

Project acronym: DustBot

Project full title: Networked and Cooperating Robots for Urban Hygiene

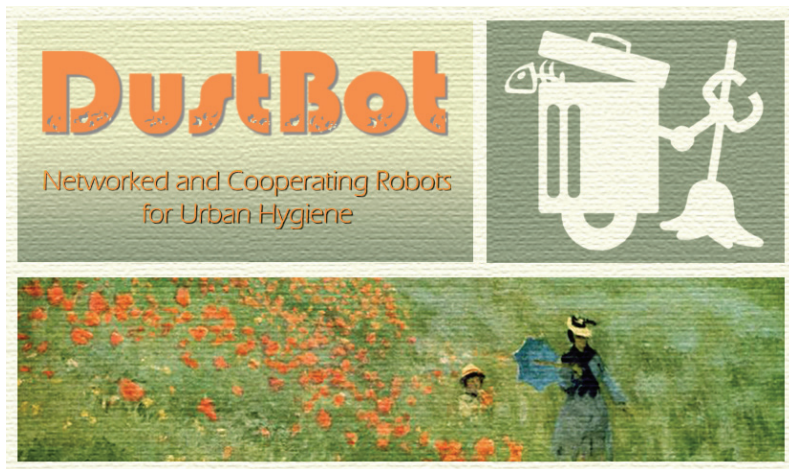
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(PU = Public; PP = Restricted to other programme participants; RE = Restricted to a group specified by the consortium; CO = Confidential, only for members of the consortium)

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1 WP9 Objectives

Dissemination activities aim at the transfer of knowledge coming from DustBot results. They will be performed in strict relation with all the technical activities, addressing the promotion of knowledge and awareness regarding Robotics, ICT and Aml solutions for the urban environment management. All Partners contribute to the Dissemination activities according to plans set-up within the project.

The dissemination of knowledge is addressed both at scientific level and at public arenas. European policy makers, scientists, commercial users, public health services, will be addressed with the information on global solutions for urban management applications, while industrial robotics and ICT players will be addressed with the most relevant technical and viable outcomes. The most relevant scientific and technical results achieved within DustBot will be published in international refereed Journals of the different fields addressed.

A detailed procedure will be defined by the Intellectual Property Rights (IPR) Committee, constituted by some DustBot partners, that has to be followed by the partners before to submit a paper to Scientific Journals or Reviews and Conferences in order to raise awareness of Intellectual Property issues and to provide any relevant information which may be of assistance to partners with Intellectual Property queries or concerns.

Specific activities for the dissemination are identified as follows:

- SubTask 9.1.1: Participation in the most important Conferences on the fields of DustBot interest, in order to promote and present the objectives and results achieved within the project (IEEE ICRA, IEEE IROS, IEEE/EMBS BIOROB, EUROSENSORS, IEEE SENSORS, etc.).



- Organisation and participation in Workshops and Open Days for putting in contact DustBot technological partners and end users
- SubTask 9.1.2: Organisation of a Concertation Meeting aimed to enable exchanges, discussion among the IST-Advanced Robotics funded projects. The meeting will focus on common technologies and challenges across projects, supporting creation of synergies, and avoiding duplication of work
- SubTask 9.1.3: Preparation of scientific publications, Press Briefings and Press Releases
- SubTask 9.1.4: Participation in working groups of the EU robotics networks and Technology Platforms (e.g. EURON, EUROP)
- SubTask 9.1.5: Preparation of the Public Project Website and Project Brochures
- SubTask 9.1.6: Preparation of a DustBot Newsletter
- SubTask 9.1.7: Dissemination of knowledge in industrial forums (Robotics, ICT, and Environmental Communities, etc.).

The effective dissemination of the project results through publications in International refereed Journals, participation in and organization of Conferences and Seminars on the different fields addressed will allow adequate placement of the project methodology and results in the International scientific and technological state of the art.

In order to promote the benefits from Robotics and ICT to the improvement and management of urban environment quality, the dissemination of knowledge will be addressed not only at scientific level but also at industrial and public arenas. Environmental-industrial communities and public health



services will be addressed with the information on global solutions for specific applications, while industrial Robotics and ICT players will be addressed with the most relevant technical and viable outcomes.

2 Dissemination through Web site

The DustBot Web site has been set up and published on 20 December 2006 at the following address: www.dustbot.org.

The home page of the official project Web site contains the following information of public interest (see Figure 1):

- The project information.
- A description of the main objectives of the project.
- A brief description of the partnership.
- The presentation of some news related to the project.
- A brochure of the project and some copies of press releases, available under the section Dissemination.
- A section dedicated to the Users' Club.



Fig. 1 – The DustBot Project Web site Home page

Additional features have been implemented in the Web site with the aim to support the cooperative work among the project partners and facilitate the exchange of data within the DustBot Consortium. In particular, a members' area has been designed and developed with limited access, in which all the private documents of the Consortium have been uploaded. The access to this area is protected by private credentials (i.e. username and password), assigned to each responsible partner of the project and to the Project Officer: when accessing the members' area, the web browser prompts the user to insert its own username and password for authentication. If the user is not identified by the automatic system, the access to the members' area is denied, otherwise the user is allowed to access and download all the Consortium documents.

This area includes the following folders:

- Deliverables
- IPR
- Official documents
- Templates (for reports and PPT presentation)
- Logos and Pictures
- Meetings
- Reports

Figure 2 shows a snapshot of the main page of the members' area.

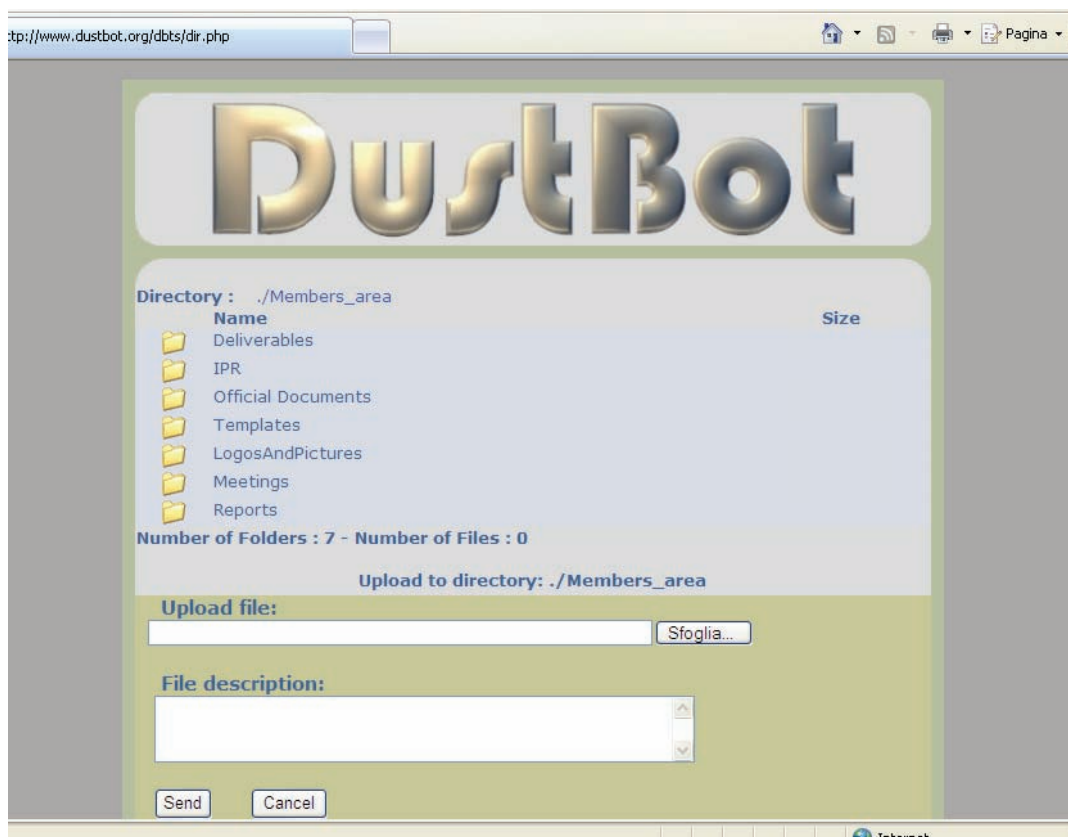


Fig. 2 – The DustBot Project members' area

In the bottom section there is the possibility for the partner to upload a file in a specific folder. At the end of the page there is a link "My folder" that is a private folder that allows to the user to upload and exchange files with the others partners (Figure 3). The partner can erase only the files in his personal folder.

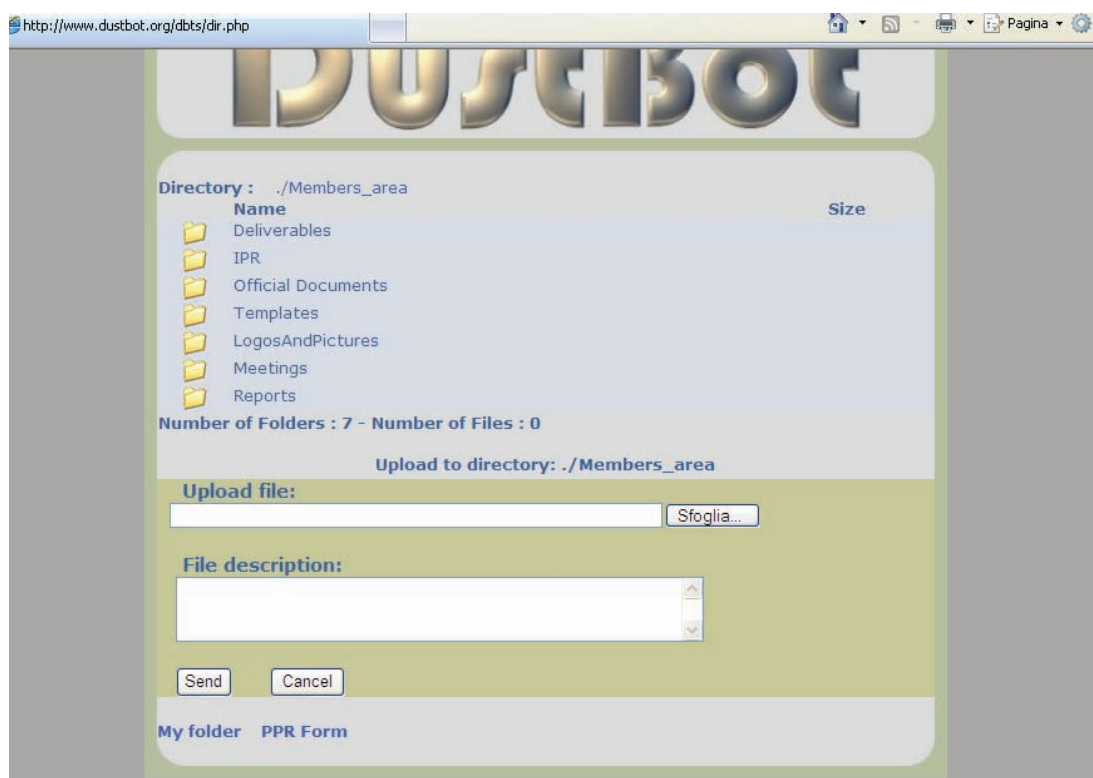


Fig. 3 - The Section "My Folder" in the DustBot Project members' area

A section dedicated to possible users of the technologies developed in the project is included in the DustBot Web site. This section (see Figures 4 and 5) gives the possibility of keeping the DustBot activity in touch with the reality of the present and future needs of the different actors of the urban hygiene community, such as companies, Environmental Organisations and Regulation Organisms, Institutions, Service Providers, etc. The policy-makers and local authorities in several countries will be direct users of the outcomes of the project. Starting from the very beginning of the project, an Italian private utility for waste management, ASMIU S.p.A., *Sponsoring Partner of DustBot and member of the Users Club*, is collaborating with the Consortium in defining the specifications of the DustBot platform. It will also assure that the implementation of the project will be in line with the real needs and that the results will be used directly in planning with future economic development.

The users can join to the “DustBot Users Club” by compiling the form present in the same section.



Fig. 4 – The DustBot Project Users' Club



Fig. 5 - The “DustBot Users Club” registration form

3 Scientific Publications

Dissemination of scientific results

This section reports the dissemination activities performed by the Consortium in terms of works sent to International Conferences and Scientific Journals focused on the DustBot objectives and activities. In particular, Table 1 reports a list of publications drawn up by the DustBot partners and sent to Conferences and Journals.

A detailed procedure on Intellectual Property Rights (IPR) has been defined by the Project Coordinator and by the IPR responsible (Synopsis). This procedure declares the steps to be followed by the partners before to submit a paper to Scientific Journals or Reviews and Conferences and in case of patents' release, in order to raise awareness of Intellectual Property issues and to provide any relevant information that may be of assistance to partners with Intellectual Property queries or concerns. The procedure is downloadable from the Folder IPR, included the DustBot members' area.

Title	Authors and Affiliations	Conferences and Journals
D-STAR MAC Protocol: a Cross Layer Solution for Wireless Sensor Networks Endowed with Directive Antennas	F. Chiti, M. Ciabatti, G. Collodi, D. Di Palma, R. Fantacci, G. Manes, A. Manes, I. Nelli (MIDRA)	COST289 Special Issue for Springer Journal of Wireless Personal Communications, to be published.
Efficient MAC Protocols for Wireless Sensor Networks Endowed with Directive Antennas: a Cross Layer Solution	G. Manes, R. Fantacci, F. Chiti, M. Ciabatti, G. Collodi, D. Di Palma, A. Manes, I. Nelli (MIDRA)	EURASIP JWCN Special Issue on Cross-Layer Optimized Wireless Sensor Networks, to be published.

A System Architecture Supporting Mobile Applications in Disconnected Sensor Networks	D. Tacconi, I. Carreras, D. Miorandi, A. Casile, F. Chiti, R. Fantacci (MIDRA)	to appear in Proc. of IEEE Globecom'07.
Supporting the Sink Mobility: a Case Study for Wireless Sensor Networks	D. Tacconi, I. Carreras, D. Miorandi, I. Chlamtac, F. Chiti, R. Fantacci,	in Proc. of IEEE International Conference on Communications 2007 (IEEE ICC'07).
A Rao-Blackwellisation Approach to GDM-SLAM – Integrating SLAM and Gas Distribution Mapping	Achim J. Lilienthal, Amy Loutfi, Jose Luis Blanco, Cipriano Galindo and Javier Gonzalez (ORU)	Proceedings of the 3rd European Conference on Mobile Robots (ECMR), 2007, to appear.
Integrating SLAM into Gas Distribution Mapping	Achim J. Lilienthal, Amy Loutfi, Jose Luis Blanco, Cipriano Galindo and Javier Gonzalez (ORU)	Proceedings of IEEE International Conference on Robotics and Automation (ICRA) workshop on “Robotic Olfaction – Towards Real Applications”, 2007, pp. 21-28.
From Sensor Networks to Autonomous Networked and Cooperating Platforms for Environmental Monitoring	Mazzolai, B., Mattoli, V. (SSSA)	Proceedings of IEEE International Conference on Robotics and Automation (ICRA) workshop on “Robotic Olfaction – Towards Real Applications”, 2007.

Table 1 – DustBot papers

4 Press Releases

Articles published on newspapers and bulletin during the first months of the project life time are listed below in descending chronological order:

- La Nazione “Il robot spazzino piace sempre di più, le province studiano il progetto” (23/05/2007)
- Il Tirreno “Sos rifiuti? Ecco i robot spazzini” (23/05/2007)



- Il Tirreno "Il robot-spazzino sarà presentato al Sant'Anna" (16/05/2007)
- La Nazione "DustBot si presenta alle istituzioni" (16/05/2007)
- Robot a Scuola "DustBot: il robot spazzino" (09/01/2007)
- la Repubblica.it "Da Trieste a Catania, tutti i "poli" italiani" (08/01/2007)
- La Nazione "Il robot pulisce le strade e dice come sta l'aria" (05/01/2007)
- University.it "Al via a Pontedera il progetto europeo DustBot" (05/01/2007)
- La Nazione - Pontedera "Lo spazzino? Sarà un super robot - Polo Sant'Anna vara l'ambizioso progetto" (05/01/2007)
- L'espresso Local "Arrivano i robot-spazzini" (05/01/2007)
- LA STAMPA.it "DustBot, il progetto per i robot spazzini" (04/01/2007)
- waytuscanly – "Dustbot" (04/01/2007)

5 Dissemination Events

5.1 ICRA Workshop

A workshop on "Robotic Olfaction – Towards Real Applications" was organised by Achim Lilienthal and Amy Loutfi (ORU) and held during the IEEE International Conference on Robotics (ICRA) in Rome (Italy) at April, 14, 2007 (see <http://aass.oru.se/~ali/icra07ws/schedule.html>).



5.2 Concertation Even at EURON Annual Meeting

As stated in the DustBot Description of Work (DoW), the DustBot partners will participate in and will organise Concertation events involving other EC funded projects on Robotics. These concertation initiatives aim at increasing mutual knowledge of the ongoing projects, exchanging experience at the scientific, technical, and management level, synergize efforts as possible, and explore possible collaborations. Specific workshops and/or focused sessions will be organised in several occasions during the project life time in collaborations with other projects on Robotics, and especially with the projects funded in the "Advanced Robotics" Strategic Objective.

A first concertation event for the Advanced Robotics Projects has been held at the EURON Annual meeting in Chania (Greece) at March 28, 2007, in the format of a special session. The DustBot project was part of this event and Prof. Dario (SSSA) gave a short presentation on the objectives and main facts.

6 Presentations

The project objectives and preliminary results obtained have been presented in the events listed in descending chronological order below. Speaker, time and place of the presentation are indicated in brackets.

- Annual Meeting of the Japanese Network Robot Forum, an important national network promoting R&D and standardisation for network robots (Tokyo, Japan, June 28, 2007; Speaker: Prof. Paolo Dario, SSSA).
- Presentation of the paper "Supporting the Sink Mobility: a Case Study for Wireless Sensor Networks" at the IEEE International Conference on Communications 2007 - IEEE ICC'07 (Glasgow, Scotland, June 27, 2007; Speaker: David Tacconi, MIDRA).



- DustBot presentation to a group of international experts from ITE/Robotdalen, including Charlotte Crump, Prof. Brian Davies, Prof. John Gray, Geoff Pegman, Ferdinando Rodriguez Y Baena, Dr. Monica Schofield, John Sorsby, Prof. Paul Taylor, Prof. Gurvinder Virk (Örebro, Sweden, June 12, 2007; Speaker: Achim Lilienthal, ORU).
- DustBot presentation to local administrations - mayors and decision makers on urban hygiene management (Pontedera, Italy, May 17, 2007; Speaker: Prof. Paolo Dario, SSSA).
- Special session on EU - Advanced Robotics projects at the EURON annual meeting (Chania , Greece; March 28, 2007; Speaker: Prof. Paolo Dario, SSSA).
- Presentation of the paper "Integrating SLAM into Gas Distribution Mapping" at the workshop on "Robotic Olfaction – Towards Real Applications" at the IEEE International Conference on Robotics and Automation - ICRA 2007 (Rome, Italy, April 14, 2007; Speaker: Achim Lilienthal, ORU).
- Presentation of the DustBot project within the talk "From Sensor Networks to Autonomous Networked and Cooperating Platforms for Environmental Monitoring" at the workshop on "Robotic Olfaction – Towards Real Applications" at the IEEE International Conference on Robotics and Automation - ICRA 2007 (Rome, Italy, April 14, 2007; Speaker: Virgilio Mattoli, SSSA).
- Workshop on "Networked Robotics" at the IEEE International Conference on Robotics and Automation - ICRA 2007 (Rome, Italy, April 14, 2007; Speaker: Prof. Paolo Dario, SSSA).

The DustBot project was further presented to companies such as Toyota Europe, ST Microelectronics and in a meeting with the president of the National Federation of the Italian Companies in the environmental sector (July 3, 2007). Finally, the DustBot objectives and the preliminary results of the project has been presented and discussed with academic visitors.

7 DustBot Brochure

A preliminary version of the DustBot brochure has been drawn up by SSSA. This document can be used by all the DustBot Consortium for dissemination aims and it is downloadable directly from the DustBot Web site, under the Folder Dissemination, available on the Home Page.

Figure 6 shows the structure and contents of the DustBot brochure.



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Project Duration: 36 months
Project Cost: 2.822.600 €
EC contribution: 1.898.000 €

9 partners from 5 countries

DustBot
Networked and Cooperating Robots for Urban Hygiene

www.dustbot.org

Objectives

The DustBot project is aimed at designing, developing, testing and demonstrating a system for improving the management of urban hygiene based on a **network of autonomous and cooperating robots**, embedded in an **Ambient Intelligence (Aml) infrastructure**.

The robots will be able to operate in partially unstructured environments (such as squares, streets, parks, etc.) and to vacuum-clean them from rubbish and dirt. They will be able to transport small quantities of home garbage, collected on demand from citizens, at their doors. By using pre-loaded information on the environment (e.g. area maps) and inputs from on-board and external sensory systems, and by taking advantage of the benefits provided by the Ambient Intelligence platform, the robots will be able to move with a proper (and selectable) level of autonomy to carry out their tasks. The robots will be also equipped with multiple sensors for the monitoring of atmospheric pollutants (e.g. nitrogen oxides -NOx-, sulphur oxides -SOx-, ozone -O3-, benzene, COx, etc.), giving information on the environmental quality in real time.

The Robots

Two kind of robots will be designed and developed in DustBot: the cleaning robot and the citizen-friendly/dust-cart robot. The cleaning robot will be equipped with the cleaning tools and with the environmental sensors modules.

The citizen-friendly/dust-cart robot will be equipped with the cart for bin-liner transport and discharge and with the user interface aimed at providing selected information about air quality and waste management to different users.

The DustBot Platform

The DustBot platform will be a complex, distributed and heterogeneous Aml environment. It will be able to automatically sense when resources, software components or communication networks need to be reallocated or re-configured.

Following the computation on stored data, feedback will be sent back to human actors (supervisors, decision makers, like municipality managers, etc.) and/or robotic operators, in order to perform actions.

Demonstration Sites

A demonstration phase has been planned aims at demonstrating the functionality and potentiality of the DustBot platform and at evaluating the performance of the system from a user and technological point of view. **Five** demonstrators will be set up in real operational scenarios during the last eight months of the project, in collaboration with local Municipalities in different sites, which have been preliminarily selected in Italy, Spain and Sweden.

www.dustbot.org

Fig. 6 - The DustBot Brochure

