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1 »*MATRIOSCHKA*« *pilot application*
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2 *project-logo*
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MATRIOSCHKA ENVIRONMENTAL MONITORING

Fraunhofer Institute for Material Flow und Logistics IML
Project Center
»**Traffic, Mobility and Environment**«

Joseph-von-Fraunhofer-Straße 9
83209 Prien am Chiemsee

Contact Person

Holger Schulz, M. Systems Eng.
Telephone +49 8051 901-118
Telefax +49 8051 901-111
holger.schulz@prien.iml.fraunhofer.de

www.prien.iml.fraunhofer.de

www.matrioschka.eu

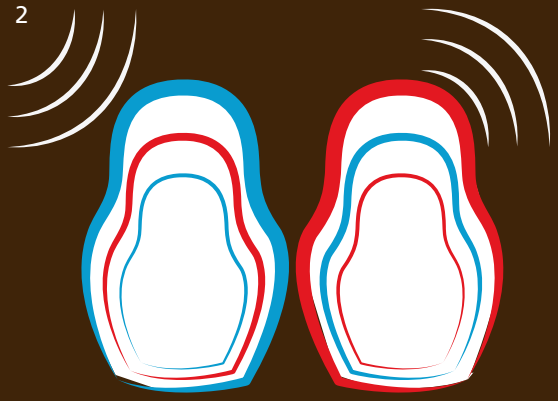
Project

Within the Bavarian-Russian research project »MATRIOSCHKA« a monitoring-system for surveillance of harmful gaseous substances, utilizing satellite navigation, satellite communication and earth observation technologies, was developed, tested and successfully demonstrated together with end-users in security services. By using these technologies a fully automatic and extensive environmental monitoring-system has been established, which detects, quantifies and locates environmentally harmful substances in an open environment and immediately transmits this information to the responsible authorities.

Thereby the overall system is able to point out environmental damage or rather explain the reasons therefore. Thus, the danger to human beings and to the environment can be minimized and incidental follow-up costs can be reduced.

The Fraunhofer Institute for Material Flow and Logistics (IML), Project Center »Traffic, Mobility and Environment« in Prien am Chiemsee led the project. The collaboration included experts and industry partners from areas of geo-information technology, satellite navigation and communication as well as from aerospace engineering.

proTime GmbH was the primarily responsible partner for the technical implementation. Furthermore the companies Volmer Informationstechnik, the Dialogis GmbH, the department of Electrical Engineering and Information Technology of the University of Applied Sciences Rosenheim, the Wirtschaftsförderungsgesellschaft Berchtesgadener Land and the Russian Space Systems are enterprises which were involved in this project. The project was funded by the Bavarian Ministry of Economic Affairs, Media, Energy and Technology via the IABG Company.



MATRIOSCHKA

Concept and Technology

»MATRIOSCHKA« is a multi-stage environmental monitoring system. The system architecture consists of the three following main components – the intelligent gas sensor, the Personal Alarm Device and the web-based information server.

The basic elements are the gas sensor modules, which were extended with several components, e.g. a temperature sensor, microcontroller, analog frequency converter as well as additional necessary algorithms, to realize the intelligent gas sensor.

This intelligent gas sensor is integrated in a system for data gathering and communication, the so called Personal Alarm Device (PAD). Depending on the application scenario, the particular PADs can be utilized as mobile or stationary units and be allocated in large areas to gather and store measured data including a geo-referencing. Moreover, the measured data and gathered information is automatically transmitted by several communication channels, e.g. terrestrial communication or satellite communication.

The server-based monitoring system autonomously triggers warning notifications as well as alarm messages and furthermore transmits this information automatically and immediately to the responsible coordination and control centers or to a relevant company head-quarter if emission limits of specific harmful substances or pollutants are exceeded or fall below a certain tolerance level.

Pilot applications

Within the scope of the project two pilot applications were planned and successfully implemented.

In Bavaria the »MATRIOSCHKA« overall system was demonstrated on the premises of the Bavarian State Fire Service Academy in Geretsried by various user scenarios, e.g. »Monitoring of industrial plants (propane emission at a liquid gas tank« or »Surveillance of a natural gas pipeline system (emission of natural/methane gas by a porous underground pipeline)«, with the support and collaboration of fire-fighters as well as officers of the Bavarian State Office of Criminal Investigation.

Main features of the pilot applications were for example the demonstration of the data transmission via GSM, LAN/WLAN, satellite communication and Mesh-WLAN, the precise localization and position indication of the mobile and stationary PADs allocated on the area, the access to the »MATRIOSCHKA« web server, the arrival of the multi-stage warning notifications and alarm messages including the appropriate position coordinates and the respective measured kind as well as concentration of harmful substances and pollutants.

Besides this the integration of robotics and real-time video transmission was another essential part of the demonstrations.

The pilot application in Russia considered the monitoring of air quality and the emission of harmful gaseous substances. The aim of this application scenario was the most extensive and permanent monitoring of the air quality, especially the surveillance of present ammonia concentration.

Innovation

The project »MATRIOSCHKA« relies on innovations in the field of sensors and satellite navigation. Mobile gas sensors which operate with localization and communication were not available on the market so far. By combining the technologies satellite navigation, satellite communication and earth observation in one overall system a very high information density is achieved and enables a precise and extensive environmental monitoring.

Benefits and main features

- Monitoring-system for stationary and mobile measurements of harmful gaseous substances
- Utilization of satellite navigation, satellite communication and earth observation
- Detection, quantification and localization of environmentally harmful substances
- Fully automatic and multi-stage environmental monitoring system
- Minimization of the danger to human beings and the environment
- Reduction of follow-up costs