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Data Modeling for Tools and Technologies for the Analysis and Synthesis of NANOstructures (TASNANO) Project

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ABSTRACT

The main aim of TASNANO project is to focus on the development of a web-based system that allows cooperative work between partners. Even if some commercial tools become available, the specificities of nanotechnology applications suggest implementing an ad-hoc tool. This approach permits to update information every moment, so that not only the latest versions of the documents are always available, but also the raw experimental data are shared in a protected environment. Organizing big amount of data begins with modelling of conceptual schemes, which individualizes entities involved into the project and links between them. The rules' application of logic modeling leads to the production of a logic scheme. The model allows the data base design, which can be enlarged and enriched preserving coherence and avoiding redundancy. Data and information can be directly treated on the web in accordance with latest modifications. [Article copies are available for purchase from InfoSci-on-Demand.com]

Keywords: *Cooperative Work; Data-Base; E-R Diagrams; Nanotechnology; Web-Based Information System*

INTRODUCTION

Carrying out research projects involving many groups located in several different places and countries originates data and information sharing problems.

This is the particular case of the research project "Tools and Technologies

for the Analysis and Synthesis of Nanostructures" (TASNANO) founded by the European Community within the thematic area "Nanotechnologies and nano-sciences, knowledge-based multifunctional materials and new production processes and devices" of the Sixth framework.

The overall aim of this project is to develop a set of nanotools, based on parallel modules - scanning proximity probes (PM-SPP) (Lehenkari 2000), for analysis, synthesis and characterization purposes both at the molecular and atomic level (Mackie 2000). Different fields of application have been selected within the project a specific nanotool is been designed and fabricated for each of them. Some examples of the application are molecular switches, quantum computers, nano-patterning, low-cost high resolution soft nanolithography, chemical sensors and biosensors (Tseng Ampere 2005). The wide range of potential applications of the nanotools that will be developed is expected to create market opportunities inside and outside the European Community.

To reach this overall aim four complementary Work Packages, each one having a specific goal, have been defined. NamelyWork package I focused on the fabrication of massively parallel Nano-Electro-Mechanical Systems (NEMS) with integrated piezoresistive readout, Work package II focused on the production of analog and digital data path electronics, nano-position stage and experimental micro-chamber, Work package III focused on the functionalization cantilevers and/or tips, and Work package IV aims to provide a systematic testing and an interactive evaluation of the developed prototypes of nanotools with exchangeable multi-functionalized probes.

In order to achieve the goals described above, the integration of different expertises, including micro- and nanosystem technology, chemistry, surface science, biology, electronics, data processing and systems engineering, is required. Moreover, standardized procedures and protocols have to be followed by all partners in order to set up a common and cooperative strategy of work. This strategy and the use of an efficient information exchange among partners are the key points in order to optimize the integration of the different background. These are present within the project and the data that will be generated.

For this reason it is very important to clearly structure and organize the information, so that redundancy is avoided, data consistency is assured and data communication is encouraged.

Data sharing can be achieved mainly in two ways: either by directly connecting the database (both in a centralized and in a federated way) or by using a web-based model. The direct connection is easy within a Local Area Network (LAN), but in this type of projects where partners are spread over Europe direct connection is not feasible. The only possible alternative is to set up a set of Virtual Private Networks (VPN) between the LANs of the involved partners. But this solution is quite difficult to implement as in order to set up VPN correctly public addresses are to be known and, in many cases, these technicalities are not under the direct control of the partners of this project, who are often not directly involved in the communication structure of their laboratories (Comer 2006).

The solution we propose is a web-based model - a versatile and low-cost way to enable distributed collaborative work, in which the generic user can access data from a remote emplacement within a secure envi-