A REPOSITORY DESIGNED TO RAISE THE STUDENTS' KNOWLEDGE AND AWARENESS ON NANOSCIENCE AND NANOTECHNOLOGY

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Abstract. As defined in the information technology area, a repository represents a digital collection in which data is preserved and maintained in an organized and structured manner. This comes helpful for many projects that envisage sharing specific databases, files or resources for being accessed or distributed. More, several free and open-source software solutions for designing open-access repositories are available at present, having features very similar to the systems built for document management. Trying to implement such digital collection, as extra-readings and references related to Nanoscience and Nanotechnology area, in the frame of the LLP KA3-ICT project no. 511787-LLP-1-2010-1-TR-KA3-KA3MP: "Nano-Tech Science Education", it was set up a repository/database for being used by students, Science prospective teachers and teachers, as a part of a Virtual Lab, which represents the main project product - an experimental virtual aid created for Science education. The Lab mainly consists of experimental room, podcasting room and repository, and serves as a platform for Science lessons, as a database of teaching materials, and as a hub for science-learning-related graphic aids and recorded and illustrated appealing experiments on Nanoscience and Nanotechnology. Its repository includes articles, books, chapters, posters, videos, experiments, methodological documents which introduce in fact, actual findings and researches developed in different countries. Basically, the main role of the repository is to update the virtual lab users' knowledge and to raise their awareness on Nanoscience and Nanotechnology. The paper presents the features of the designed repository, its main services, and specific developments. As this is an instrument under continuous updating, the paper offers also a status of its actual structure and content.

Keywords: Science education, ICT tools, repository, database, Lifelong Learning Programme, NTSE Project.

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1. INTRODUCTION

Many free and open on-line communities of educational resources have been developed since the World-Wide-Web interconnected the whole Earth and revolutionized the way in which people can access the information. More than that, it offered new alternatives for instruction, teaching and learning, but also changed the paradigms of information storage. Nowadays, concepts like e-libraries, virtual libraries, warehouse or repositories become very common, being defined as digital collection in which data is preserved and maintained in an organized and structured manner. Various digital collections and repository programs are mainly oriented on developing specific structures and services with the view to support learning, training and research, managing the digital content, maintaining the infrastructure for storage and dissemination of digital objects.

At the same time, in order to create a valuable warehouse, there are several software solutions, known as commercial / open source digital repository systems. In the process of selecting of a specific system, relevant criteria have to be addressed. The criteria may vary (this depends on the requested features), but in general, they can be related to [1]: functionality, scalability, extensibility, interoperability, ease of deployment, system security, system performance, physical environment, platform support, demonstrated successful deployments, system support, strength of development community, stability of development organization, strength of technology roadmap for the future.

Several repositories have been designed in various educational projects. All of them contain organized and updated educational materials, documentation and other resources (tutorials, publications, researches etc.). The resources constitute a real help for students, teachers, trainers, researchers and managers, as meaningful means for their work.

In this respect, a digital collection - as a repository - has been set up for students, prospective teachers and in-service teachers, in the frame of the LLP KA3-ICT project no. 511787-LLP-1-2010-1-TR-KA3-KA3MP: "Nano-Tech Science Education (NTSE)", as extra-readings and references related to Nanoscience and Nanotechnology area.

2. THE NTSE PROJECT

The three years *NTSE* project has gathered 6 institutions from 5 countries (Turkey, Romania, Bulgaria, Greece and Italy) and aims to use ICTs as tool to make the learning of Science subjects more attractive and accessible. It is specially addressed to students from the general and vocational schools, university students who attend Science education courses, pre-service and in-service Science teachers. More, the project set up a special virtual space which consists of a web-platform for Science lessons (*Virtual Lab*) that includes a multimedia database of teaching materials - mainly experiments and educational video-clips related to Nanoscience and Nanotechnology [2].

The main project objectives are oriented on [3]: (a) encouraging students to learn about Science / Nanotechnology and to be engaged in explorative and relaxing Science learning through experiments and activities; (b) making Science teachers more enthusiastic and able of using ICT in their classes; (c) encouraging the university students (as future Science teachers) to promote the Science knowledge with the support of ICT.

In this context, ICT become a key instrument having as main role to prepare students for solving particular Nanotechnology challenges, even in the frame of a curriculum which is not designed to address certain Nanoscience topics. As a main product, the developed *NTSE*

Virtual Lab offers specific parts equipped with simple and attractive video-simulations suitable for being included in inquiry-based scenarios which encourage the learners to think about *nano* processes and phenomena, to find solutions and exchange information through specific channels (*blog*, *video-conference*). The *Virtual Lab* particular sections are: *Home*, *Experiment room*, *Podcasting room*, *Repository*, *Blog*, *Glossary*, *Competition room*, *About*, *Help*.

3. THE NTSE REPOSITORY

As a specific deliverable of the project, included in the *Virtual Lab*, the *NTSE Repository* (also accessed at: http://ntse.ssai.valahia.ro) has been designed as a virtual database that contain extra-readings and references related to *Nanoscience* and *Nanotechnology* area. It proposes special sections that include articles, books, chapters, posters, video-clips, experiments, methodological documents, useful for students, prospective teachers and in-service teachers, who can consult the items and use them as educational materials. More, the role of this warehouse is to update the *Virtual Lab* users' knowledge and to offer a collection of interesting educational materials, with the view to raise their awareness on Nanoscience and Nanotechnology.

Different systems were considered for implementing this application. In this sense, open source specific software was analyzed: *DSpace* ("a turnkey institutional repository application" [4]), *EPrints* ("a flexible repository software" [5]) and *Fedora* ("a common repository software" [6]). Finally - considering the *functionality* and *scalability* criteria -, the *EPrints* solution was adopted: a free professional software platform for building high quality *OAI*-compliant (*Open Archives Initiative*) repositories.

The *NTSE Repository* interface (Fig. 1) provides to the users basic services like: *repository browsing*, *searching tool*, *list with the latest added items* etc. The users interested for uploading items in the repository must be registered, but the registration procedure is simple following the "*Create Account*" interface steps. After the process of registration, the user can edit his/her own profile by specifying the name of the organization, the working department, the home page URL, but also other information. After the login process, a list with the items uploaded by the current user is browsed. All the items uploaded in the repository can be retrieved by year, subject, author, using the "*Browse*" menu.
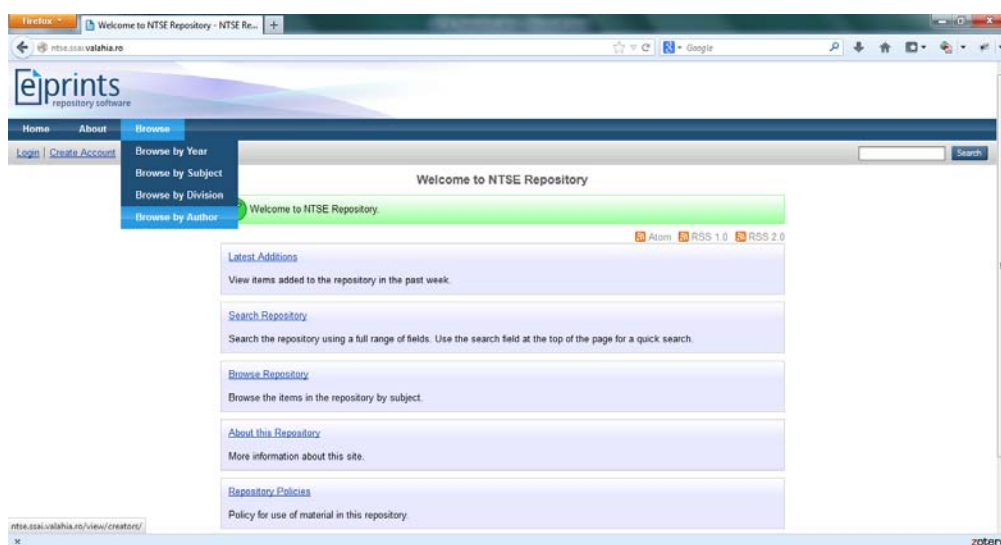

Fig. 1. The *NTSE Repository* interface (http://ntse.ssai.valahia.ro).

Fig. 2 illustrates the results obtained after a browsing action related to a particular author. The whole list of subjects is predefined and represents the *Library of Congress Classification* [7] and the sub-categories are automatically generated when an item is linked to a specific subject.
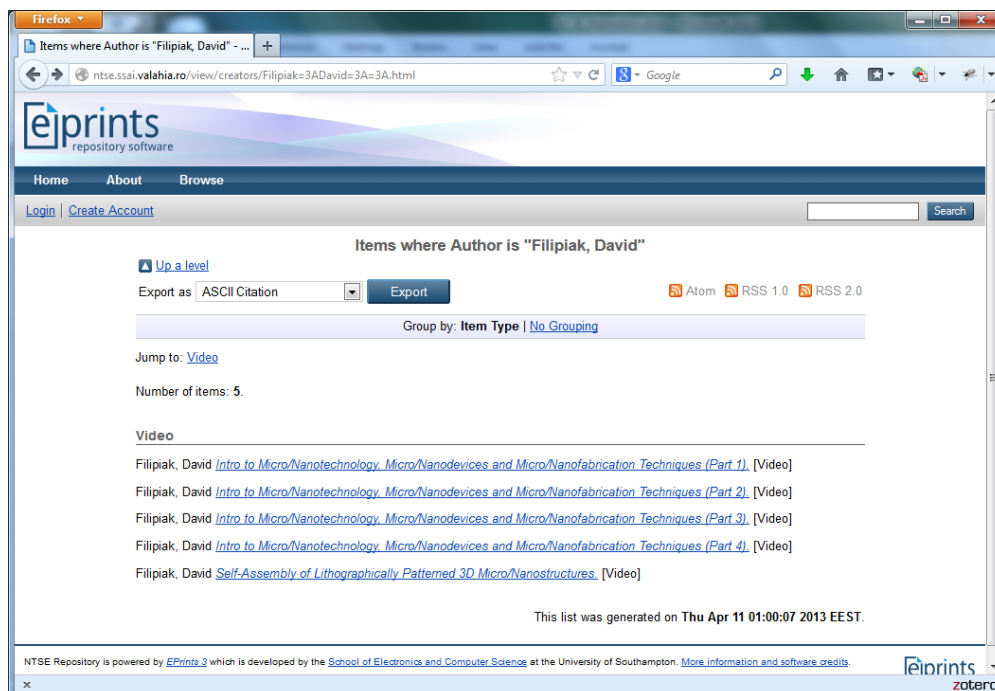

Fig. 2. Results of a browsing action related to a specific author.

The searching tool can be used for a simple or advanced search. When the advanced search is used, the user can introduce the searching criteria in a specific web form (Fig. 3).
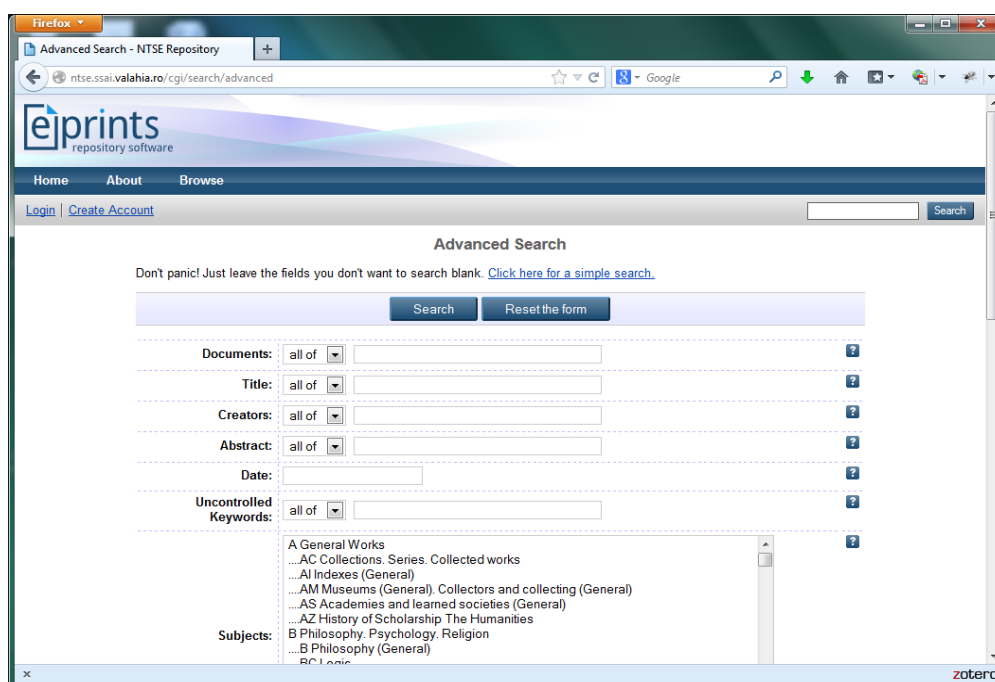

Fig. 3. The *Advance Search* interface.

This action can be performed by taking into consideration a series of metadata fields like: document terms, titles, creators, subjects, item type, editors, item status etc. Fig. 4 illustrates the results obtained after a searching action, using the *item type* criterion.
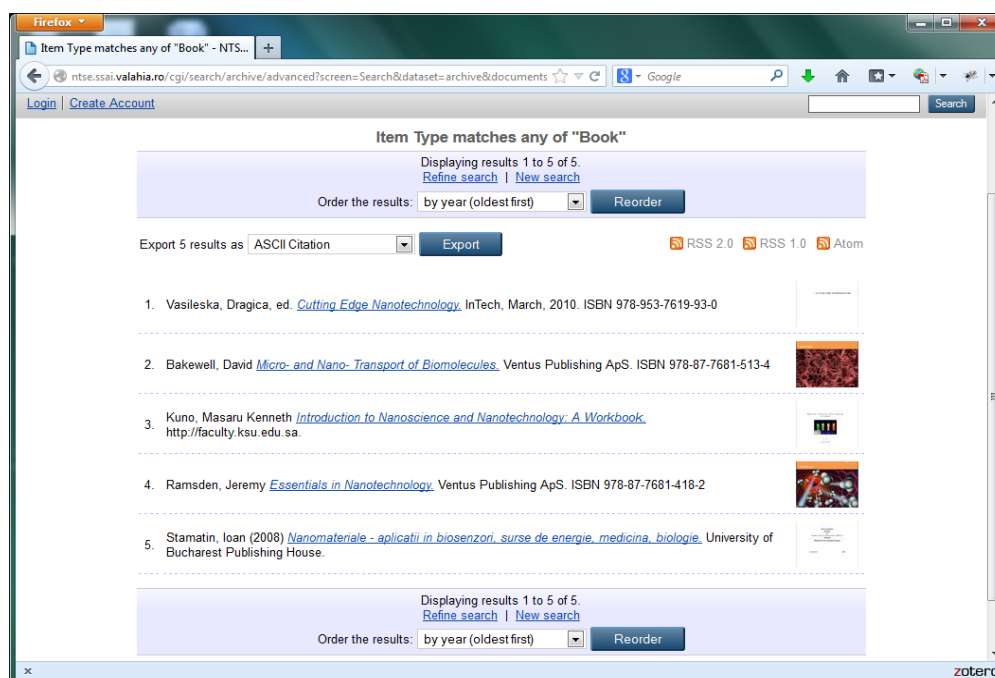

Fig. 4. Results of a searching action using the *item type* criterion (*book* - in this case).

A simple click on a selected item offers the opportunity to visualize the type of the recorded object, related subject, depositing user, uploading and last modified date, specific URI, but also the possibility to view the item (Figs. 5 and 6).
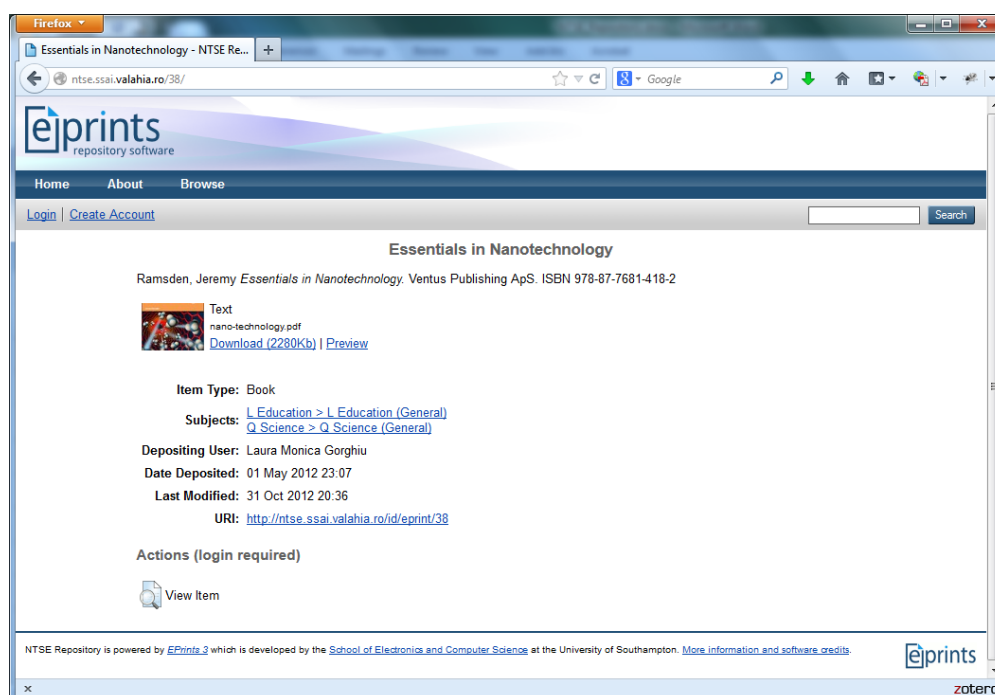

Fig. 5. Specific information window related to a recorded item.

An uploaded item is published in the repository only if this has been approved by an editor. The editors are powered users that perform a reviewing of the items and they can modify the metadata fields of an uploaded item.
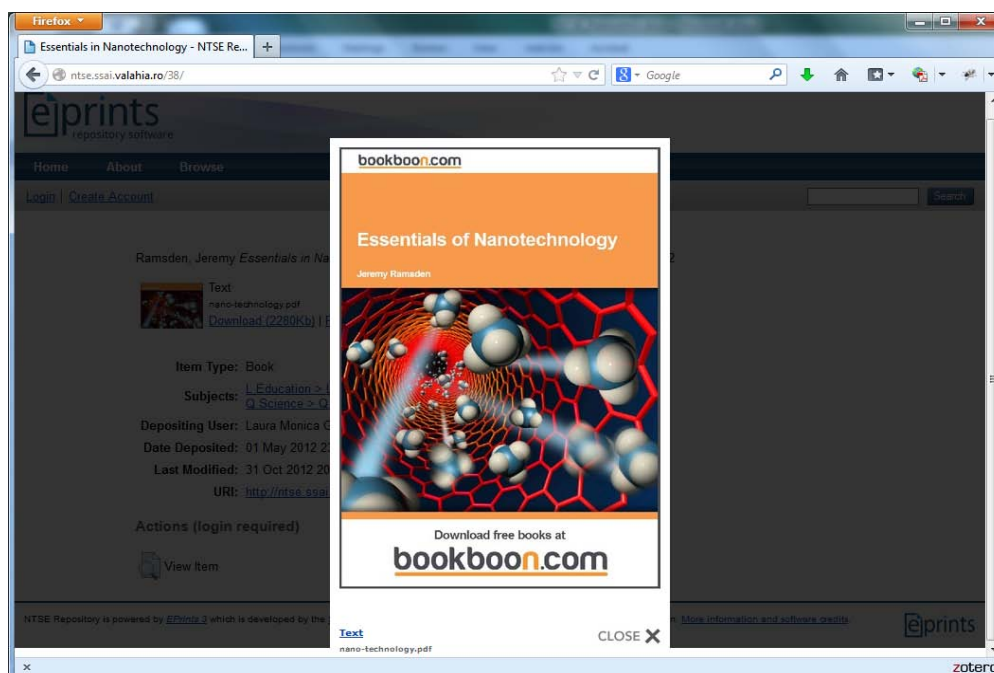

Fig. 6. Access to a recorded item from its specific information window.

The *NTSE Repository* is linked from the *Virtual Lab Experiments Room*, providing specific resources related to the topic of the proposed experiments. In this respect, more information is available to students, in order to raise their knowledge and awareness on Nanoscience and Nanotechnology.

4. CONCLUSIONS

Repositories represent virtual places in which data is stored and maintained, having the format of an extended database. The *NTSE Repository* was set up as an ICT tool which includes extra-readings and references related to *Nanoscience* and *Nanotechnology* area. The scope of the repository is to offer access to digital resources organized in specific categories. Related items as articles, books, conferences, video-clips, teaching resources, represent a welcome support for the students, prospective teachers and teachers who want to enlarge their knowledge in the *Nano* area, but also to use the included resources in their learning activities.

Near the open access which is a crucial issue, the students - as one of the main beneficiaries - have at their disposal an important learning resource that comes with real advantages in terms of cost-efficiency ratio and provides facilities for optimal retrieving of necessary information in a large collection of *Nano* digital objects.

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