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EUDEM2: Overview and Some Early Findings

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EUDEM2:

Overview and Early Findings

After the overwhelmingly positive feedback and encouragement in response to the EUDEM1 project, work on EUDEM2 has begun. This article describes the second version of the EUDEM study and some of its initial results.

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Introduction

The EUDEM2 project found its existence as a follow-up activity of EUDEM1, which took place in 1999. EUDEM 1999 was a small-scale and limited study the Vrije Universiteit Brussels Department of Electronics and Information Processing (as coordinator) and the Ecole Polytechnique Fédérale de Lausanne (EPFL), Laboratoire de microinformatique (LAMI) department carried out on behalf of the European Commission (EC). The study lasted for six months and resulted in a web-based database of contact persons and actors active in Europe in the domain of humanitarian demining (HD) and a report on the "State of the Art in the EU [European Union] related to Humanitarian Demining Technology, Products and Practice."

Ever since this project ended, many echoes were heard demanding to continue this study and to further elaborate it since it was a first attempt at providing an overview of activities in Europe in this field. The report[1] also provided an overview of technologies developed or under development in different research centers, university laboratories and some commercial companies. The pros and cons of each technology were analysed and presented taking into account the relationship between cost and effectiveness. The report also gave some insight into the personal conceptions of the actors by providing a set of 50 face-to-face interviews[2] that had been conducted during the project. These interviews explained the views of industrials developing equipment for HD, research institutes, academic researchers from several European universities, some end-users (represented by European non-governmental organizations [NGOs]) and some donors of funding for both research and mine action assignments, or national governments from some European countries. An overview is provided below of the interviewed organizations, classified into different types.

Table 1: Overview of organizations interviewed.

ORGANISATIONS	TYPE	# Interviews
Industry	Equipment manufacturers (for HD)	6
	R&D	9
Operators	NGO	3
	MAC	4 (Geneva, Croatia)
	Commercial	2
Research centres	Supra-national	2 (ISL, JRC)
	National	7
University laboratories		4
Government agencies	**MOD, Foreign Affairs, Development Aid**	5

At the end of 2001, the new EUDEM2 project was approved by the EC as a support measure in the fifth framework. The new project was started in the beginning of 2002 and has run for one year. After the initial intensive effort to elaborate the web pages, a second intensive focus will be placed on the foreseen visits to the European players in HD and the study of technologies currently on the market, under development or with potential for future developments.

EUDEM2: Aims

EUDEM2 is not only meant to be a follow-up of the results obtained during the EUDEM1999 study, but intensified results are expected on a much longer term (three years) and broader scale. The EUDEM2 team has expanded; next to the two previous academic partners, a third one was added, namely, the Gdansk University of Technology, Department of Medical and Ecological Electronics (MEED) department. The third partner is responsible for certain specific tasks in the consortium, which will be elaborated further in this text. Next to the additional partner, the EUDEM2 team was reinforced by an advisory panel that follows the developments of the team and guides and assists the team by providing advice and information. The advisory board consists of representatives of research, commercial companies, governments or donors, end-users and military representatives. The advisory panel meets with the EUDEM2 team several times per year and is not only guiding and advising the team on a regular basis but also assists and supports the annual workshops organized by the EUDEM2 team.

EUDEM2 aims to support ongoing research and development (R&D) of technologies that could assist mainly the European research community, the EC and technology developers by offering them a constantly up-to-date overview of results and achievements in the domain, but the focus of data provided is larger than just Europe. Bridging the gaps between the research world, the military expertise, the actual practice in the field and the commercial developers by providing information to avoid duplicating efforts is the key to the success of the project. Next to this central and most important aim, the EUDEM2 team wishes to bring the aforementioned players together on a regular basis to create synergy and cooperation possibilities. Furthermore, the team searches for new technologies not currently used in HD that show potential for the future and could not only quicken HD activities, but make them safer and more efficient as well.

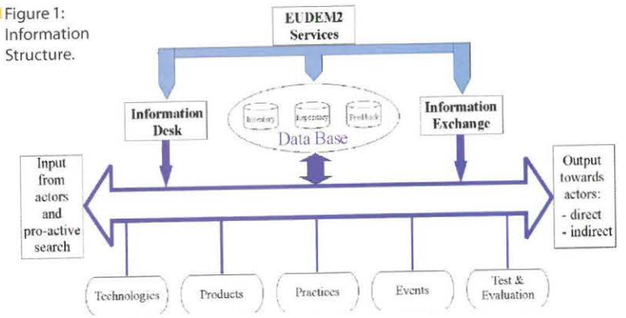
Working Methodology

EUDEM2 Web Pages

In order to fulfill these aims, a new web-based database was created to replace the older EUDEM1999 database of contacts. Initially the new database was furnished with updated information from the EUDEM1999 report and database of contacts, but since March 2002, a completely new and much more elaborate version of it has been available online at http://www.eudem.vub.ac.be. Data in this database have been searched for in the scattered set of information that is available on the World Wide Web today, via recent or key publications and through other scientific material that is available on the subject. All data on the web pages have been analyzed and verified before being integrated into the database. The web pages are presented in a user-friendly way and are continuously updated as new valuable information is found. The information is structured under five different categories as shown in Figure 1.

Each class of information is linked with all the others through a set of indexes defining the relationships between the objects as described in the scheme depicted in Figure 2. The database is not only used to store flat data structures and facts, but will also support more complex relationships between them and explicitly incorporate general knowledge about the objects described. A given organization is, for example, active in a given technical activity, and participating in several projects whose publications can be listed. The figure shows the link classes that build up the relationship between the classes and hence the navigational structure of the application.

Figure 1: Information Structure.



All topics are interrelated with each other in order to provide the users of the EUDEM2 site a clear and complete overview of the available information. Along with these easy navigation tools, a search engine to facilitate quick and easy retrieval of sought information and a "What's New" section were added to allow the user to easily locate new items without going through all the pages.

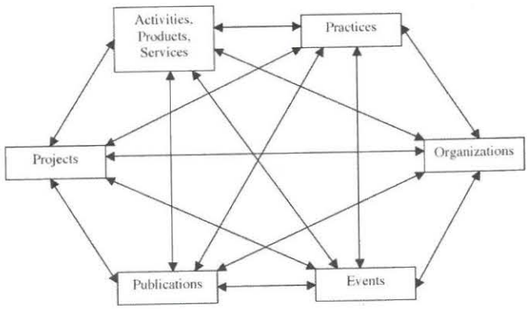
Face-to-Face Interviews

One has to understand that face-to-face interviews guarantee a more effective means of gathering information than questionnaires and open the road for bi-directional information exchange.[3] Coupled with a face-to-face interview is an on-site visit, with a better understanding of the real-life situation within the organisation and the possibility to collect (in person) extra information (brochures, presentations, data on CD, etc.).[4]

Although the cost for interviewing face-to-face is significantly higher than for video- or teleconferencing, it seems necessary to speak to representatives of organizations in person in most cases.[5] Setting up appointments for video- or teleconferencing is as time-consuming as face-to-face interviews, and the former are less trustworthy since people often have unforeseen issues that require urgent attention. It is easier to reschedule video-conferencing than personal visits for the interviewee. Coupled with that, not all organizations involved are equipped for these kinds of interview techniques. Most importantly, people tend to give more details when you are in front of them than when they are called. Documentation is collected in an easier and much more efficient way in person than through promises to send it, as this tends to be forgotten or delayed in many cases.

In order to facilitate analysis of the data collected during the interview, the skeleton of the interview consists mainly of the following setup. An interview is always started by giving the interviewee a short introduction of what our survey consists of and for what purpose it will be used. Consequently, a brief overview of the interviewed organization is asked for. This part is followed by an attempt to clarify the involvement in HD activities. A brief discussion is held on the past and current activities of the organization. Most emphasis is placed during the interviews on the personal opinion of the interviewee with respect

Figure 2: EUDEM2 Database Conceptual View.



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to a certain technology and/or practice.

When specific projects—not necessarily directly related to HD—are discussed, the interviewer tries to identify the following:

1. Project aims
2. Maturity of the different technologies involved and corresponding cost estimates
3. Testing procedures
4. "Transferability" of the developed techniques to different aspects of HD
5. Technical specifications of the equipment, performances in certain circumstances, compatibility between different techniques, degree of success in the field
6. R&D activities and strategies, research funding and commercial perspectives[6]

Whenever time is available, it is a pleasure to talk about diverse topics of interest in a non-structured way. It is obvious that according to the type of organization to be interviewed, topics discussed during the interview need to vary, but to a limited extent. In order to make it easier to analyse an interview, a rather rigid structure is necessary. Also, interview content needs to be approved by the interviewee prior to publishing. This needs to be completed fairly quickly (one week or 10 days at most) after the interview itself.

The questionnaires have been adapted according to the type of organization interviewed and focus has been shifted from topics of relevance, but following the same line of thinking and structure. Three different categories and questionnaires have been drafted for:

- Industrial Companies/Equipment Manufacturers
- Research Centres/University Labs/Governmental Agencies (e.g., Ministries of Defence (MODs), Foreign Affairs, Development Aid [R&D-related])
- Operators: NGOs, Mine Action Centers (MACs), Commercial/Governmental Agencies (e.g., MODs, Foreign Affairs, Development Aid [Mine Action-Related])

Although the setup of the questionnaire is open-ended at several places, a certain number of questions can be evaluated as quantitative data, which greatly facilitates the analysis and leads to more objective results. The open-ended questions will be evaluated but will be presented only as summaries.

The Technology Survey

One of the main aims of EUDEM2 is to carry out a broadly scoped and in-depth technology survey. The technology survey activity will be carried out worldwide, through literature analysis, direct contacts and participation in international conferences.

The study of some of these individual technologies will have to be coordinated with the new emphasis on the status of past/current R&D projects (overview of ongoing research), in particular the EC-financed ones, and the possibility of enhancing currently available equipment, as previously mentioned. It is foreseen to:

- Summarise the state of various R&D projects, for instance under the format of a header with information on the state of the art of certain technologies (see also North Atlantic Treaty Organization (NATO) activities and a corresponding four-year study).
- Establish a clear terminology and go for a proper classification, distinguishing for example between Research (product/system five to 10 years), Development (less than three years), Verification (less than one year), and Production (now), i.e., according to the state/stage of maturity.

The implementation of the EUDEM2 Technology Study (running obviously in parallel to continued information gathering and analysis) will be carried out as follows:

During the first year, the project's partners will concentrate in particular on their respective fields of interest, e.g., metal detectors, soil response, geophysics and medical physics, R&D in central/eastern Europe.

During the second year, the choice will be restricted to a few (two to three) technologies of interest and identification information niches (e.g., patents). The gathering of information on the status of past/current R&D projects will be started. After this stage the projects team will (1) Analyse the chosen technologies, (2) Deepen the understanding of the past/current R&D projects and (3) Prepare the "Technology Survey Report 1."

During the EUDEM2-SCOT conference that will take place in September 2003 these ideas will be presented, and if possible, findings will be discussed during some dedicated sessions.

It is generally known that without help and inputs from the representatives from the HD communities, most studies are not valuable at all. Therefore the EUDEM2 findings will be confronted with the opinions of representatives of the end-user community, the military community, the research community and the technological community at all times.

Overview of the Work Done up to February 2003 and Beyond

It was decided that up to the end of 2003, the project's partners will concentrate on their respective fields of interest, in particular, those listed below.

As for metal detectors (electromagnetic induction devices), an analysis of patents as a valuable complementary source of (technical) information on the most diffused sensor for HD applications has been conducted. The course of action will be as follows: classify and analyse the most important designs in more depth, make individual patents available on a CD-ROM linked to the main document, publicise the study on the EUDEM2 web pages. After this, a study of possible new sensor combinations involving metal detectors will be conducted.

Electromagnetic geophysical sensing methods (Electrical Well Logging, Galvanic Resistivity, Magneto-Telluric Resistivity, Telluric Currents, Induction, Radio Wave and Induced Polarisation) are also being analysed in depth. Furthermore, R&D on HD-related items or on technologies with the potential to be transferred to HD, with a first focus on R&D carried out in central/eastern Europe is ongoing.

At present, soil parameters are often not sufficiently considered in HD-related scientific publications, although their knowledge is really needed by the end user to be able to predict the detector's performance in situ. This is true not only for electromagnetic properties, but also for example for neutron or vapour sensors. Knowledge of these characteristics could lead to combined soil maps, which could allow assessments to be conducted a priori to determine the portion(s) of contaminated land on which a given sensor is likely not to work satisfactorily. This study is ongoing. Also, some Ground Penetrating Radar (GPR) and Electrical Impedance Tomography (EIT) studies are ongoing.

Interviews with some of the key players in Europe have been started, but it is too early to communicate results because the current sample size set of data is still too small.

The EUDEM2 team has been and still is keen on collaborating with other organisations that are active in collecting technology-related research for HD. Active collaboration with a German investigation of technologies currently under development resulted in a preliminary set of structured lists of equipment being developed at the moment. Further elaboration of these lists could result in a well documented catalogue.

Next, further collaboration with other information collecting initiatives was launched and will be elaborated. Contacts were made with the Mine Action Information Centre (MAIC) of James Madison University (JMU), USA; Action for Research and Information Support in Civilian Demining (ARIS) of the Joint Research Centre (JRC), Italy; and the Geneva Centre for Humanitarian Demining (GICHD), Switzerland.

This support activity consists mostly of replies to mail enquiries, phone contacts and meetings. The Help Desk has been up and running since the start of the project, and it advertised on the EUDEM2 website. The Help Desk provides the user with a direct reply when necessary; otherwise the queries are redirected of to relevant persons/web pages. During the first year of the project, the Help Desk service received five to 10 requests per month; since January 2003, the usage has slightly gone up. The complexity of the queries varies a lot, but the satisfaction of the users is rather high. More than 50 percent of the users give as feedback that they are satisfied with the replies received.

There were intentions to build a special page with frequently asked questions (FAQs), but the questions are rather diverse and often require personalised and therefore rather individual replies.

Two EC Cluster Meetings have been organized, and a third one took place in March 2003. The EUDEM2 team has provided help in defining the themes of these meetings, identifying possible speakers, sending invitations to the speakers and reporting on the Cluster Meetings.

One of the aims of EUDEM2 is to share information and bridge gaps between the different players in HD. The original project proposal contained plans to organise yearly focused technology workshops where a limited number of key people would sit together and try to come up with some recommendations for future R&D. It was decided to organise a workshop in project years one and two with a limited audience, to organise a large-scale international conference in Brussels in September 2003. The initiative is a joint venture between the Society of Counter Ordnance (SCOT-USA) and EUDEM2. The International Conference on Requirements and Technologies for the Detection, Removal and Neutralization of Landmines and UXO will do the following:

1. Provide an international forum of exchange between researchers and end-users, allowing for comparison of performance, related cost and time-to-market of the proposed solutions.
2. Assess the current state of research in demining technologies.
3. Develop means for future international collaboration within this context, while taking into account end-user perspectives and requirements.

More information about this forthcoming event is available at http://www.eudem.vub.ac.be/eudem2-scot/.

Some Early Findings and Conclusions

Call for Collaboration

Although the HD market is very small and shrinking, as some claim,[7] and activities are mainly focused on research rather than on development a lot of activities take place in several research labs all over the world. It seems that most of these activities have no connection at all with other initiatives, and therefore, the first and most-needed point of action would be to join the efforts with other organisations that carry out similar research and work together instead of next to each other in small corners. This could lead in the first place to enormous savings of the scarce funding available. Also, duplication of activities would be obsolete and results would be sped up, and in the end, most importantly, this would also save lives.

Future research needs to focus more on the integration of what has been done in research for HD up to now. How can what has been researched and developed as prototypes be taken into the field? We should focus on a distillation of the best items of all systems and merge them in new concepts or systems that are easily field-able. It is now time to move to development; there is no need to further research new sensor systems.

Emphasis should be placed on technologies and applications, currently available or under development from within the Information Technology (IT) sector. Current equipment needs to be elaborated further but should ideally adopt some IT solutions into its system. Our daily use of high-tech equipment like global positioning systems (GPSs), satellite use, palm tops, etc. should be visible in the R&D of technological solutions to the mine problem as they could provide radical changes in HD practices today!

A lot can be said about technologies that have a dual or multiple purpose or use, but this is what the high-tech tools for HD should provide in the future. This would tackle the problem of the small and shrinking market and could open a world of new perspectives for all players involved.

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**All graphics courtesy of the authors.*

Endnotes

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