geographical positions. The progress of the learning process for this scenario is as follows:

– The first student goes to the zone of "Bilarigia" in the governorate of Jendouba: Zone "A"
– The second student visit me "El Ksour" governorate Tataouin: Zone "B"
– The third student visit me "Henchir Douamis »Beja: Zone "C"

Each student will observe and will seek the peculiarities of the zone visited. The informa-tion generated by the student must be shared with others in order to collect information and track the learning approaches of each. We should have an information collection environ-ment and real-time sharing between mobile students. Before sharing information, students must be registered or logged in a learning environ-ment. Once identified, the learner could communicate with peers:

– The first student sends information on the zone "A" to the second student and third of the learning environment.
– The second student at the same time (real time) makes a comment on information of the first student and then sends the information on Zone "B"
– The third student will also add environmental learning information about zone "C".

Our learning process must enable information sharing and communication among mobile stu-dents live in a mobile learning environment. Each student is in a particular zone, away from his colleague, then it must be located geographically across its geographic coordinates. The learning environment must: Display the header information shared name (or nickname) of the student and the name of the zone to visit.

For example:

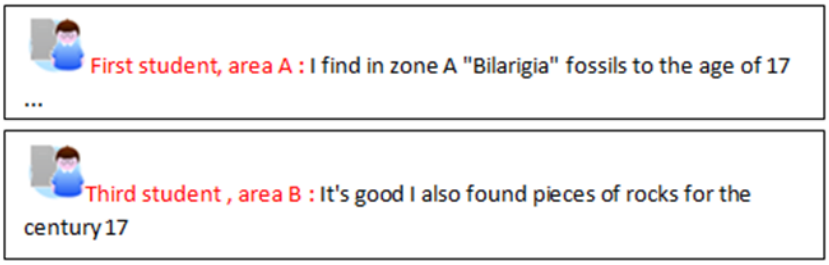

FIG. 1 – *Example of information in a M-learning situation exchange*

It must be stored in a geographic database of the coordinates (latitude and longitude) of each mobile learning.

2.1 Scenario Analysis

2.1.1 Constraints

To implement this scenario in a real situation it is necessary to consider a list of constraints. Some constraints were identified from this scenario:

1. We must consider the user profile According to (Wang et al. (2004)), all variations that characterize a user or group of users can be grouped under the profile of term, which selects the activity of the learner to choose their working context is the training and explain the selection and sending information to the learner at the right time..

2. The environment and context of learning can similarly influence the presentation of information and its semantics. Context can meet the needs of a mobile learner; some studies show that it has 72% of the information needs of mobile users are linked to contextual factors including the location and time.(Bouidghaghen et al. (2009))
3. The geographical position allows the learner to identify the elements that have important effects on mobile learning.
4. We can also find technical constraints attached to the mobile device used for learning.

We must also take into account the learning process and exchange of information between learners in real time.

2.1.2 Genericity

To implement this scenario in a real situation it is necessary to consider a list of con-straints. The generic is a function that is based on the vis-à-vis the type independence, and possi-bly the number of its arguments .It aims to be used as such in different contexts. We created our scenario for a group of students doing a survey of archaeological tourist areas of our country. But the questions asked in this situation are:

- Is there a change in the format and content of information if we change the context and the learning environment?
- Is for certain learning situations geographical position is important and for other situation right?
- If you change your learner is that the information exchanged is the same or not?

These questions focus on the user profile and the information exchanged within a mobile learning, that is to say, if we look there are changes in the profile and information, if may mark a shift from one place to another (change of geographical coordinates). First, regarding the first question, we can say that an environment or a place is characterized by a specific context, that is to say it contains a set of specific elements such as: the learner, time, the learning device, local, etc. The information sent or received by the learner in a learning environment and from its context must be adapted to the latter. We can deduce that the information is influenced by the context of the learning location. To answer the second question we can take against such. If we instead of archeology students, journalists, mathematicians and we want to integrate them in a scenario like the one described above, that is to say that these students will exchange information with each other through a mobile environment and where they are in a situation of mobility (each student should be in a separate location and different from where colleagues are located).The courses of math and physics are based on formulas and developments to implement and does not require the exchange of contextual information. Then the change of the local and the learner's position does not influence this learning situation even if the learner in case of mobility. We conclude then that in some learning situations the geographical position of the learner is not important. Each student has their own profile, and the profile elements are responsible mentioning what information should be sent to the learner and to characterize and identify the learner in the learning situation. So to answer the third question, we can say that we must create a model of ontology that describes the user profile and should be standard but dynamic.

2.1.3 Information Modeling

For the modeling of data released throughout the scenario that is to say the models that describe the user profile, training context, and its geographical position, we propose to use the description of ontology: the ontology of the context and geo-ontology. The ontology of the context to describe the learner in his general work context with the main elements related to its profile and mobile device. The geo-ontology is for describing the geographical infor-mation of the location of the mobile learner. We need to set up this scenario models created can be reused in other learning situations whatever the context and learners. For mobile learning quick and easy must search for in-formation on the web must be filtered and semantic search, which justifies our choice of using ontology for describing information.

3 Context models

A situation of mobile learning consists of a group of models: scenario model, model of domain, model of context (including the model of learning it) and models which describe the position of learning it. In our job, we finalized on the characteristics of the models of ontology in the context of mobile learning and the geographical position of learning it. These mod-els have as an objective the installation of the teaching aid go-located in an adapted context and which is one of the necessary specificity of mobile learning.

3.1 Context models

Context modeling differs from a work to another one. A significant number of the researchers offer the modeling of context according to dimensions such as works in (Truong et al. (2008) ;Phumisathan et al. (2010) ; Bouidghaghen (2009) ; Göker and Myrhaug (2002) and Tamine-Lechani L. (2010)).This counterpart, the specification of originality of every work is in touch with the number of dimensions taken into consideration, according to the need and the vision of the researcher. For example in works from Derntl et al. (2005); context is composed of Five dimensions which are: physical context, numerical context (numerical resources: e-book, e-paper, Web services), devices (software, material, network, portable devices), learning it (characteristics of teaching him, tasks) and the specific context of the application area.

In INCONTEXT project (Hong and al., 2008) presented in (Figure 2), the dimensions of different context in comparison with other plans. They are made up by the team of work which linked with the man (as a person, organization, and competences), services (as SMS and of management of documents), the location (for example, site and address), the role of the members of the teams (for example, and the department), activities (for example, plan and communication and the correlations between the man and services).

The idea offered by (Göker & Myrhaug, 2002), and (Tamine-Lechani & Boughanem, 2010), is that context must be defined according to five specific dimensions: the dimension dispositive, the dimension task / problem, context of the document, the spatiotemporal dimension and the dimension user context. The Work of Boughanem, 2010, is based on the approach of RCI (contextual research of information) honest three dimensions to represent context: the

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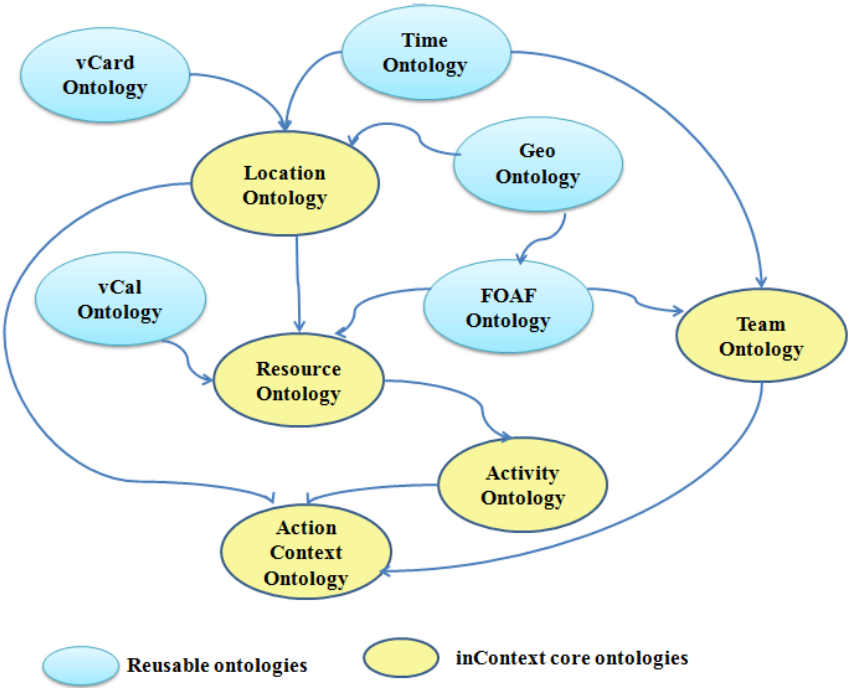

FIG. 2 – *Structure of the « inContext » context model.*

interest centers, the location and the time. In (Derntl & Hummel, 2005), we have the approach of modeling, which includes learning context in "the model of learning activity: LAM" where every object must be an authority described in the model of the structure of learning (CSM) (Figure 3). We clear another modeling of context which is oriented object and differed from other models.

Moreover, it exists other models based on ontology allow to structure and to introduce the semantic approach expressly. We offer some models of ontology for context: SOUPA (Standard Ontology for Ubiquitous and Pervasive Applications) (Chen et al. (2005)) : It is an ontology which represents users with their profiles, their events, their time, their place, and their actions as well as rules linked to security and to confidentiality. Ontolo-gy SOUPA reuses ontology: FOAF (Friend-Of-A-Friend ontology), DAMLTime, the space ontology of OpenCyc, RCC (Regional Connection Calculus), and COBRA - HAVE, MOGATU BDI, and Rei policy. She is also composed of two groups of ontology: SOUPA Core and SOUPA Extension. CALA-ONT (Context Aware Learning Architecture Ontology): It is an ontology which makes sensitivity, easier for context and adaptation of learning services in a pervasive envi-ronment. It contains four classes (Person, CompEntity, Place and Activity) and their sub-classes, as well as twelve main properties which describe relations between the authorities of classes of high level and their properties Cho et al. (2008).
CONON (Wang et al., 2004) presented in Figure 4, is an ontology which uses OWL. It becomes divided into two levels:

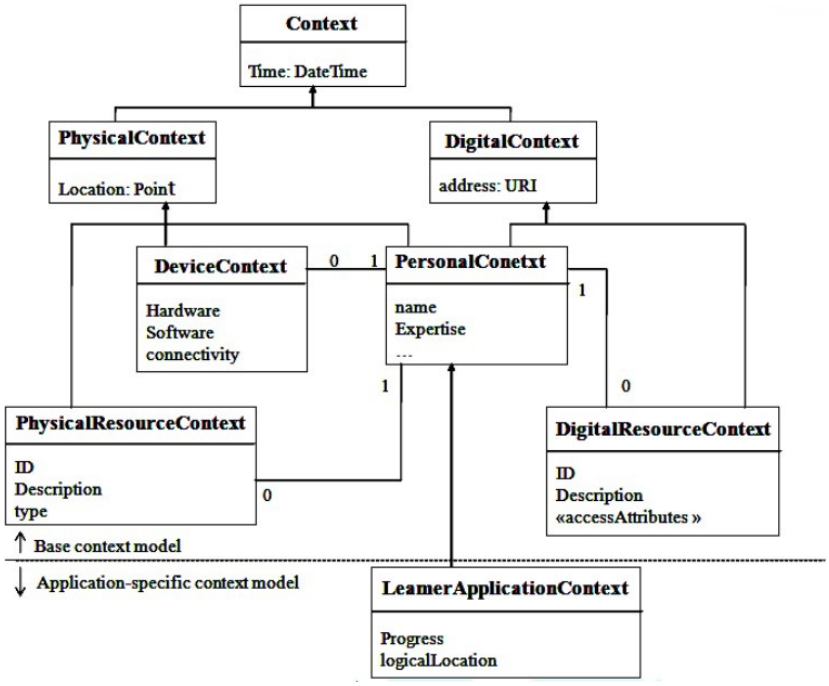

FIG. 3 – *The model of the structure of context CSM.*

– Generic level: this level contains 4 classes to model context which are the users, the location activities and computer entities.
– The second level: allows introducing the classes of generic level.

3.2 Geo-location models

The Geo-location is a method or procedure which allows to position and to transmit the geographical position of an object, of a person or of a resource, so Geo-ontology defines the model which describes geographical concepts in a definite way within a domain of space information. We are interested in this article also in the geographical position of one learning motive, which must be stocked or kept within the learning environment. There are several jobs in touch with the description of the ontology of geographical information. For example, we find in Wang et al. (2008) that the authors use notion of «the triple «with 4, 5 and 6 elements. In this travel, the Geo-location was defined as follows:
Geo-ontology $= C, R, A, X, I$ Where: C: geographical concepts, R: relations between concepts, A: the attributes of the geographical objects X: the restriction rules between concepts, relations and attributes and I: Authorities.
In Phumisathan et al. (2010) , and Henricksen (2003) , they introduced the model of Geo-ontology of cultural knowledge (Figure 5) and which recovers the site of the diversity of the cultural site of heritage by period. The description of Geo-ontology represents the knowledge

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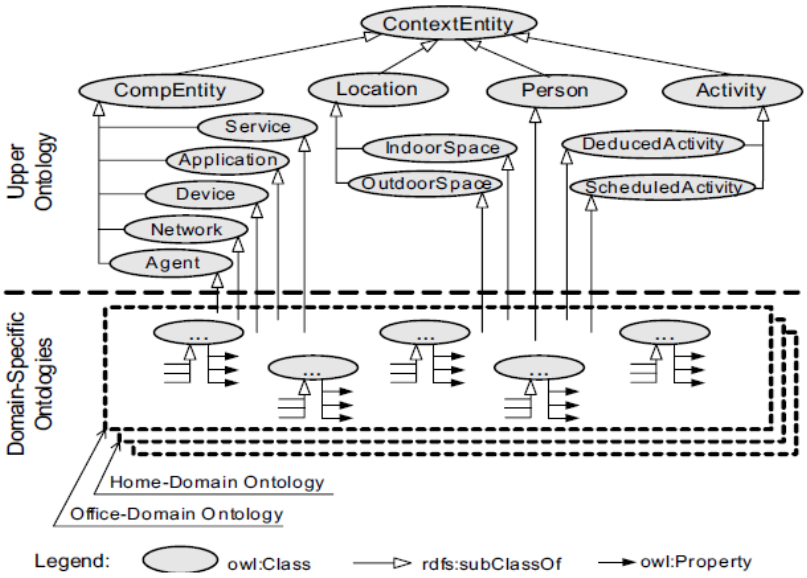

FIG. 4 – *Structure of ontology CONON.*

of the relation between the cultural sites of heritage, the periods and the information on the (geographic) location. The model offered by this job is based on three main concepts: Place, Person and Time.

In other works (Miron (2009) ;Egenhofer (2002) ;Fonseca et al. (2002))have approached the concept of the Semantic Web Geospatial regroup different activities of different works and which took into consideration the group " GeoXG ", the purpose of which is the development of spatiotemporal ontology for the semantic description of information with space and temporal accessible references on the Web. The reason to study the approaches of modeling of the space and temporal quantitative annotations (GeoRSS) or qualitative (Ontology SpatialRelations defined by Ordnance Survey) is the absence of the languages of ontology in terms of space and temporal types (Figure 6). Then, we can say that the group " GeoXG " succeeded in resolving the problems of deficit of the standardized models and of mechanisms of reasoning of space data. These researches drive semantic presentations in a new frame which offers in researches of information geo-space based on ontology space - temporal.

In Egenhofer (2002) , and Fonseca et al. (2002) , they find that the geo-space Semantic Web allows to the users to recover more precisely associated semantic data. There are many ontology, as «Ontology of GeoRSS» which is a standard containing geographical coordinates (points, lines, of zones of interests) in a flux RSS which are intended for geographical applications. "GeoRSS" defined two elements of the standard: GEORSS GML and GeoRSS Simple.

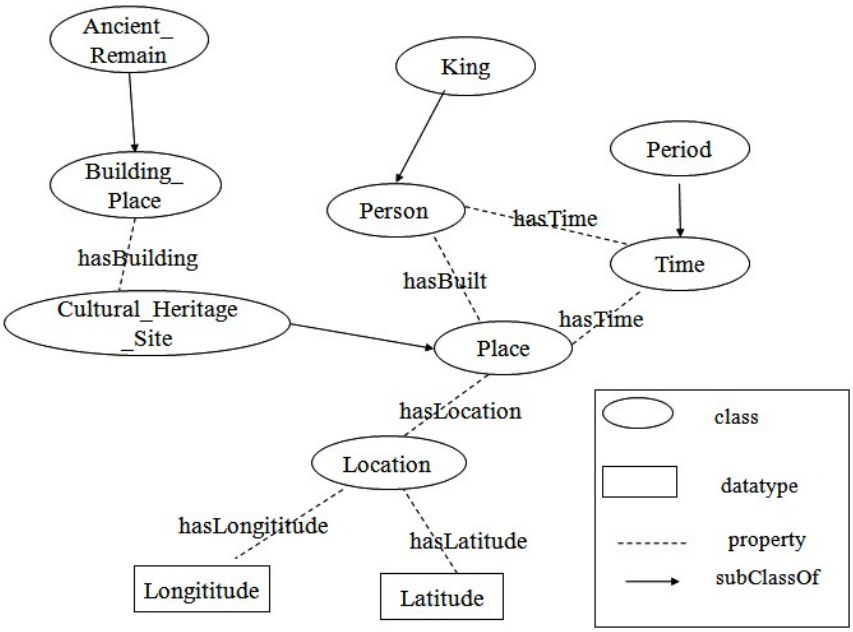

FIG. 5 – *A geo-ontology for cultural knowledge.*

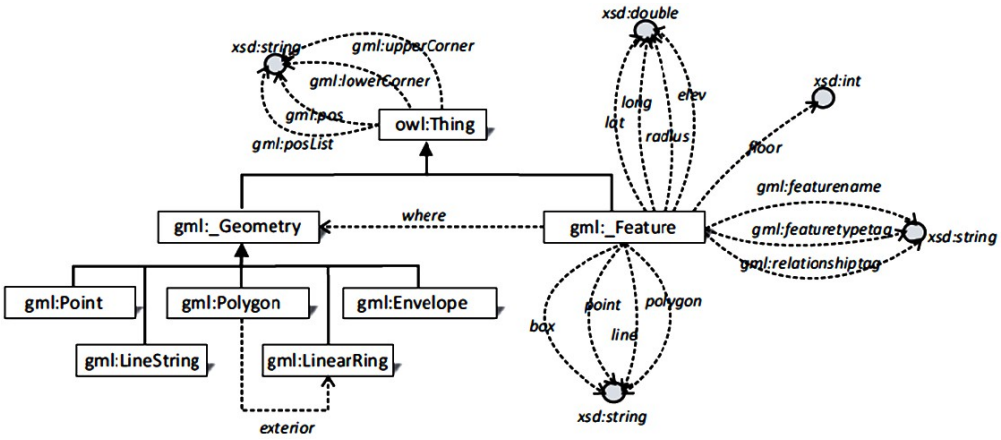

FIG. 6 – *Graphic Representation of ontology GeoRSS Simple.*

3.3 Self adaptability of Service-Oriented Architecture to the context

In figure (Figure. 7) we presented our research results based on the needs in terms of self adaptability of service oriented architecture (SOA) (Curbera et al. (2008)) to the context. This architecture is based on workflow when we can use the management?s rules, when we aid to treat external and internal events in the context. Web services are a sometimes block not change

as an access provider, that?s why we integrate this rules in Web services block to change the behavior of Web services at an event to finally determine good self adapt these web services and then the SOA to the context. These management rules also provide us with real-time processing. The impact of real time is during extractions new needs and events not processed by Web services through well to technologies dedicated in the context. Our architecture is based on objects or components to make the dynamic reconfiguration of components using more advanced mechanisms. It qualifies the distribution of applications across multiple servers and not the increase in service levels. There is a distributed architecture whose purpose is to deliver services to their audience and they will be accessible from any types of clients. Security and administration are offered by this system in treating the business logic from the workflow and rules. Contextual resource discovery is the use of context data to discover other resources within the same context. The invocation of distant and ambient services is also permitted by this architecture using technologies dedicated to each type of invocation.

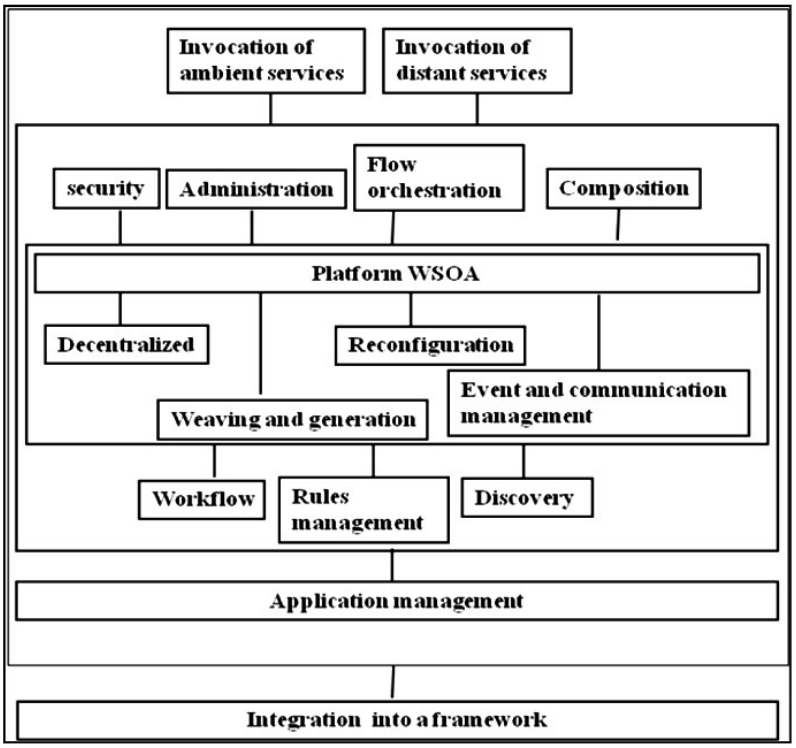

FIG. 7 – *System architecture for self-adaptability of Web services to the context.*

3.4 Synthesis and comparative study

3.4.1 Constraints

At the end to compare different works and offered ideas concerning the models which describe the context and geographical information, different criteria can be kept. 1st criterion (C1): Dimensions treated in the model. It is a question of comparing many of the approaches and main notions used or mentioned to construct context as part of a mobile learning. As we itemized it in the course of the previous part of the state of art, the number of dimensions or also key concepts differs. However, it is possible to remember that there are common dimensions mainly at several works such as: user's profile, location, time, and device specificity. Second criterion (C2): Treatment of context in models. It represents the integration of context (with one or some dimension) in a model which describes position location of a mobile user. Third criterion (C3): Types of models it is a question of identifying different types offered to model information on context and geographical location of learning it. We find, other than criteria introduced before, important characteristics such as applica-tion field and the approach centered on the model, which can enrich our summary picture of the model of context and of Geo-location.

3.4.2 Synthesis

This comparative study between the context models and that of Geo-location, allowed us of clear some key concepts which allow us to construct our own model of Geo-ontology which describes learning its motive and Geo-located in a context of mobile learning. In spite of the big diversity of analyzing work we can note that there are two models of description of information as part of a mobile learning; one to describe the context in detail and other models for the Geo-location. Even if we find models of context which includes the dimension of location into their structure (Truong et al. (2008) ; Nguyen (2010) ; Bouidghaghen (2009) ; Derntl et al. (2005); Azouaou and Desmoulins (2006); Göker and Myrhaug (2002); Tamine-Lechani L. (2010)) or also on other Geo-location model which include the user in their structures and their approaches as (Frank (2001); Phumisathan et al. (2010); Fonseca et al. (2002)), these models not allowing to cover both aspects jointly; context with all its dimensions and the Geo-location. As part of this work it is a question of allowing the geographical location of learning for mobile learning, for it is important to consider at the same time the dimensions of context and its geographical location. These data should be semantically annotated to allow research and interoperability of information. It is then a question of offering and of setting up a uniform ontological model.

4 Geo-context ontology

4.1 Presentation

Such as introduced in the previous parts, the identification of the geographical position of one learning motive in the course of its learning and in a contextual learning situation is one of the main concerns of researchers of the domain of M-Learning currently. Researches and

A novel geo-context model.

Project	Modeling direction	C1	C2	C3 (Model)	Application Environment	Centered approach
Derntl and Hummel, 2005	Context	5	+	Graphic	E-Learning	_
Azouaou and Desmoulins, 2006		5	+	Hierarchical ontology	E-Learning	_
CONON, 2004		4	+	ontology	_	_
SOUPA, 2004			+	ontology		
CALA-ONT, 2008		4	+	logical ontology	_	_
InContext, 2008			+	Hierarchical ontology	E-Learning	_
Göker & Myrhaug, 2002 and Bouidghaghen et al. 2009			+	_	RCI (Contextual research of information)	_
Bouidghaghen, 2009		3	+	_	Approach of RCI	_
LBWiKi, 2008	Geo-location		_	OO aplication / location hierarchic	E-Learning	_
Wang et al., 2007			_	Tag languages	Different applications	
Crime Case Geo-ontologie, 2004		_	+	Conceptual	_	_
Frank, 2001		_		Hierarchical ontology	_	_
Phumisathan & Tantasanawong, 2009		3 Concepts: Place, User, Time	_	Geo-ontology	_	_
Geographical Space, 2007		3 Parts: SpatialThing, SpatialRelation and SpatialData	_	Geo-ontology	_	_
KAON, 2002		9	_	Graphic	_	_

FIG. 8 – *Summary of the different context and geo-location models.*

available plans have as objective to offer a model of standard ontology to describe the Geo-location of resources in mobile environments and model of contextual learning. We however do not find a complete model which describes both models at the same time (model of contextual and model Geo-ontology learning) in a clear and detailed way where learning it is in the center, characterized by its own profile, could react for its learning in a mobile environment across the necessary devices. A main objective of our research work is to define an ontological model of the Geo-location of resources in mobile learning environments. In Figure 8, Figure 9, Figure 10 and Figure 11 we present our model offered of learning geo-located must allow describing the contextual situation of one learning motive in the course of its learning as well as its geographical identification. From models and examined the works, our proposal will be as follows; Create the single model which describes at the same time context and geographical location in a situation of mobile learning. The model should be based on dimensions of context and of Geo-location of by examin-ing works. We for it chose dimensions according to; In comparison with context: it exists different concepts important concerning the context model. Among dimensions introduced in different works, we chose the following dimensions:

- User dimension: it is the element actor in our situation. Learning him is necessary being identified by its profile, which contains groups of information.
- Equipment dimension: the devices of mobile connections are his colleagues in an environment of mobile learning are the elements of connection between learning it and.
- Time dimension: it is a dimension which informs on the instant or the period of holding of a learning activity another one. Moreover, it is about an important dimension to manage the review of contexts or of cross situations allowing enriching context.
- Activity dimension: it is a dimension which introduces events accomplished by learning him in a mobile situation.

In comparison with the Geo-location: As introduced before, there are some dimensions to define the model of the Geo-location in different works, we choose to follow concepts among these last:

- The spatial-temporal dimensions: this dimension which includes two dimensions, one for the site and another one for the dimension of time.
- Location dimension: it is the basic dimension of a Geo-location model. It contains all information on a geographical position. There are two other dimensions which describe space data in touch with the location dimension.
- Geometry dimension: it is a dimension which describes geographical coordinates such as: line, point, and polygon.
- Geo-reference dimension: it is a dimension which describes the site of learning by the couple (degree of latitude / degree of longitude).
- Time dimension: This dimension can be present in the Geo-location model and in the context model.

In comparison with mobile learning: Our model contains the dimensions which we specified above: the contextual dimensions and the Geo-location dimensions. Furthermore, we have added other dimensions than we consider such to be important as:

- Temporal dimension: this dimension introduces the dimension of time. She chooses temporal elements as well as relations between them. She will concern shutters then context and Geo-location.
- Cartography dimension: it is a card which regroups all geographical data and gives the

possibility of showing them to a user. In our model this class allows to introduce different geographical concepts and their space relations.

– Network of connection dimension: this class belongs to the dimension of the physical context. It manages the link of communication between the device and learning its motive.

Our "Geo-context" ontology describes apparently the relations of a learning with its own profile in a context of mobile learning, as well as the detailed description of the concepts of space data such as: geometry (point, line, polygon) and Geo-reference (degree of latitude, a degree of longitude). This model should have a standard structure, which we can reuse in other scenarios for mobile users. It is also important to have a semantic description of the notions used in the model. This semantic description of the model would indeed allow a reuse of information in different learning contexts.

4.2 Geo-context ontology

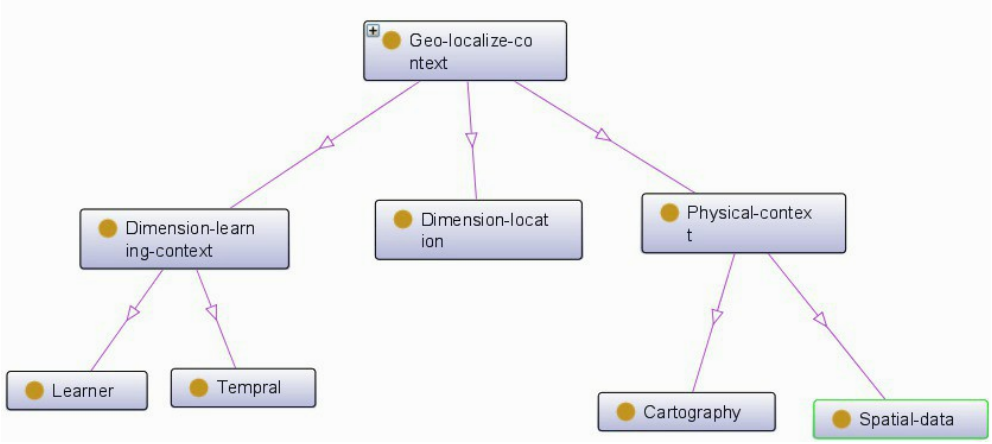

FIG. 9 – *Geo-Context ontology (1/4).*

We accomplish our model of "Geo-context" ontology, with the aid of the editor Protégé, who describes at the same time context and geographical position of one learning motive. Our ontological model allows describing in detail a situation of mobile learning Geo-located.

5 Reasoning and validation

5.1 Reasoning on ontology

As we introduced forward that ontology is a model representative of all the individuals, classes, attributes and properties between them. We mentioned that it is necessary to use a language which allows describing and to accomplish ontology for the semantic Web as RDF or OWL (Ontology Web Language) which described logical links enters the triple. To see that our

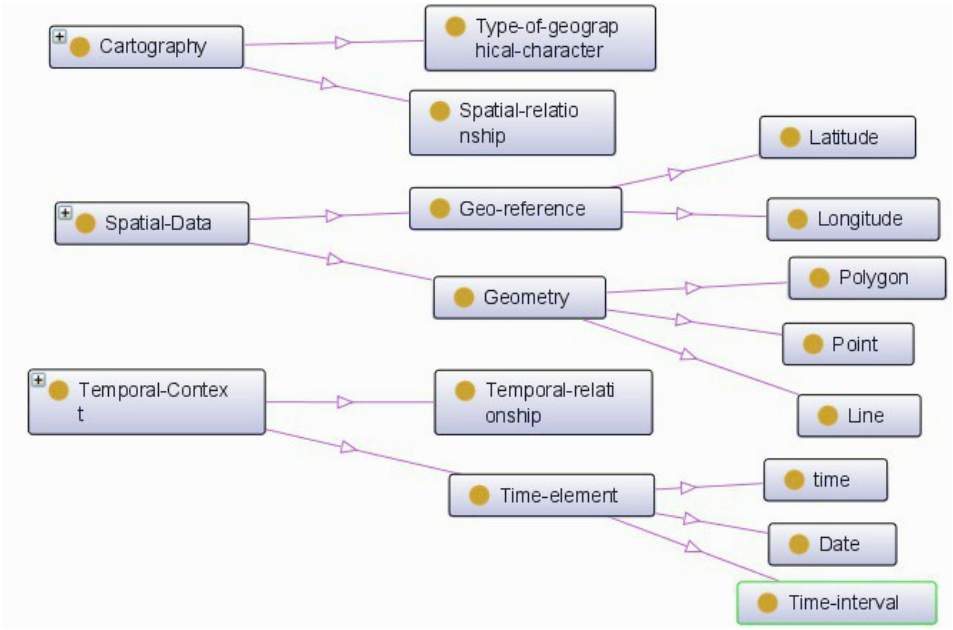

FIG. 10 – *Geo-Context ontology (2/4).*

model is correctly described, it is necessary to use an inference engine which allows to consider or to deduce on ontology. Among inference engines, most to use we find "Pellet" which uses SPARQL (QUERY LANGUAGE FOR RDF) as being a language of the request which allows to question any element of the triplet that RDF forms. We offered then some requests SPARQL to validate our model:

- A request which allows choosing the personal information of the mobile learners (Figure 13)
- A request which allows choosing different stocks of degrees of latitude for the different places (Figure 14)
- A request which allows choosing the personal information of the different mobile learners as well as its stocks of degrees of latitude (or also a degree of longitude) (Figure 15)
- A request which allows choosing the name, forename and lD-place of every learning with its interest domain (Figure 16)

5.2 Validation and case study

5.2.1 System architecture

Our pervasive system (Figure 17) enables the sharing of information of a particular archaeological area and the guidance in the various sectors in this space. Each mobile user uses an equipment where we installed the RTSOAW system Felhi and Akaichi (2012a) ,(Felhi and

A novel geo-context model.

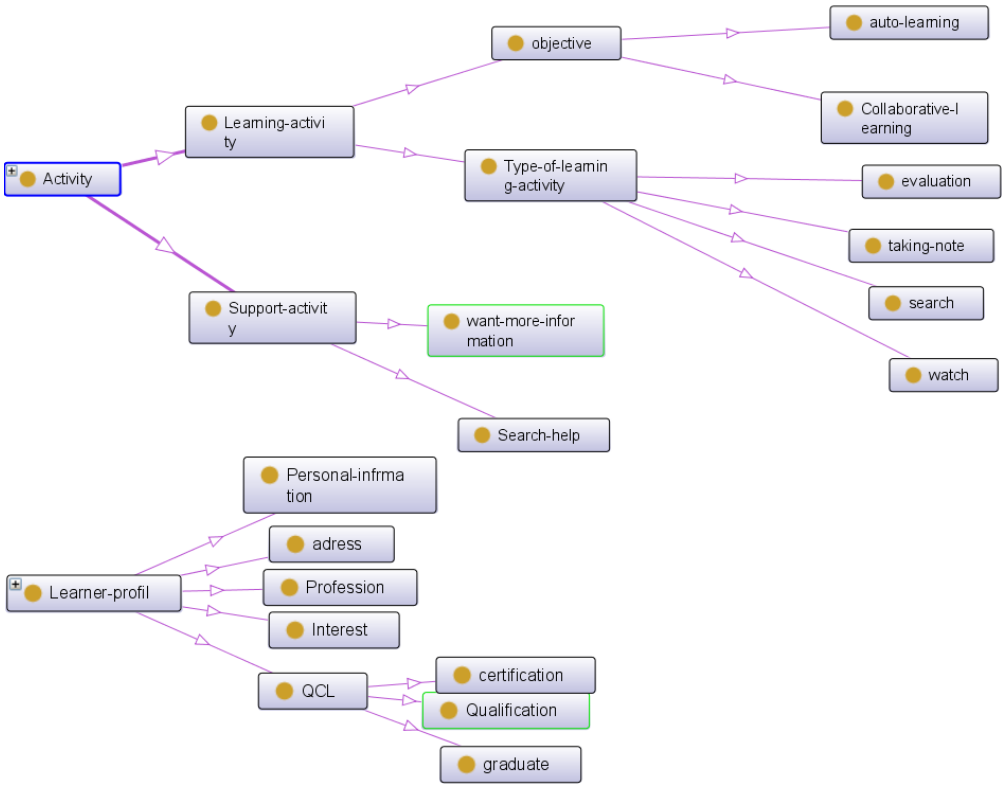

FIG. 11 – *Geo-Context ontology (3/4).*

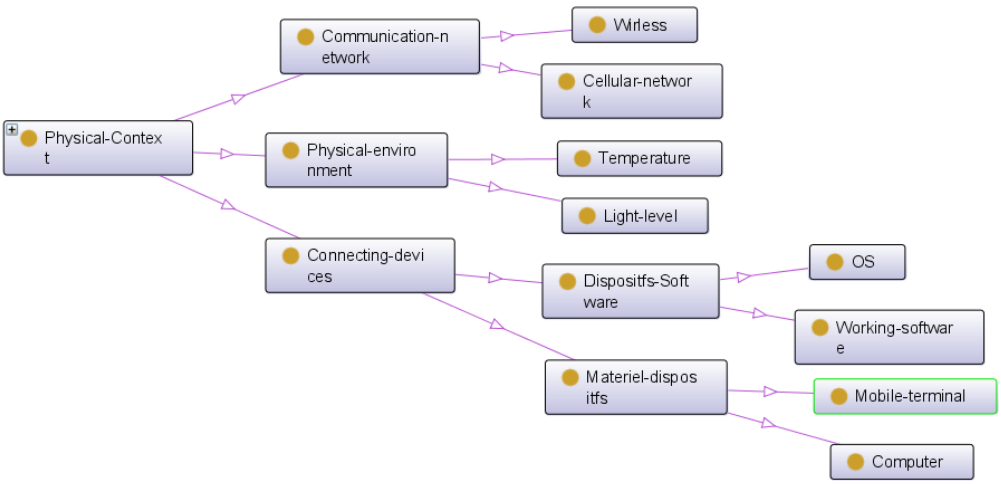

FIG. 12 – *Geo-Context ontology (4/4).*

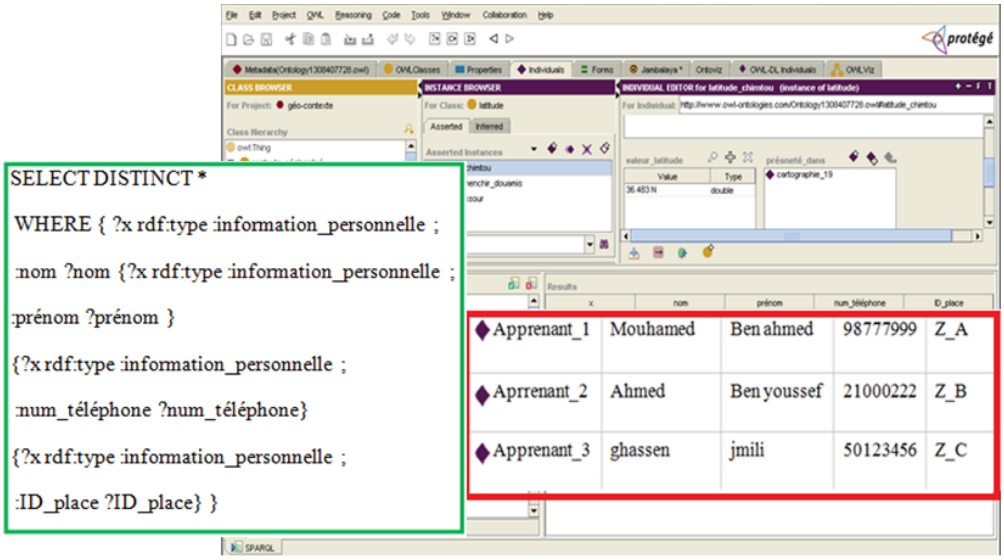

FIG. 13 – *Request of personal information of learners.*

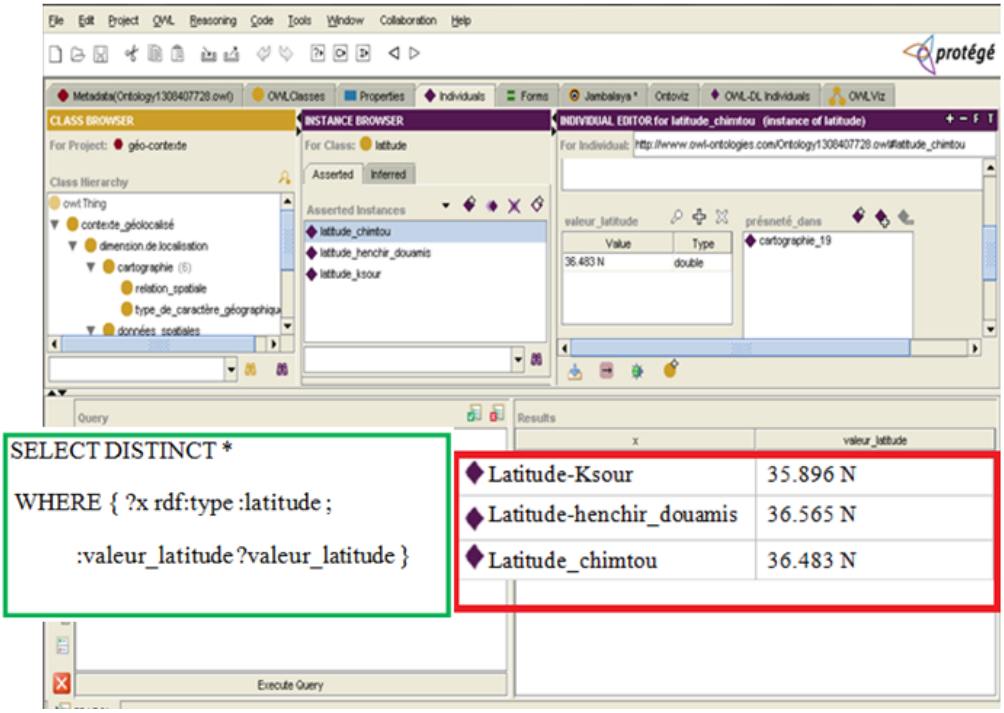

FIG. 14 – *Request of value of degrees of latitude.*

A novel geo-context model.

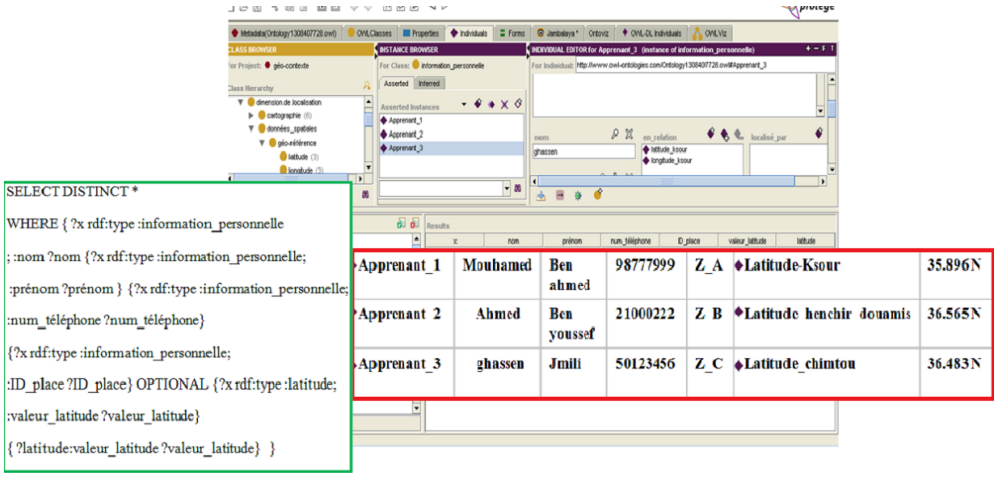

FIG. 15 – *Request of stocks of degrees of latitude for every learning.*

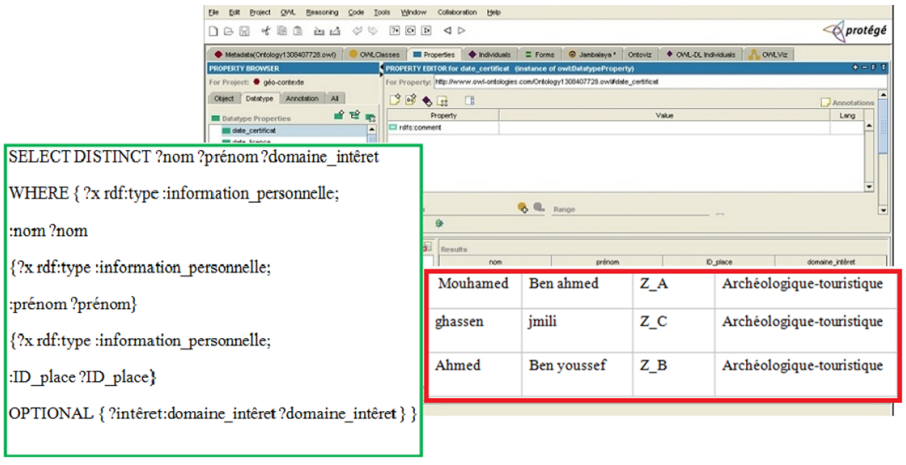

FIG. 16 – *Request of interest domain for every learning.*

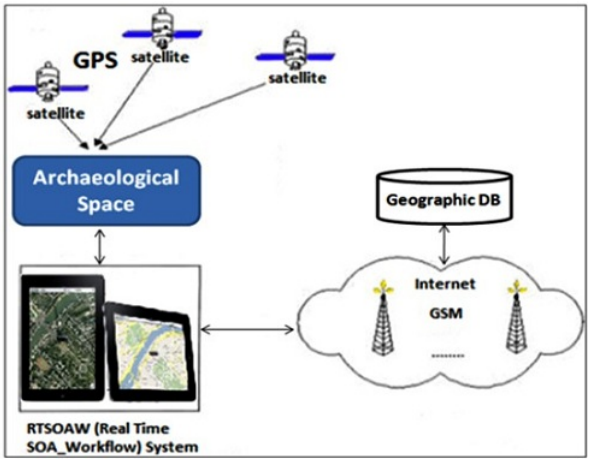

FIG. 17 – *Archaeological geo-location system.*

Akaichi, 2012b) based on Web services and workflow Workflow (2006),this user is located across geo-graphic coordinates using GPS or satellites equipment. Our system enables to store in a geographic database the coordinates of each mobile environment taking into account the working environment where the user moves. The environment and context may well influence the presentation of information and semantics. Context can meet the needs of a mobile user and the information needs of mobile users are linked to contextual factors including the location and time. Thereafter, our system allows to self adapt the mobile user with its environment by displaying every time a description of the place where now is located in real time, and it also displays the trajectory towards a requested sector in its space archaeological.

5.2.2 User interface

Figure 18 present the user interface that displays the current archeological place. We use our RTSOAW approach where we have integrated the WComp platform (Tigli et al. (2011b)& Tigli et al. (2011a) & Tigli et al. (2009))and WWF workflow. Using the management rules we can follow the event every user request in real time. In our case study, and in this interface, the user can view the archaeological area where it moves in real time, and it can also look for the trajectory to a sector in the archaeological area.

6 Conclusion and future works

We started our work by a scenario that presents our needs to create an ontology model later and then we compared the different context models and geo-location models existing in the literature. This paper presents an approach for context modeling and the geographical position of a learner in a mobile learning situation. We studied various works of context modeling

A novel geo-context model.

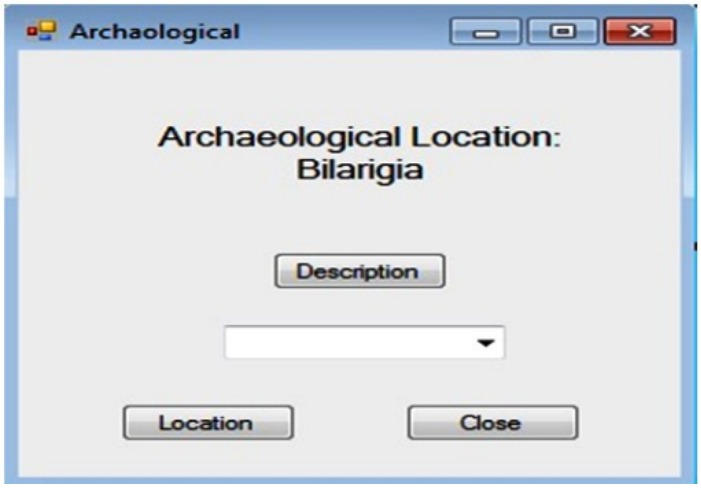

FIG. 18 – *Archaeological geo-location Interface.*

and geo-location and we have selected different main dimensions to propose a model of the background and geographical location of a mobile learning, to arrive later to create our own ontological model: Geo-context that enables the reuse and sharing of infor-mation in mobile learning situations. We have shown the feasibility of this idea by an arc-haeological location case study based on self adaptability of Web services to the context. We hope in our future work enhance our approach in another application domain.

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Résumé

Grâce au développement technologique et du web qui ont marqué plusieurs domaines, et surtout le domaine d'apprentissage, nous constatons un changement de méthodologies et de moyens pour la formation surtout avec l'usage des dispositifs mobiles. Il devient ainsi nécessaire de modéliser le domaine d'apprentissage mobile afin de bien spécifier les besoins et les modalités de réalisation. Dans ce domaine, le contexte et la position géographique d'un apprenant mobile présentent les deux concepts principaux pour modéliser une situation d'apprentissage mobile. Notre article s'inscrit dans le cadre d'une modélisation ontologique d'un contexte géo-localisé pour un apprenant mobile. L'auto-adaptabilité des services Web au contexte est une solution pour l'intégration des systèmes distribués et d'information hétérogène autonome. Ainsi ils peuvent résoudre plusieurs problèmes dans différents systèmes basé sur l'architecture orientée services et les services Web. Nous nous intéressons à l'étude d'un certain nombre des modèles de traitement du contexte ainsi que des modèles de géo-ontologies. Nous proposons un modèle permettant de décrire à la fois le contexte et la position géographique. Ce modèle pourrait être intégré dans un environnement d'apprentissage mobile permettant ainsi la description sémantique et la réutilisation de l'information. Nous montrons le raisonnement et la validation de notre approche dans une situation d'étude archéologique géo-localisation basée sur l'auto adaptabilité des services Web pour le contexte.