INFRALERT

Linear infrastructure efficiency improvement by automated learning and optimized predictive maintenance techniques

Content

EDITORIAL

Dear Readers,

Welcome to the second issue of the INFRALERT newsletter, which briefly sumarizes the work done so far and also includes an interview with Mr. Axel Simroth (Fraunhofer), the INFRALERT Project Coordinator.

In this second issue, we are pleased to provide you with short summaries of the latest project meetings as well as the 1st INFRALERT Open Workshop successfully held in Brussels.

In the Newsletter, we offer you a short overview on recent and upcoming events related to the project.

We hope you will enjoy reading this second issue of the INFRALERT Newsletter.

the INFRALERT Consortium

For more information and news, please see our website.

PROJECT STATUS

The INFRALERT project has reached the mid-term of its implementation. During this period, the Partners have been concentrated on:

- Development of appropriate methodologies to **foreseen** future **asset conditions**.
- Application of supervised **machine learning** techniques (classification) **to generate alerts**.
- Development of a suitable **framework** to obtain/evaluate **system RAMS** and **operational/maintenance costs**, compliant to existing European standards.
- Setup of stochastic **optimisation techniques** to obtain optimal intervention solutions subject to uncertainties in the **planning process**.
- Setup of the **Data Farm structure** (model, data storage, ontology) and addressing the challenges to effectively process the heterogeneous data types to be collected.
- Development of the **eIMS IT architecture**, functional design, and graphical user interface.

Some results of this intensive work can be found in the public deliverables that you can download at **http://infralert.eu/**.

The current progress towards these objectives is related to the fact that the two pilot cases are being taken into consideration in the development of the algorithms and analytic methodologies.

A short overview on the high-level scope of the two pilots is presented below.

PILOT TEST

In the road pilot case it will be demonstrated how the mid-term planning of maintenance interventions on a network can be improved. Maintenance alerts will be generated based on predicted development of the asset condition, alerts will be estimated in a five year time horizon, RAMS and LCC parameter derived from historical data will be used for calculating KPIs in the planning process. Several experimental settings will be analysed where the trade-off between cost efficiency, quality of the network (in terms of road condition) and service availability (in terms of traffic reduction) will be shown.

Road network, Coimbra region in the centre of Portugal, managed by Infraestruturas de Portugal

In the Swedish rail pilot it will be demonstrated how an optimal priorisation and selection of short-term maintenance interventions can be achieved by considering uncertain failure and defect occurrences and their consequences. Derived from RAMS and LCC analysis, a set of probable preventive interventions will be generated, and the scheduling and integration into the pre-defined maintenance windows is carried out. Again, the trade-off between optimal costs for maintenance, expected costs for failures and reliability of the assets will be analysed in a set of real-world experiments.

Railway corridor, Iron Ore Line in Malmbannan in northern Sweden, managed by Trafikverket

INFRALERT

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1ST INFRALERT OPEN WORKSHOP

The 1st Open Workshop of the INFRALERT project has been held on the 16th November 2016 at the EU Liaison Office of the German Research Organisations (KoWi) in Brussels (Belgium).

This public event of the INFRALET project was organized in three sessions with contributions from insiders and outsiders.

INFRALERT sessions

The first session, was devoted to an introduction to the project with a welcoming talk by Mr. Axel Simroth (Fraunhofer IVI), the Project Coordinator. After the introduction, a general overview was presented by Dr. Noemi Jimenez-Redondo (CEMOSA), technical manager of the project, followed by Mr. Cesare Santanera (DMA) who presented the background and motivations.

In the second session, examples of asset management and maintenance planning were presented by Mr. João Gomes (Infraestruturas de Portugal) and Mr. Henk Samson (STRUKTON RAIL) in the road and railway sector, respectively.

The third session focused on the technical developments, including the presentations of all the INFRALERT partners on the main progress and outputs of the project up to date. Firstly, Mr. Cesare Santanera (DMA) presented progresses and challenges that the INFRALERT Data Farm is facing to effectively process the heterogeneous data types that are being collected. Mr. András Juszt (Regens) presented a technical overview on the eIMS IT architecture and its functional design, together with Mr. Levente Mihály who showed the audience a live demo of the graphical user interface. Work packages devoted to the analytic part of the project were presented next. Dr. Johan Odelius (Lulea Tekniska Universitet) presented the models being used for asset condition forecasting. Prof. Francisco G. Benitez (Universidad de Sevilla) reported on the work progress related to generation of work orders and alert management using Machine Learning techniques, and finally, Dr. Álvaro Calle-Cordón (CEMOSA) presented the advanced carried out to extract system RAMS characteristics and models to assess Life-Cycle Costs. The third session round of presentations was closed by Mrs. Ute Kandler (Fraunhofer IVI) who presented the developments of the decision support tool for maintenance planning.

After the technical results were presented, an open discussion session moderated by Dr. Jesús Rodriguez, Managing Director of the Spanish Construction Technology Platform (PTEC) took place. In this last session interesting questions were addressed including ICT tools for capacity improvement of existing infrastructure networks, the new role played by data-driven model in maintenance engineering and Big Data technology issues among others.

All presentations of this workshop are available on the website.

PROJECT MEETINGS

2nd EAB workshop (after Open Workshop)

Just after the 1st INFRALERT Open Workshop, it took place the second workshop with the External Advisory Board (EAB) members. In particular, the persons attending the meeting were:

- Antonio Pérez de Arenaza, from Acciona Concesiones (Spain)
- Gerhard Eberl, from ASFiNAG (Austria)
- Henk Samson, from Strukton Rail (Netherlands)
- Pascal Rossigny, from CEREMA (France)
- Benedict Stein, from HPE (Germany)

They gave recommendations to the General Assembly on the methodological approaches and technical developments presented during the INFRALERT Open Workshop.

Next Project Board Meeting

The time for the next annual Project Board meeting is approaching, which will take place in Lisbon (Portugal) from 7 to 9 June 2017.

Apart from reviewing the work done to date and the evolution of the deliverables, this event will be an opportunity to discuss all related details to the pilot demonstrations. Furthermore, there will be the Exploitation workshop organised and guided by the external experts for prospective exploitation.

Thanks to our IP colleagues we will also have the opportunity of an interesting visit of the famous bridge "Ponte 25 de Abril".

We will keep you informed on advances through the website.

INFRALERT

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INTERVIEW WITH THE INFRALERT PROJECT COORDINATOR

Mr. Axel Simroth, Group Manager of the team "Operation Research" at Fraunhofer IVI

He works since 2006 at Fraunhofer Institute for Transportation and Infrastructure Systems in Dresden, Germany. He is leading the working group Operations Research, which is concerned with the application of mathematical optimisation models to provide decision support for diverse - ranging from infrastructure asset management, logistics processes, manufacturing and resource scheduling.

His institute - the Fraunhofer IVI - is one of about 70 institutes of the Fraunhofer Gesellschaft, focusing on applied research in the areas of transportation and mobility, vehicle and infrastructure systems.

As the Project Coordinator, in this issue of the Newsletter he explains the project by means of interview questions.

Q1. How did the idea to develop the INFRALERT project come up?

Some of the partners of the INFRALERT consortium - CEMOSA, University of Seville, DMA and Fraunhofer IVI, already had a successful collaboration within the FP7-funded project ACEM-Rail. In this project we together started working on issues related to railway infrastructure management, focusing on the monitoring and data acquisition part of the asset management. We concluded after the project that there is still a gap when processing and using all the gathered data, extracting meaningful information and providing decision support using intelligent IT tools. This idea was the seed to set up a continuation project like INFRALERT.

Q2. What were the factors that influenced the making of the Consortium?

First of all, we were looking to compile a consortium with partners having an excellent background and expertise in the required technical challenges - from data processing to data analytics and decision support. Also, we were looking to be able to cover the transversal issues of the project: the scope of INFRALERT is not only on rail infrastructure, but on linear transport infrastructure in general. In this respect, Infraestruturas de Portugal is a partner that provides us with opportunities to demonstrate our results in a road infrastructure setting.

Q3. What according to you are the main goals of the project? Why are these goals considered to be important?

In a short, the first main goal of INFRALERT is to enable stakeholders in the infrastructure asset management process to do a more efficient planning of their maintenance and intervention activities, applying a predictive maintenance concept. In a more detailed view, this requires intelligent processing of existing data in several steps of a data analytics process: from measurement data localisation, efficient handling of big data, nowcasting and forecasting of asset condition and failures, extracting RAMS and

(Q3 cont.)

LCC parameter, generation of maintenance alerts to the final decision support for the planning.

To be effectively applied, it is important to embed the novel analytics and decision support tools into a flexible and adaptive IT environment, which is the second main goal of the project. This is done using a cloud-based and modular approach, ensuring that the system can be applied in diverse scenarios fulfilling the necessary requirements.

Q4. What opportunities can INFRALERT represent for infrastructure maintenance systems?

Due to the modular approach of the single INFRALERT tools it will be possible to extend the functionality of existing infrastructure maintenance systems (IMS) which mostly lack of intelligent data analytics and decision making. There are already contacts established and ongoing discussions during the project with IT service providers and integrators of IMS solutions to collaborate in this matter.

Q5. Fraunhofer has participated (or participates) in a number of European projects. What role does Fraunhofer IVI play in the INFRALERT project?

Fraunhofer IVI acts as the Project Coordinator of INFRALERT. On the technical level, we are responsible for Smart Decision Support toolkit, which involves the mathematical modelling of decision-making processes and the algorithm development for optimising the maintenance planning.

Q6. The project has reached the mid-term of its implementation, what is the current state-of-play?

In the first project stage, we defined the requirements of the final results and described the concept behind the solutions to be delivered. The Data Farm, which is the basic data collection and pre-processing layer of the overall system, has been designed and is in the process of being implemented. The architecture of the

INFRALERT

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INTERVIEW CONTINUED

(Q6 cont.)

INFRALERT overall solution - the expert-based Infrastructure Management System or eIMS - and its functionalities have also been defined. Ongoing work in relation to the eIMS is done to integrate the toolkits and develop the GUI. Regarding the toolkits for data analytics, some of them are already in a state to be validated and demonstrate results in testing environments. We are now in a phase of linking and combining the several tools to be applied in the pilot scenarios - the rail use case in Sweden and the road use case in Portugal.

Q7. Where do you see the biggest challenge(s) within INFRALERT?

Besides the technical challenges that each of the partners is faced with in its own developments, the biggest overall challenge probably is the integration of all the diverse technologies into a single system. The vision for this overall solution - which brings a big change to the asset management process - was very clear to us from the beginning, but during the implementation "the devil is in the details".

Q8. What do you expect from the project in the coming months?

As said we are now approaching the crucial phase of demonstration in the pilot scenarios. This is particularly important for the project and at the same time exciting for the partners because we now expect to see our efforts during the last months materialising in benefits for the end users. From preliminary results in testing conditions we are quite confident that matters will develop in our sense, but it is always interesting to see how the developed solutions will behave in reality - and of course also how the end users react.

Q9. What continuation will INFRALERT have?

We definitely will not stop our activities with the results that we are delivered by the project! There are already several follow-up projects and activities initiated which will assure a smooth continuation of the work - in a research context as well as concrete business opportunities for partners. For instance, we as Fraunhofer IVI together with CEMOSA are part of the consortium Smart DeMain, which is an associated member of the Shift2Rail Joint Undertaking. Here, we are contributing with expertise in maintenance decision support and RAMS/LCC analysis, strongly related to our INFRALERT project.

RECENT AND UPCOMING EVENTS

For promoting and sharing project results, the INFRALERT partners have participated or plan to participate in:

March 28, 2017:
COLLABORATIVE INNOVATION DAYS

1st Workshop on Infrastructure Cloud – Construction and Maintenance in Brussels, Belgium.

Dr. Noemi Jimenez-Redondo from CEMOSA showed the project in this thematic workshop, that also included a poster session.

June 12 – 16, 2017:
World Conference on Pavement and Asset Management (WCPAM 2017) in Milan, Italy.

September 21 – 22, 2017:
Building up Efficient and Sustainable Transport Infrastructure (BESTInfra 2017) in Prague, Czech Republic.

April 16 – 19, 2018:
Transport Research Arena (TRA 2018) in Vienna, Austria.

FUTURE WORKSHOPS AND WEBINARS

3rd INFRALERT EAB Workshop

It will take place in November 2017. The purpose of this meeting will be not only to present and discuss the results and output of the project, but also to involve EAB members in the project and to transfer their feedback to results, based on first project results, for further fine-tuning of the research.

2nd INFRALERT Open Workshop

The Second INFRALERT Open Workshop will be held around April 2018, concurrent with the last meeting of the consortium (the venue is pending to be decided). The main objective will be to present the final results achieved in INFRALERT project and to serve as a discussion forum for researchers and professionals who are interested in the field.

Similar to the 1st Open Workshop, it will be open to any person interested in the project's topic.

For announcements, programme and Registration, please refer to the INFRALERT website.

Need more information

For any feedback, questions or more detailed information about INFRALERT project, please contact:

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Or visit our website:
  http://infralert.eu

which contains general information about the project, news and upcoming events as well as dedicated pages for most important dissemination documents and press releases (including public deliverables).