Newsletter - Rome

SYnergy of integrated Sensors and Technologies for urban sEcured environMent

N.2 - January 2022

Outline:

Welcome!

We are glad to announce a new newsletter's issue of the European funded project "SYnergy of integrated Sensors and Technologies for urban sEcured environMent" (SYSTEM). This is the **second issue** dedicated to the testing activities carried out in the city of **Rome, Italy.**
You receive this email because your work is strictly related to the output of this project and we have thought you might be interested on our work.

SYSTEM
Facts & Figures

Funding programme: Horizon 2020
Call: Fight against crime and Terrorism, SEC-10-FCT-2017
Type of action: Innovation Actions
Project Reference: 787128
Starting date: 1 September 2018
Duration: 42 months
Number of partners: 21
Total cost: € 9.087.796,60
Total EU funding: € 7.926.173,05

SYSTEM is an **Innovation Action** awarded to a consortium led by Fondazione FORMIT addressing the challenge of the topic "Integration of detection capabilities and data fusion with utility providers' network" (SEC-10-FCT-2017) included in the 2016-2017 Work Programme "Secure societies – Protecting freedom and security of Europe and its citizens" of Horizon 2020. SYSTEM started on 1 September 2018 and aims at **developing and testing a customised sensing system** for hazardous substances detection in complementary utility networks and public spaces. The proposed innovative monitoring and observing of fused data sources have been tested across urban areas in six cities (Bratislava, Idstein, Latina, Munich, Rome and Warsaw). Detection results have been gathered in real time and sent and fused in remote mode to a customised monitoring centre that will be helpful to Law Enforcement Agencies to better and faster detect suspicious illegal clandestine laboratories. To achieve these aims, a wide set of skills and capabilities has been considered key to success, determining the large partnership working on the project, made by partners cooperating with more than ten stakeholders supporting the project activities.

Who we are

The SYSTEM Consortium, composed by 21 partner organisations from Belgium, Germany, Greece, Italy, Poland and the Slovak Republic, includes four law enforcement authorities (RaCIS – Arma dei Carabinieri, Bundeskriminalamt Kriminaltechnisches Institut, Centralne Laboratorium Kryminalistyczne Policji, Ministry of Interior of the Slovak Republic), three utility network operators (Acea ATO 2 S.p.A., Acqualatina S.p.A., BVS a.s.), five scientific/ academic partners (Universität der Bundeswehr München, Hochschule Fresenius GmbH, Warsaw University of Technology, Ustav Hydrologie Slovenskej Akademie Vied, Vrije University Belgium), two industrial partners (Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V., RESI Informatica S.p.A.), three small and medium enterprises (Blue Technologies sp. Z o.o., SENSICHIPS Srl, T4i Engineering), two research foundations/ no profit organisations (Fondazione FORMIT, ISEM – Inštitút pre medzinárodnú bezpečnosť a krízover riadenie), one association (Observatory on Security and CBRNe Defence), and one municipality (Roma Capitale).
Additional law enforcement agencies, utility network operators and municipalities have already provided their commitment to support the testing and demonstration of innovative technologies.

Discover more about us here!

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SYSTEM testing activities in Rome

Three deployment and demonstration visits were in total performed in Rome during the project time until December 2021. Prior to them, preliminary activities were carried out to identify a sector of the sewer network with appropriate characteristics to deploy sensing technologies in non-controlled environment under safe conditions. Onsite inspections were carried out in eight different locations and sixteen manholes to identify a place meeting the following properties:

- flow speed < 1m/s,
- manhole depth < 5 m
- availability of several manholes along the sewer to carry out tests in different conditions
- no discharges between the selected manholes
- no traffic issue to safeguard the safety of operations and lower the impact on population.

Deployment and demonstration visits were therefore carried out in November and December 2021 comprising different activities, including organisation

and planning of the installation of sensors, installation of sensors as well as several testing activities. During the first and third visits held on 21-22 September 2021 and on 15 December 2021, Smart Cable Water (SCW) and Air sensors (SCA) were respectively deployed in selected manholes and trash bins: both sensors managed to classify the detected substances without knowing their nature, which was then confirmed by Carabinieri. The second visit was, on the contrary, completely dedicated to the solid waste scenario. The SCA and the T4i ARMA were in such occasion deployed in an AMA S.p.A. collecting centre.

"AMA S.p.A. has been pleased to host the SYSTEM demonstration visit at its factory given the great value these technologies hold for our company. Testing activities encouraged leaders in AMA to think about the future possible deployment of sensors to improve urban security and the role of the company in supporting the LEAs as contributors to public order to the Roman urban community", said Silvio De Sisti, Chief Engineering and Innovation Officer working in AMA.

During the three deployment and demonstration visits data gathered by sensors were sent to the GENESI Monitoring Centre (MC), which successfully collected them all in real time, thus enabling data fusion. Despite the challenging circumstances due to the ongoing COVID-19 pandemic and the difficulties encountered in arranging the activities, all sensors, data communication and data fusion have been successfully tested in the different scenarios. A list of deployment and demonstration visits including reference to partners and technologies joining is shown in the Table below:

Index	Timeframe	Type of Visit	Partners	Technologies
1	21.09.2021-22.09.2021	Deployment	FORMIT, RESI, SCP, ACEA ATO2, Carabinieri	SCA, SCW, MC
2	02.11.2021-05.11.2021	Demonstration	FORMIT, RESI, OSDIFE, Roma Capitale, AMA, T4i Eng	T4i ARMA, SCA, MC
3	15.12.2021	Demonstration	FORMIT, RESI, SCP, OSDIFE, ACEA ATO2, Roma Capitale, Carabinieri	SCA, SCW, MC

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SYSTEM TECH FOCUS
T4i ARMA

What is the T4i ARMA

T4i ARMA is a robust chemical detector developed for solid waste trucks belonging to the T4i DOVER® 'family' of products. Based on fast GC-PID technology, it can be used for detection, identification and monitoring of target chemicals found in harsh environments. It has been designed in a way to withstand vibrations originated by the vehicle's movement, collect vapour samples from within the waste chamber, run an optimised GC analysis and trigger and transmit alarms to an operational centre whenever a target chemical is detected. A special, robust industrial-type button is connected through shielded wire (1-10m) with the detector allowing on demand measurements. The detector transmits alarms upon detection of compounds of interest to the MC. Advanced software has been developed for enhancing user experience.

Where the T4i ARMA was installed

From 02 to 05 November 2021 the T4i ARMA was deployed on a solid waste truck during the SYSTEM project testing campaign in Rome. A number of lab and field tests, in fully and semi-controlled simulated environments were used to prepare for this deployment. T4i ARMA final deployment in an operational, uncontrolled environment was achieved thanks to the cooperation with AMA and FORMIT, who hosted the test session. The deployment plan was based on a realistic scenario, that of the routine household waste collection. Rehearsals of the scenario had been carried out prior to the actual testing and demonstration (D) day. T4i ARMA was initially tested on solid waste bins containing actual waste, enriched with target analytes that were added to the matrix. Efficient and reliable detection was confirmed together with identification of the target analytes. Installation and set-up on the waste truck took one full day, thus ensuring proper operation of T4i ARMA whilst onboard. Data (alarms) were automatically transmitted to the GENESI Monitoring Centre (MC) provided by RESI, which visualised them in real time on a map. Despite COVID-19 restrictions, field testing has been carried out at the premises of AMA in Rome. T4i ARMA achieved the tests objectives and results confirmed the detector performance and efficiency. Feedback for further improvements was collected.

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SYSTEM workshop for utility network operators

The SYSTEM project is glad to announce a **workshop** tailored for utility network operators dedicated to present its integrated system for continuous monitoring of compounds to detect hazardous substances. The workshop will be held online on **03 February 2022 from 10:00 a.m. to 12:30 p.m.** After presenting the system and its application to the sewage, solid waste and air scenarios, a round table discussion will follow on possible usage and challenges in deploying the system for environmental purposes. Presentations about the environmental implications of hazardous substances production in the pre– and post COVID-19 era and about the operational constraints to deploy sensing technologies in a SYSTEM-related harsh environment and standardisation needs will nurture the open discussion. **Registration by 01 February 2022 including participants' name, surname and affiliation** is mandatory to know more about the event and get the link to join.

WORKSHOP FOR UTILITY NETWORK OPERATORS

online, 03 February 2022
10:00 a.m. - 12:30 p.m.

Register at secretariat@systemproject.eu to join!

SYSTEM suggested readings

Chachuła, K.; Nowak, R.; Solano, F. Pollution Source Localization in Wastewater Networks. Sensors 2021, 21, 826.

In December 2016 the wastewater treatment plant of Baarle-Nassau, Netherlands, failed. The failure was caused by the illegal disposal of high volumes of acidic waste into the sewer network. Repairs cost between 80,000 and 100,000 EUR. A continuous monitoring system of a utility network such as this one would help to determine the causes of such pollution and could mitigate or reduce the impact of these kinds of events in the future. We have designed and tested a data fusion system that transforms the time-series of sensor measurements into an array of source-localised discharge events. The data fusion system performs this transformation as follows. First, the time-series of sensor measurements are resampled and converted to sensor observations in a unified discrete time domain. Second, sensor observations are mapped to pollutant detections that indicate the amount of specific pollutants according to a priori knowledge. Third, pollutant detections are used for inferring the propagation of the discharged pollutant downstream of the sewage network to account for missing sensor observations. Fourth, pollutant detections and inferred sensor observations are clustered to form tracks. Finally, tracks are processed and propagated upstream to form the final list of probable events. A set of experiments was performed using a modified variant of the EPANET Example Network 2. Results show that the proposed system can narrow down the source of pollution to seven or fewer nodes, depending on the number of sensors, while processing approximately 100 sensor observations per second. Such a system could thus provide meaningful information about pollution events in utility networks.

Hehet P, Köke N, Zahn D, et al. Synthetic cannabinoid receptor agonists and their human metabolites in sewage water: Stability assessment and identification of transformation products. Drug Test Anal. 2021;13(10):1758-1767.

Since their first appearance in 2008, synthetic cannabinoid receptor agonists (SCRAs) remain the most popular new psychoactive substances (NPS) in the EU. Following consumption, these drugs and their metabolites are urinary excreted and enter the sewage system enabling the application of wastewater-based epidemiology (WBE). Knowing the fate of target analytes in sewage water is essential for successful application of WBE. This study investigates the stability of several chemically diverse SCRAs and selected human metabolites under sewage conditions utilising a combination of liquid chromatography–tandem mass spectrometry and high-resolution mass spectrometry (HRMS).

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