



RESilient transport InfraStructure to extreme events

Overview of the first year of RESIST project

Newsletter N°2 - December 2019

Editorial

Welcome to the second RESIST Newsletter!

The RESIST project is a Research and Innovation Action that has received funding from the European Union's Horizon 2020 Research and Innovation Programme, under the Grant Agreement No 769066.

RESIST (RESilient transport InfraStructure to extreme events) is a 36-month project, started on 01 September 2018, whose aims are to increase the resilience of seamless transport operation to natural and man-made extreme events, protect the users of the European transport infrastructure and provide optimal information to the operators and users of the transport infrastructure

This is the second issue of our bi-annual newsletter, which presents an overview of the project's achievements during the first year of the project.

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Progress of the project

During the first year of the RESIST project, Consortium made a great progress. RESIST partners worked in the design of the hardware adaptations of the previously-developed aerial

platforms for inspecting, by contact, steel and concrete bridges and tunnels, including the general architecture and localization and navigation functions. A dual sensor perception module was designed and built for high resolution image acquisition and 3d reconstruction of the structure surfaces, ultrasonic sensors for contact inspection and radiometric sensor for rebar characterization. Also, the vibration modules were designed to be installed permanently on the structure. Prototypes of these systems have been tested in the partners' labs.

In addition, the network architecture for supporting resilient and secure communications was defined. For this purpose, partners have explored the scenarios of exploiting a REDComm node in the field. A study on security concerns for the communication between the Remotely Piloted Aircraft System (RPAS) and the Ground Control Station (GCS) has been performed. Moreover, a server in the REDComm node has been set up and installed that provides a visualization Environment (proxmox) to be exploited by various RESIST functionalities as required.

Furthermore, During the first year of the project, partners presented the early exploitation plan of the project that is highly correlated to the innovation management plan. According to the plan, all the innovation results of the project are identified and classified according to their TRL level. The results with a low TRL will be considered as Innovation Results (IRs) and further innovation actions will be organized for them (publications in scientific journals and papers, presentations in scientific meetings, conferences and workshops, etc.), while the results with higher TRL, that are more mature to be launched to the market, will be considered as Key exploitable results (KERs) and further exploitation actions will be organized for their efficient exploitation. To achieve this, a Business Model Canvas methodology was presented that identifies and analyses several parameters (key resources, key activities, key partners, value propositions, customer relationships, channels, customer segments, cost structure and revenue stream) that can boost the exploitation of RESIST's results.

Several standardization activities have been performed regarding the new European UAS regulation. It has been already developed a definition of a pre-risk assessment scenario after applying the SORA methodology (risk assessment methodology for the Specific category of the UAS regulation) to RESIST missions. Furthermore, the future European U-space regulation, related to the integration of the drones in the airspace, is being closely monitored.

Pilots

Pilot 1

The integrated platform of RESIST will be field tested on a selected section of the Egnatia Motorway, I/C Peristeri -I/C Aracthos in Greece. A long ravine bridge (T9/T11) whose abutments are founded on an active landslide area and recently stabilized by extended counter measures, will be inspected/assessed in a fast and efficient manner. During this pilot case the response of EOAE (Road Operator) to catastrophic seismic activation of landslide will be validated, using RESIST platform. Both aerial drone mission results and SHM measurements will be used, analysed and compared to analytical predictions of the bridge response to hazardous loading conditions.



Figure 1 Egnatia Motorways Bridge T9, Greece

Pilot 2

A) Millaures Bridge

Over the first year RESIST started to develop the following activities:

1. Improvements of current A32 Emergency Plan in order to integrate upcoming RESIST procedures in case of extreme events
2. Obtaining information on the stability of Millaures Bridge and St. Petronilla Tunnel (state of conservation and maintenance - currently we got only reports about visual inspections - there aren't sensors)
3. Implementation of the schedule of interventions in case of critical events
4. Forecasting of bridge maintenance activities
5. Remote prevention activities using variable message signs and traffic lights that stop transit on the bridge or entry into the tunnel in case of extreme events
6. Interaction between the information management system of the motorway with the procedures established by the official emergency plans
7. Implementation of DSS (Decision Support System) for the management of emergencies



Figure 2 A32 Control Centre

As Millaures bridge is built with steel and concrete, it will be used as test site in order to "train" automated vision systems to recognize structural defects and damages like cracks of concrete, oxidation and heavy corrosion of steel parts of the infrastructure.



Figure 3 Millaures Bridge - Cracks and steel oxidation

B) St. Petronilla Tunnel

The installation of a "Wi-Fi in Motion" network in tunnel has been completed. "WiFi in motion" is called because it allows continuous connection without data loss with moving vehicles, as in the tunnel there isn't cellular signal from telephony service providers. Wi-Fi network will be tested for communication of data from robotic systems (RPAS) and wireless sensors.

The most relevant functional aspects are the following:

- Broadband connectivity able to guarantee communication of data, voice and images;
- Operation on the move at least up to the speeds set by the Traffic Laws;
- Complete independence from commercial telecommunications operators (free for the user);
- Compatibility with mobile devices on the market and normally used.

In the Italian pilot a simulation of an earthquake will be run managing the following consequences after the catastrophic event.

Here some examples:

- Cars trapped inside the tunnel by debris;
- Blackout;
- Lack of communication;
- Traffic routing;
- Coordination between rescue teams;
- Crack detection of tunnel concrete.



Figure 4 Wi-Fi in Motion



Figure 5 St. Petronilla test area

Project Meetings

The 2nd RESIST Plenary Meeting

The second Plenary Meeting for the RESIST project was organised on 24-25 September 2019 in Graz, Austria (Figure 5). The meeting was hosted by Graz University of Technology. During the two-day meeting, the project partners discussed on the project's progress and forthcoming activities linked to RESIST project. More info [here](#).



Figure 6. RESIST Consortium

Dissemination Events

IEEE/RSJ International Conference on Intelligent Robots and Systems 2018

[Tutorial on Aerial Robotic Manipulation](#) was organized by Guillermo Heredia, USE, on 5th October 2018 during the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) on 1-5th October 2018 in Madrid, Spain. The tutorial was supported by RESIST project as well.

S-MOVING 2018

Antidio Viguria, FADA-CATEC, gave a presentation on RESIST project at [S-MOVING](#) Conference on 17th and 18th of October 2018 in Málaga, Spain. The presentation focused on Remotely Piloted Aircraft Systems (RPAS) and their validation.

European Robotics Forum

Workshop, called [Aerial Robotics Technologies & Applications with the new European UAS regulation](#), was co-organized by Anibal Ollero (USE) during the [European Robotics Forum](#) on 20-22nd March 2019 in Bucharest, Romania. The Workshop was supported by RESIST project.

RESIST at AUVSI XPONENTIAL

Antonio Jimenez and Rafael Caballero, FADA-CATEC, presented a RESIST project on 30th April - 2nd May 2019 at [AUVSI Xponential](#) in Chicago. Partners used the video with the results of the [AEROBI](#) project and presented [RESIST](#) as the next step for increasing the TRL of the technology.

Conference on Drones and robots for mapping, inspection and maintenance

Guillermo Heredia, USE, attended the conference called Drones and robots for mapping, inspection and maintenance

In May 2019 in Oslo, Norway. The presentation was on Aerial Robotics for Inspection and Maintenance which is relevant for RESIST project, more precisely for design and control of aerial robots.

2019 International Conference on Robotics and Automation (ICRA)

Guillermo Heredia, USE, attended the ICRA Conference on 23rd May 2019 in Montreal, Canada and presented RESIST project at the [Workshop "Benchmarks for Robotic Manipulation"](#). The presentation focused on benchmarks for aerial manipulation.

RESIST at 1st PANOPTIS plenary meeting

Kostas Bouklos, ICCS, presented the RESIST project at the 1st [PANOPTIS](#) plenary meeting, which was organised on 06 June 2019 at the [National Technical University of Athens campus \(NTUA\), Athens](#), Greece.

2019 Robots: Science and Systems (RSS)

Workshop, called [Aerial Interaction and Manipulation: Unsolved Challenges and Perspectives](#), was co-organized by Guillermo Heredia (USE) during the 2019 Robots: Science and Systems (RSS) on 23rd June 2019 in Freiburg, Germany.

Anibal Ollero (USE) gave a presentation on Aerial robotic manipulators: Unsolved challenges and perspectives. The Workshop was supported by RESIST project.

RESIST at ICVSS 2019

RESIST was present at the International Computer Vision Summer School 2019 (ICVSS) on 7-13 July 2019 in Sicily, Italy.

Rafael Weilharter, TU Graz, presented a poster about his current work, which included giving an overview of the Photogrammetric Computer Vision System for RESIST.



Fig. 6 Rafael Weilharter, TU Graz

RESIST was a sponsor at NIS'19

Andreas Miaoudakis, FORTH, presented RESIST project at the [6th Network and Information Security \(NIS'19\) Summer School](#), which took place on 16-20 September 2019, in Crete (Greece).

This event was jointly organised by the European Union Agency for cybersecurity (ENISA) and the Foundation for Research and Technology - Hellas (FORTH).



Fig. 7 Andreas Miaoudakis, FORTH

Links

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Partners



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Project Coordinator

Dr. Angelos Amditis
Institute of Communication and Computer
Systems (ICCS) 9, Iroon Polytechniou
Str. Zografou,
GR-15773, Athens, Greece
a.amditis@iccs.gr

Communication & Dissemination Manager

Dr. Adewole Adesiyun
Forum of European National Highway
Research Laboratories(FEHL)
42/b3, Blvd de la Woluwe, Brussels, Belgium
adewole.adesiyun@fehrl.org

FEHL Secretariat | +32 2 775 8245 | info@fehrl.org | www.fehrl.org

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