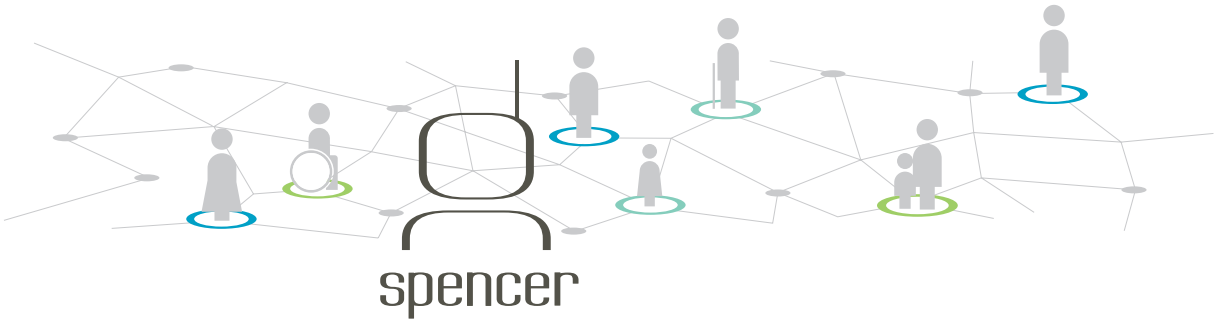

Grant agreement no: FP7-600877

SPENCER:

Social situation-aware perception and action for cognitive robots

Project start: April 1, 2013

Duration: 3 years

DELIVERABLE 7.2

Project brochure, dissemination material and first exploitation plan

Due date: month 12 (March 2014)

Lead contractor organization: BLUE

Dissemination Level: PUBLIC

Patrick Balmer (BLUE), Martin Magnusson (ORU), Kai Arras (ALU-FR)

Contents

Dissemination and exploitation plan

1 Introduction

The objective of all dissemination and exploitation activities is to achieve high impact of SPENCER during and beyond the life-time of the project. To this end, we aim at collecting the knowledge and the results of all technical work packages and to arrange for the appropriate exploitation of such results as well as the dissemination of non-confidential knowledge.

The goal of these activities also include the transfer of knowledge *within* the Consortium and to promote and support close collaboration between partners. This deliverable describes first actions taken during the first 12 months towards this goal.

2 Corporate Identity

For a successful dissemination, a professional project presentation that appeals to the eye is crucial today. Thus, we have spent effort to create a consistent coporate design for SPENCER. After a design process with several iterations with a professional designer, we went for the following logo that visually supports the goals of the project.

The logo illustrates a robot that reasons about the social fabric of its surrounding accounting for individual human attribues such as gender, age, mobility. This shall stand for our goal for robots to achieve unseen levels of understanding in and of human environments.

We created a logo, a small version of the logo with square-like aspect ratio, and a web header shown in Figs. 1 and 2.

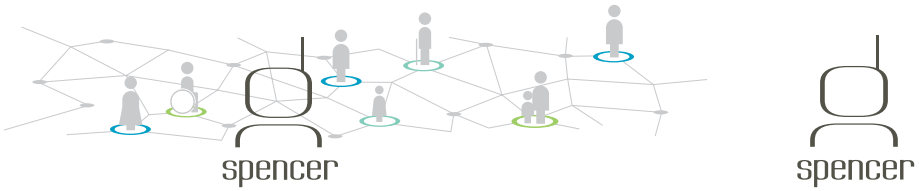

Figure 1: **Left**: the SPENCER logo. **Right**: the small logo

Figure 2: The SPENCER web header

The consortium commits itself to use the corporate design throughout all publications and project-related documents. In this way, the corporate design material also serves as a tool for documentation standards and to ease document control procedures.

3 Project Website

3.1 Goals and action plan

A publicly funded project like SPENCER requires a well-made project web site that serves multiple goals: to provide detailed and up-to-date information about the project, its partners and goals, to allow for progress monitoring, and as an internal communication platform. As target audiences, we aim at the wide public, the scientific community, the press, and industrial stakeholders.

In the DoW, we planned the following related actions:

- Create public project web-site
- Keep web site up-to-date
- Create YouTube channel
- Publish a newsletter

3.2 Status

The web site http://www.spencer.eu (see Fig. 3, left) went online at project start in April 2013. It is described in all detail in deliverable D7.1 "Public SPENCER web site and communication platform". Since then, it had been kept up-to-date by the consortium, in particular the dissemination responsible ORU and the coordinator.

The SPENCER YouTube channel (see Fig. 3, right) is available at https://www.youtube.com/user/spencereuproject. All video-related material will be published under this address, a link from the web site to the YouTube channel has been established.

The SPENCER newsletter will target both the members of the consortium (typically in the first half of the project) and the public (typically in the second half of the project). The first newsletter will be produced within the next six months based on the information in the first periodic report.

4 SPENCER Wiki

In addition to the SPENCER web site and its functionalities as communication platform (via internal pages and mailing lists), we also established a SPENCER Wiki as platform for *technical discussions* within the consortium. Figure 4 shows the entry page and example pages of ongoing discussions. The example shows discussions on the SPENCER architecture.

The Wiki is implemented on a Redmine server by partner TUM.

5 Project Brochure

The SPENCER project brochure is attached as appendix A. We summarize the actions taken in this respect and give the status of this activity.

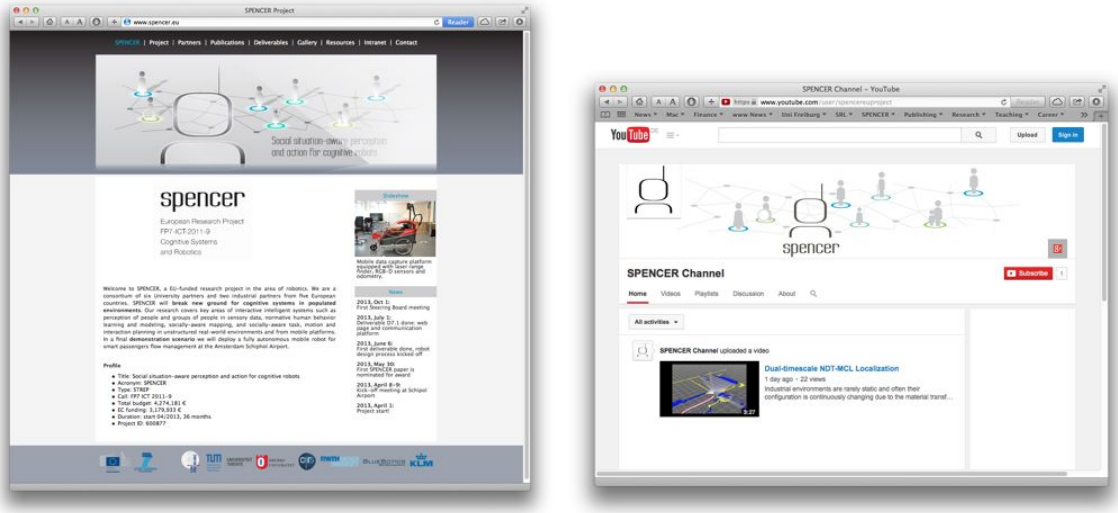

Figure 3: **Left**: the entry page of the SPENCER web site. **Right**: the SPENCER YouTube channel

The brochure contains a brief summary of the project, the list of the involved partners, and most importantly, the contact information with a link to the web site. The brochure aims at a wide group of people and target audiences, it is intended for everyone that could be interested in SPENCER and indicates where to find more information. We think mainly of:

- Robotics researchers, e.g. to be distributed at a conference or a trade fair booth;
- Press, e.g. to give an brief overview on SPENCER to raise interest;
- Industrial stakeholders: to show the state of the art of this research;
- Robotics enthusiast: to explain them what a robot is capable today.

In short, the brochure is the first step for someone interested in SPENCER to learn where to look for more information. It will be part of our future dissemination activities and can also be downloaded from the project web site at http://www.spencer.eu/resources.html.

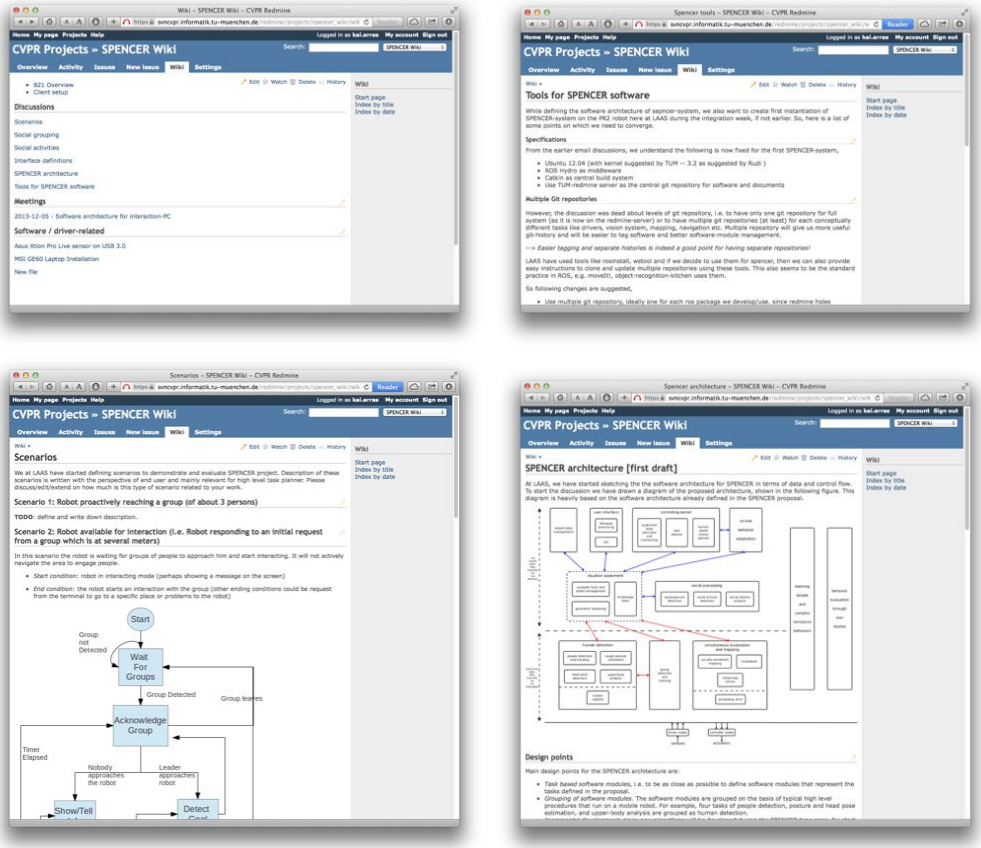

Figure 4: The entry page of the SPENCER Wiki for technical discussions within the consortium (top left) and example pages.

6 Dissemination

6.1 Goals and action plan

In order to disseminate the scientific developments performed within SPENCER, we planned the following actions according to the DoW:

- Identify and proactively seek and maintain contact with closely related projects. Seek collaborations and find opportunities for exchange and synergies
- Maintain contact to media, prepare press releases and news bulletins
- Publication of scientific papers and participation in the top conferences in the related fields. Organization of and participation in workshops at such conferences
- Publication of all collected and annotated data sets produced in SPENCER
- Dissemination of the project outcome and potential to the aviation business by a KLM PR specialist

- Participation in working groups of the EU robotics networks and Technology Platforms (e.g. euRobotics, EUnited Robotics)

We will now consider those actions and describe their status.

6.1.1 Seek contact to related projects

We have established contact with the following projects:

- ORU has officially established contact with the EU-project STRANDS (coordinator Nick Hawes, `url`).
- ALU-FR has officially established contact with the EU-project FROG (coordinator Vanessa Evers, `url`)
- ALU-FR has officially established contact with the EU-project ALIZ-E (coordinator Tony Balpaeme, `url`)

We are now in the process of identifying possibilities for synergies and commonly organized events with these projects for both dissemination and scientific exchange. For this purpose, and in the case of STRANDS, we aim at a joint meeting of STRANDS and SPENCER representatives at one of the upcoming robotics conferences (e.g. ICRA 2014).

Collaborations with FROG and STRANDS are already taking place since partners Vanessa Evers (UT) and Bastian Leibe (RWTH) are beneficiaries in those projects. Strong synergies are expected for WP4 (from UT) and for WP2/WP3 (from RWTH).

6.1.2 Media coverage

The consortium had the following media contacts in which SPENCER had been explicitly mentioned or whose topic was closely related to SPENCER:

- Michiel Joosse from UT was interviewed by the Jij & Overijssel web magazine (Nov. 2013). Online at http://www.overijsseldoetmee.nl/verhalen/3393/robots
- Kai Arras from ALU-FR was interviewed by the local Uni Radio on SPENCER-related topics (July 2013).
- Vanessa Evers and Michiel Joosse from UT were interviewed by the National Dutch Radio on the program “BNR eyeopeners” (March 2014).
  Online at http://www.bnr.nl/?service=player&type=fragment&audioId=2201914
- Hayley Hung from UT was featured in an article entitled “Modelling human behaviour in a social context” in the Highlights 2013 issue of the TU Delft magazine (Dec 2013). Online: www.tudelft.nl/fileadmin/Files/tudelft/over/Feiten_en_cijfers/jaarverslagen/TUDelft-highlights2013-EN.pdf

With more results in the course of the project, we will further intensify dissemination to the public and also expect a much stronger interest as soon as the SPENCER robot can be demonstrated.

6.1.3 Publications

- O. Hosseini Jafari, D. Mitzel, B. Leibe, Real-Time RGB-D based People Detection and Tracking for Mobile Robots and Head-Worn Cameras, Proc. IEEE Int. Conference on Robotics and Automation (ICRA), 2014, to appear.
- Rafael Valencia, Jari Saarinen, Henrik Andreasson, Joan Vallv, Juan Andrade-Cetto and Achim Lilienthal, Localization in highly dynamic environments using dual-timescale NDT-MCL, Proc. IEEE Int. Conference on Robotics and Automation (ICRA), 2014, to appear.
- Michiel Joosse, Manja Lohse, Vanessa Evers, Sound over Matter: The Effects of Functional Noise, Robot Size and Approach Velocity in Human-Robot Encounters, ACM/IEEE International Conference on Human-Robot Interaction (HRI), Bielefeld, 2014, pp. 184 - 185.
- Thibault Kruse, Harmish Khambhaita, Rachid Alami, Alexandra Kirsch, Evaluating Directional Cost Models in Navigation, ACM/IEEE International Conference on Human-Robot Interaction (HRI), Bielefeld, 2014.
- Michiel Joosse, Manja Lohse, Vanessa Evers, Lost in Proxemics: Spatial Behavior for Cross-Cultural HRI, ACM/IEEE International Conference on Human-Robot Interaction (HRI) Workshop on Culture Aware Robotics, Bielefeld, 2014.
- Saarinen J., Andreasson H., Stoyanov T., Lilienthal A. J., 3D Normal Distributions Transform Occupancy Maps: An Efficient Representation for Mapping in Dynamic Environments, International Journal of Robotics Research (IJRR), 2013, pp. 1627 - 1644.
- Michiel Joosse, Manja Lohse, Vanessa Evers, Short Duration Robot Interaction at an Airport: Challenges from a Socio-Psychological Point of View, International Conference on Social Robotics (ICSR) Workshop on Robots in Public Spaces: Towards Multi-Party, Short-Term, Dynamic Human-Robot Interaction, Bristol, 2013.
- Manja Lohse, Niels van Berkel, Betsy van Dijk, Michiel Joosse, Daphne Karreman, Vanessa Evers, The Influence of Approach Speed and Functional Noise on Users Perception of a Robot, EEE/RSJ International Conference on Intelligent Robots and Systems, Tokyo, 2013, pp. 1670 - 1675.
- Stoyanov T., Saarinen J., Andreasson H., Lilienthal A. J., Normal Distributions Transform Occupancy Map Fusion: Simultaneous Mapping and Tracking in Large Scale Dynamic Environments, Proc. IEEE/RSJ Int. Conference on Intelligent Robots and Systems (IROS), 2013, pp. 4702 - 4708.
- Saarinen J., Stoyanov T., Andreasson H., Lilienthal A. J., Fast 3D Mapping in Highly Dynamic Environments using Normal Distributions Transform Occupancy Maps, Proc. IEEE/RSJ Int. Conference on Intelligent Robots and Systems (IROS), 2013, pp. 4694 - 4701.
- Saarinen J., Andreasson H., Stoyanov T., Lilienthal A. J., Normal Distributions Transform Monte-Carlo Localization (NDT-MCL), Proc. IEEE/RSJ Int. Conference on Intelligent Robots and Systems (IROS), 2013, pp. 382 - 389.

- Kucner T., Saarinen J., Martinsson M., Lilienthal A. J., Conditional Transition Maps: Learning Motion Patterns in Dynamic Environments, Proc. IEEE/RSJ Int. Conference on Intelligent Robots and Systems (IROS), 2013, pp. 1196 - 1201.
- Luber M., Arras K.O., Multi-Hypothesis Social Grouping and Tracking for Mobile Robots, Robotics: Science and Systems (RSS), Berlin, Germany, 2013, **Best Student Paper Award Finalist**.

6.1.4 Annotated data sets

1. Rathausgasse (ALU-FR): Figure 5 shows an example scene from this data set. This data set was recorded in a pedestrian zone in Freiburg and contains laser range data (collected with a SICK LMS-500), RGB-D data (from two vertically mounted 3D cameras), as well as odometry (from ALU-FR's child-stroller data capture platform). The data set contains around 20 minutes of data in total. The dataset can be used to train person detectors in RGB-D and laser data, learn features for detecting social groupings and activities, and test and evaluate different methods for person and group tracking.

ALU-FR have annotated the laser data of a subset (3 minutes, 300 meters distance covered, around 6000 frames) with person tracks and social groups. The annotations are in a text-based format. The laser data and annotations will be made public in the future. The RGB-D data, however, is not yet anonymised and can therefore not be made public at this point.

2. Basement (ORU): We also have three public data sets recorded in the basement at ORU. Figure 6 shows example scenes from these data sets. These data sets were recorded in progressively more dynamic environments, and have been used as challenging test cases for localization in changing environments. Each of these data sets contain odometry data (from wheel encoders), ground-truth localization data (from using retroreflective markers in the environment) and 2D laser range data (from a SICK S-300)

- **Static.** Empty rooms, without any additional obstacles or moving people. Data set available for download at http://aass.oru.se/~han/datasets/static1_2013-09-05-15-25-31.bag.
- **Dynamic.** The "dynamic" scenario contains additional obstacles and people that moved around in the vinicity of the vehicle. The obstacles were moved around throughout the experiments. Data set available for download at http://aass.oru.se/~han/datasets/dynamic1_2013-09-04-17-08-57.bag.
- **Boxes.** During the "boxes" scenario, four persons spread boxes around the basement making the layout gradually change substantially. At the end of the experiment the boxes were gradually removed, such that the final state of the basement was identical to the initial state. Data set available for download at http://aass.oru.se/~han/datasets/boxing_new.bag.

6.1.5 Further dissemination activities

Partner RWTH presented their real-time RGB-D based people tracker to the computer vision research community as a demo at CVPR'13. The tracker is an important component in WP2.

Figure 5: **Left:** the Rathausgasse (Freiburg) dataset, captured in a crowded pedestrian zone in multiple runs over a distance of 300 meters. It contains color and depth camera images, as well as distance measurements from a 2D laser range finder. **Right:** the mobile data capture platform that was built at the beginning of the SPENCER project to capture scenarios like this. It is equipped with a SICK LMS-500 laser range finder, custom-built wheel encoders for odometry, and two vertically mounted Asus Xtion Pro Live RGB-D sensors. The orientation of these sensors will be changed in the future to reflect the actual setup on the SPENCER robot platform.

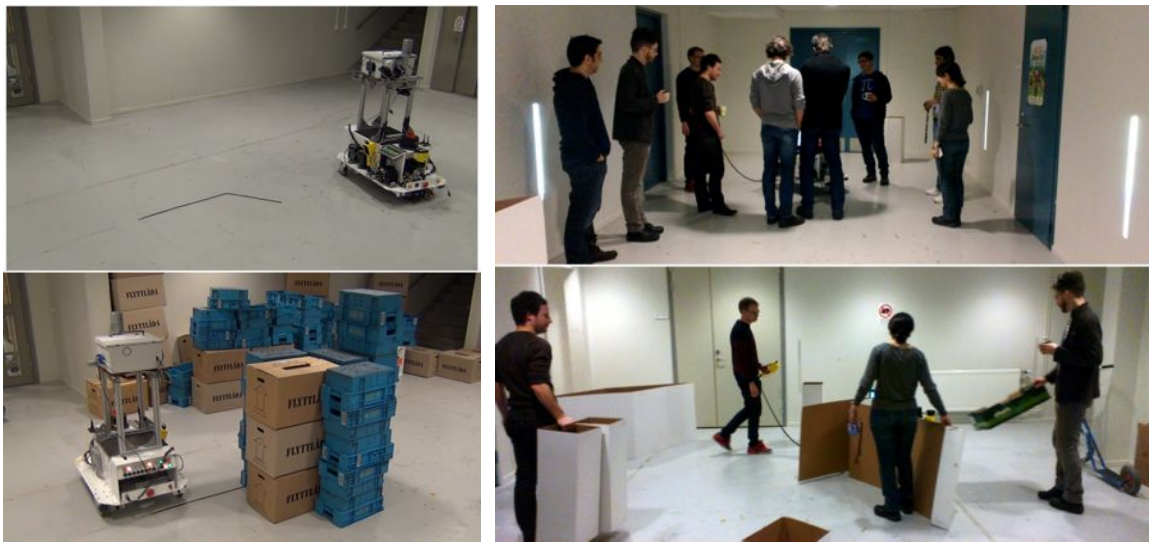

Figure 6: The Basement data sets. **Left:** Two snapshots from the "boxes" scenario, at the beginning (top) and in the middle (bottom) of the data set. **Right:** Two snapshots from the "dynamic" scenario.

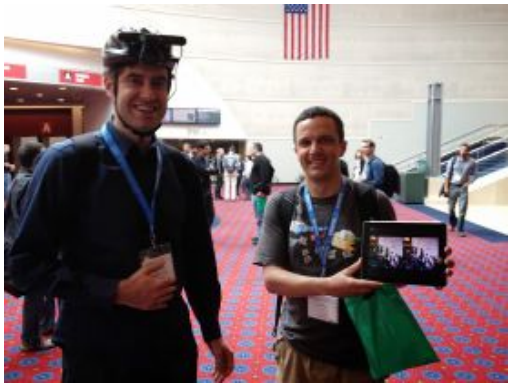

Figure 7: Partner RWTH (Bastian Leibe, left) present their RGB-D based people tracker at CVPR 2013 in a live demo. The tracker will be used in SPENCER as component in WP2.

Using a head-mounted Kinect, all computation was done in real-time on a gaming laptop on batteries, and with automatic result video streaming to an iPad. The demo was very successful and RWTH reached a large number of people (around 200).

Finally, partner ALU-FR was nominated for a best paper award at RSS 2013 in Berlin with their SPENCER paper Luber M., Arras K.O., "Multi-Hypothesis Social Grouping and Tracking for Mobile Robots".

7 Exploitation

7.1 Goals and action plan

The goal of our exploitation activities is to make the industry aware about the market potential of the concepts developed within the project and to take actions towards commercialization. To this end, we planned the following actions (according to the DoW):

- Organization of an end-user workshop
- Continuous identification of exploitable results for other application domains
- Provide support in finding special ways for exploiting results
- Maintain an address database for SPENCER-related stakeholders, potential customers, and other interested people

The status of these action points are described in the following.

7.1.1 End-user workshop

We will invite the end-users on the advisory board and additional end-users that have been contacted in the course of the project. The purpose of the workshop is to discuss and concretize exploitation opportunities of SPENCER technologies, in particular in the aviation industry.

The workshop will be held in conjunction with steering board meeting V at milestone MS3 in month 28. At this point, the second demonstration is expected to already implement the use-case to large parts, showing most of the relevant capabilities.

7.1.2 Continuous identification of exploitable results

We will continuously monitor the functionality set created within the project and map it to other potential applications, especially in the domain of the other commercial activities of KLM and Blue-Botics.

Concretely, we will carefully follow the development results – e.g. after integration weeks – and analyze the different outputs in order to determine if and for which application they could be used. For example the group tracking feature could be used to optimize people flow in a public area.

BLUE, for instance, is active also in other domains than airports where SPENCER developments may be commercialized. Examples include public spaces, train stations, shopping malls, museums, or hospitals. As soon as more results have been achieved by the project, BLUE will make use of its business network and make demonstrations of the SPENCER robot to these actors when and where possible.

7.1.3 Finding special ways for exploitable results

We will build up on the use-case scenarios both of the project and other potential applications in order to initiate business models concepts able to drive the way towards commercialization of SPENCER technologies.

As example, based on the results of the final demonstration, the consortium, particularly BLUE, will propose to KLM to continue the exploitation of the platform at Schiphol, to adapt it for further needs of the passengers and/or to produce and deploy more platforms.

7.1.4 Existing contacts

A concrete integration example of a robotic platform in an airport environment is the international airport of Geneva with which partner BLUE has a past and ongoing collaborations with mobile robotics technologies (Fig. 8). BLUE has deployed a robot in the baggage claim area which serves as a mobile information kiosk and guidance platform. A video about this deployment is at https://www.youtube.com/watch?v=_L5BdMtbQMA.

Furthermore, we had contacts with SITA, a large specialist in air transport communications and IT solutions. They are a KLM supplier for the information and check-in kiosks and “sponsored” us by providing the barcode readers for the SPENCER robot for free. They are very interested in robotic solutions and, with their position on the market, are an excellent starting point for exploitation of SPENCER results.

Figure 8: Partner BLUE has an ongoing deployment of an autonomous mobile robot at Geneva Airport. This is a good opportunity to gain experiences in this application domain and for the exploitation of SPENCER technologies. Geneva airport is also on the SPENCER Advisory Board.

7.1.5 Address database

Based on these existing contacts and the prospect database of partner BLUE, a mailing list with industrial stakeholders and other interested parties is being established. Additionally, the euRobotics mailing list will be added to reach even more people in the community.

Finally we will use our contacts to the end-users on the SPENCER Advisory Board, Frankfurt Airport, Frankfurt Hahn airport, and Geneva airport, for the exploitation of the results.

A Project Brochure

A.1 Formatted for screen

Below is the screen version of the SPENCER brochure.

A.2 Formatted for printing

The next two pages show the printable version of the SPENCER brochure.

spencer

Social situation-aware perception and action for cognitive robots

The SPENCER project in short:

Title: Social situation-aware perception and action for cognitive robots

Acronym: SPENCER

Beneficiaries: 8 partners

Duration: 1 April 2013 - 31 March 2016

Call: FP7-ICT-2011-9

Contact & information: www.spencer.eu

SEVENTH FRAMEWORK PROGRAMME

European Commission

About SPENCER

SPENCER will break new ground for cognitive systems in populated environments.

Our research covers key areas of interactive intelligent systems such as perception of people and groups of people in sensory data, normative human behavior learning and modeling, socially-aware mapping, and socially-aware task, motion and interaction planning in unstructured real-world environments and from mobile platforms.

In the demonstration scenario we will deploy a fully autonomous mobile robot for smart passengers flow management at the Amsterdam Schiphol Airport.

Partners:

Albert-Ludwigs-Universität Freiburg, Germany
Kai Arras: Coordinator, PI

Technische Universität München, Germany
Rudolph Triebel: Scientific Manager & Daniel Cremers, PI

Universiteit Twente, The Netherlands
Vanesse Evers & Hayley Hung, PI

Örebro University, Sweden
Achim J. Lilienthal, PI

Centre National de la Recherche Scientifique CNRS, France
Rachid Alami & Raja Chatila, PI

Rheinisch-Westfälische Technische Hochschule Aachen, Germany
Bastian Leibe, PI

BlueBotics SA, Switzerland
Patrick Balmer, PI

KLM Royal Dutch Airlines, The Netherlands
Ruben Alblas, PI