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TRAGLOR: A LOM-BASED DIGITAL LEARNING OBJECTS REPOSITORY FOR AGRICULTURE

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***Abstract**: The Turkish Agricultural Learning Objects Repository (TrAgLor) is a multilingual, context specific, and IEEE LOM Draft Standard compatible learning objects repository. Its main objective is to store digital learning objects which has been developed for agriculture, veterinary, food, environmental and forestry sciences as well as all other related basic and applied sciences. TrAgLor also enables the stored objects and their metadata are easily accessible, searchable and sharable for all kind of user parties from learners to teachers. The TrAgLor's content is provided and enriched with contributions, discussions and evaluations by its member users and editors. The contributed objects and metadata in TrAgLor are peer-reviewed by disciplines editors, and classified and refined on their general, educational and technical characteristics. Beyond TrAgLor system is one of the vertical learning repositories for agriculture, food, veterinary and forestry sciences, it also serves as a reference model for future repositories, based on IEEE LOM draft metadata standard, in life sciences.*

Keywords: e-learning, learning repositories, learning objects, metadata, agriculture, LOM

I. INTRODUCTION

A metadata is shortly "data about data" that consists of a set of descriptive and classification information for a specific entity. In practice there are many different metadata standards and specifications, developed for several domains or use of general purposes. Among these, Learning Object Metadata (LOM) is a draft standard that has specifically been developed for defining educational resources. It specifies a conceptual model that defines the structure of a metadata instance for a learning object. In this draft standard published by published by IEEE LTSC, a learning object is defined as "any entity -digital or non-digital- that may be used for learning, education or training". For this standard, a metadata instance for a learning object describes relevant characteristics of the learning object to which it applies [2]. The LOM defines the descriptive, structural and semantic features of a learning object with 9 categories of metadata elements such as general, life cycle, meta-metadata, educational, technical, educational, rights, relation, annotation, and classification.

Metadata instances of learning objects can be used by a learning technology system (i.e. LCMS, LMS, WBT etc) to manage, locate, evaluate or exchange learning objects. The aim of standardization is to achieve interoperability between systems from different origins [4]. A digital learning object metadata repository (LOR) works as an e-learning support system that provides the necessary mechanisms to create, store, search, retrieve, and exchange metadata of the objects on central and/or distributed databases. In most of the cases learning objects and their metadata are located in a single system however they can be stored and managed on different systems.

E-learning systems should be designed in a way that they provide easy access to all levels of learning objects from atomic to the most complex structures in the learning process. The LORs play an important central role to achieve these goals with their search and retrieve components. With their metadata search they facilitate the learners, teachers and developers to find appropriate objects that match their learning objective and the level of study. LORs make course selection is easy and time saving on users decision on what courses are suitable for their learning.

Today there are many successful examples of LOM- and none-LOM based learning objects repositories which have been developed for various disciplines of study. They include CUBER (http://www.cuber.net), ARIADNE (http://www.ariadne-eu.org), MERLOT (http://www.merlot.org), CAREO (http://careo.natera.ca), Maricopa MLX Learning Exchange (http://www.mcli.dist.maricopa.edu/mlx), BIOME (http://biome.ac.uk/), SMETE (www.smete.org), and ESCOT (http://escot.org). These repositories have differences between their architecture, interfaces, content volume and services offered. For example CUBER, ARIADNE, CAREO and ONES are some examples of LOM and extended LOM-based repositories.

Majority of existing LORs have the categories that index the learning objects for life sciences including agriculture, food, environment and forestry sciences, the number of repositories which have specifically been developed for agricultural learning resources is very limited. For instance, in a review has been carried out by Tzikopoulos et al. in 2005 a set of 27 of 59 well-known repositories have been identified that covering agricultural topics [7]. CG-Online Learning Resources by CGIAR (http://learning.cgiar.org) and Bio@gro by Sideridis et al (http://www.bioagro.gr) are the examples of LOM based repositories that serving agriculture specific objects [3][5]. FAO also recently developed a Learning Resources Metadata (http://www.fao.org/aims/ap_ applied.jsp) based on Dublin Core standard (http://www.dublincore.org) which borrowing some elements taken from IEEE LOM [8].

It is generally accepted that information to sustain and increase agricultural production is spread over different agencies, notably farmers, universities, research institutes, extension services, commercial enterprises, and non-governmental organizations. However, this knowledge is often poorly documented or hard to access [6]. In this regard learning systems and digital repositories for agriculture could be remedies to overcome this problem. According to Tzikopoulos *et al*. presentation of proposed good examples of agricultural DLRs and guidelines on their effective use by the agricultural actors could be of particular interest for both practitioners and researchers in this field [7].

For the reasons explained above, an open access repository system has been developed in order to ease to find and share agricultural learning objects between the parties. However the system named "The Turkish Agricultural Learning Objects (TrAgLor)" mainly stores the Turkish resources it is a multilingual and multicultural learning objects repository based on LOM standard, and it is being modified for international use constantly. In this paper, TrAgLor repository is introduced and its main features are described briefly.

II. SYSTEM ARCHITECTURE AND FUNCTIONS OF TRAGLOR

2.1. System architecture

As seen in Figure 1 TrAgLor, is a Web based metadata repository. It has 3 tiers that consist from client tier, application tier, and data tier. Client tier of TrAgLor includes user interfaces that interact with member and non-member users via web browsers. Although there is membership system to access and utilize member-specific functions all kind of users can freely access the system. As shown in Figure 2, TrAgLor user interfaces have been designed with simplicity and easy navigation principles at first. In order to achieve this design goal TrAgLor's application layer has five component groups as illustrated in Figure 1. These components are:

- Objects and metadata management,
- Memberships and session management,
- Search, browse and list engines,
- Non-objects content management,
- Communications and collaborations management,
- Web services for systems interoperability.

TrAgLor is one of the repositories that offer all possible kind of objects entry mechanism. Metadata entries can be recorded with 4 adding methods. These are:

- Object entry form (simple method),
- Metadata entry form (classical method),
- Treeview metadata editor [1]
- Metadata uploading (file transfer method).

Retrieval components of TrAgLor offer several flexible ways of finding the relevant objects that are concerned for different aims. The repository has a developed search engine that contains simple, advanced, full-text and in-file search options to the users. The objects can be searched on their metadata from title to subject category for all elements of LOM structure.

In order to achieve the appropriate objects TrAgLor's browsing subsystem makes the users may linearly navigate through educational disciplines directory and from AGRICOLA category map.

TrAgLor provides three options to view descriptive information about the objects. They are object view (Figure 2), metadata view (tabular form) and metadata (in XML form). This flexible approach for identifying the objects offers the options for different levels of expertise of the users.

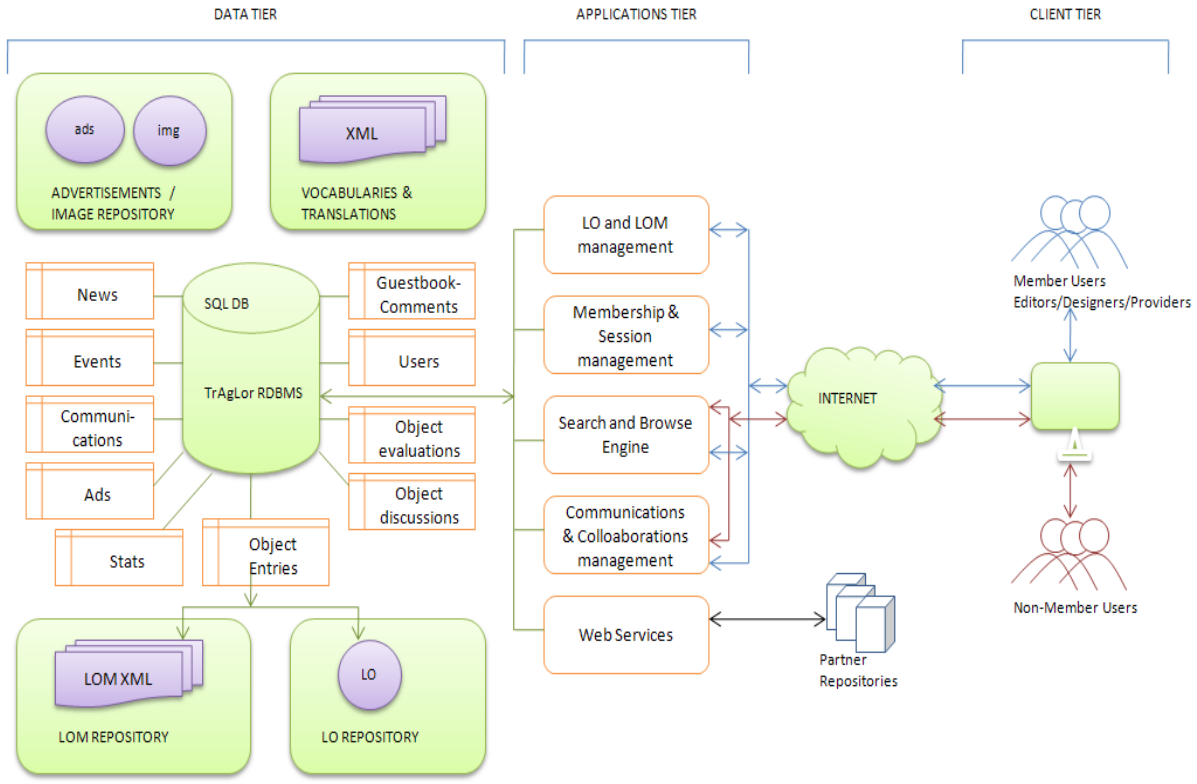

Figure 1. System architecture of TrAgLor

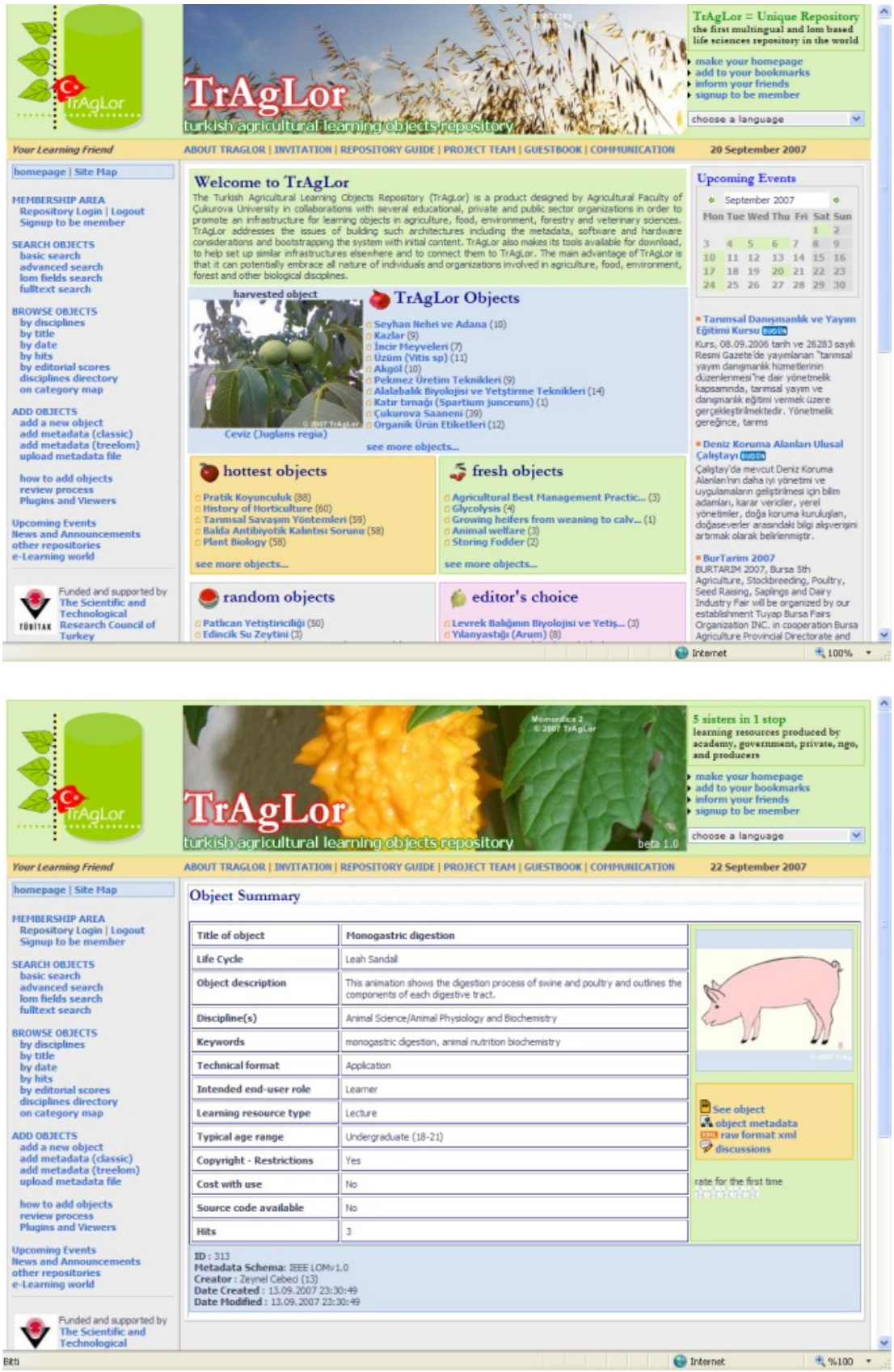

Figure 2. Sample screenshots [homepage (top), object summary view (bottom)]

TrAgLor is not only a repository system but also a light portal, publishing daily news, events and educational links for agriculture, food, veterinary,

forestry and environmental sciences, technology and business. These non-objects content of the repository informs the users in a single point of access without paying any extra effort to go and find other systems.

The data layer of the systems is consists from SQL database, objects and metadata datawarehouse, repository management and language specific data files used in multilingual interfaces of the system.

In design and development of TrAgLor, MS .NET and related technologies such as C# programming scripts and libraries, and AJAX have been used at the server side. XHTML, XML, XSL, CSS were the other core technologies in developing the system. The system operates under MS IIS and SQL Server Database on a MS Windows 2003 Server platform.

2.2 Content and usage

TrAgLor is currently in its first beta stage and operates at the URL of http://traglor.cu.edu.tr. The repository started to service in August 2007. At the present time (as of Jan 14th, 2008) it has 365 metadata records which have been 16615 times visited by the users nearly in 5 months. As it is seen from Table 1, TrAgLor has its own 125 learning objects which were 7735 times visited by its users.

Table 1. Content and access statistics for TrAgLor (as of Jan 2008 since 8th Aug 2007)

Items	Number
Total number of metadata	365
Total view of objects	16615
Average view of objects	45
Total view of metadata	6901
Average view of metadata	22
Number of TrAgLor objects	125
Total view of TrAgLor objects	7735
Average view of TrAgLor objects	61
Page views (daily)	595
Page views (monthly)	17847
Page views (total, singular hits)	89236

The high rates for monthly page hits around 18000 shows that there is a high interest to use the learning objects in agriculture. This is also an indicator that if quality and quantity of the objects are served to the learners and teachers a high popularity will be achieved, and interests to e-learning will expand in the future.

III. CONCLUSIONS AND FUTURE WORKS

TrAgLor is one of early examples on new paradigm implementations related with IEEE LOM standard. It provides and offers some distinguished approaches and/or innovative techniques that are listed below:

- Random image banners in every page gives image-based information to the learners,
- Customizable view styles for users (will be available in beta 2.0),
- A very advanced search mechanism,
- Multilingual user interfaces (Turkish, English, and German currently),
- Multilingual and multicultural learning content,
- News and events content,
- Different view styles of metadata (tabular-, xml- and web-views)
- Tree view metadata entry to easily build LOM structured elements,
- Full LOM compatibility for interoperability between the systems,
- Learning objects which are specific to agriculture, food, veterinary, forestry and environmental sciences

As a non-profit learning technology system TrAgLor is just a product of a project funded for only developmental works. Therefore it needs financial and content support to make it is sustainable in the future. So we should try to develop some sustainability plans for maintenance and management of it. At the present, the system is being announced to faculties of agriculture, veterinary, food and forestry in Turkey, and the academic staff and students are invited to content contribution and usage for institutional and individual e-learning applications.

In the forthcoming versions of the TrAgLor, we also aimed that a number of Web based authoring tools will be developed to create the learning objects on the repository. Additionally some application best practices will be demonstrated to use the objects in building courses and packaging for sampled curriculums for the faculties of agriculture.

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