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An Online Knowledge Gateway for Industrial Design Education and Research Activities

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1. Introduction & issues

This poster presents the development of DesignNet, a knowledge-based project to the online digital display, retrieval and archiving of rich media resources for industrial design education and research. The project addresses the needs of end-users (teachers and students) and content providers interacting with the School of Design of the Politecnico di Milano. It moves from the assumption that conventional modalities of archiving and presentation currently adopted by the Politecnico and other academic institutions are not coherent with design teaching. Typical outputs of industrial design process are in fact 3D models or 2D graphics (digital and/or physical), not just texts or simple images. The challenges, philosophy and methodology in creating this evolving Web-based, cataloguing, multimedia knowledge-base of Virtual Reality and textual design resources are discussed, along with description of the related system and prototype.

Traditional cataloguing standards or automated search engines are not efficient with files such 3D models and 2D graphics. Their performances degrade with multimedia data, as they have not been created to be catalogued and their textual information are implicitly contained but not explicitly declared. Design knowledge is mainly iconically manifested and manipulable, thus most of present resources resulted "invisible" and did not have a defined and organized location through time. Easy usability, transfer and visualization of such data were identified as main goals of the project. Furthermore, as such resources are in large quantities and in constant evolution, we needed an open, integrated and collaborative structure, with multiple levels of description and the possibility of regular checking and updates.

2. The system

DesignNet gateway features a searchable, browsable database of high quality resource collections and services, recognized cataloguing and indexing standards and specific interface modalities. The application profile schema used in the project is based on Dublin Core Qualified, chosen because of its flexibility and simplicity.

Selection and definition of Dublin Core schema for the project has been experimentally led testing different schemas with content providers (departmental and interdepartmental laboratories and archives and the Permanent Design Collection of the Triennale Foundation of Milan).

The recently released OAI Version 2.0 of Protocol for Metadata Harvesting is being investigated for interoperability issues, although we are aware that this will result in a loss of the detailed qualification that has been done within the project.

In order to provide a unified integrated access, a in-house Italian Thesaurus for Industrial Design has been manually developed using terms and classes from specific domains. This term-based approach was preferred as it improves the precision for descriptions and subject access to resources, enabling more updating, exhaustiveness, specificity and flexibility than classification and subject headings. We referred to ANSI/ISO standard, Dewey Decimal Classification, manuals and pre-existing thesauri. The School of Design community was also actively involved for term selection and class organization, according to the main issues occurring in the creation of a design project.

Parallel to the thesaurus is the elaboration of authority files of companies, institutions and relevant people of the design world, periodically updated. We are also planning the use of Visual Retrieval Techniques for the automatic description of shape, scale and colour distribution of large set of 3D files, as a complementary tool to browse the repository.

A crucial problem of heterogeneous resource collections in Web-based applications, often preserved in different repositories which have adopted different standards and formats, is their management and visualization with a homogeneous interface. In the DesignNet system, metadata are associated to resources inside a RDBMS with a Web interface

appositely created. This allows effective information retrieval and manipulation through exploitation of Java and XML, access to metadata but also to the very same resources. Visualization is supported by previous selection of current available standards (PDF, JPEG, VRLM, MP3, Real, QuickTime), turning raw files into deliverable products to assure their portability on different platforms.

3. The prototype's implementation

Within those general workflow and conditions a first prototype has been implemented. The heart of multilayered structure DesignNet Metadata Management System is DesignNet framework, based on a J2EE platform and on a Dublin Core Metadata Schema structure. The framework is a set of tools which enables to create, catalogue and search items recorded within the database. Content is collected, selected and processed with metadata creation and validation. The Industrial Design Thesaurus is both an information storage and retrieval tool. It's used by indexers as a listing of words and phrases authorized for use, showing with relationships, variants and synonyms. For searchers it's a aid to navigation and retrieval, sitting behind the search interface.

An input tool with HTML form allows content providers and project team members to: create new records, search and browse existing ones, verify and give them authority, update them when needed. A RDMBS repository stores the records and a application provides a searchable and browsable interface using a Apache 1.3.9 Web server. The database can support queries based on terms from the Industrial Design Thesaurus, authority files, Dublin Core Elements and Qualifiers. As the framework has been built to be flexible, at any time tables can be added or deleted without having to change the entire schema of the database.

In order to represent semantic values while searching documents, dynamically build schemas provide to help users in the retrieval and to evoke the context of the searched resources, in terms of quantity and typology. The system shows users their search path, stirring up a major consciousness of the researching context and methodology. Moreover, there are some features to trace our activity: tags can be used to insert an object into advanced bookmarks listed by category or related to a real project. Users can see this tag and ask the system such information.

The system features a single point of entry for the user to cross-database digital resources; knowledge-based retrieval with dynamic visualization; advanced search and browse functionalities. Also available are: documentation for DesignNet Team members and users (with glossary, resource selection criteria, metadata manual, progress report, publications); online white-boards for message exchange and e-bulletins for user feedbacks; maps of people competences; sections with on-going projects and latest resources added; conference and events notice board to promote Italian design knowledge; electronic forum for linking students, researcher and professionals for training, long term partnerships, research activities; possibility of sharing files with others on the Internet through upload and download.

Documentation and references of the project are available at www.designet.polimi.it.