BADGER at a glance...

The Project

The Objectives

The Partners

News and Events

Upcoming Events

- **IROS 2018 - 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems, Oct 1-5 – Madrid, Spain**

  This year's IROS conference is organized in Madrid, Spain, on 1-5 of October. The conference is chaired this year by the BADGER Coordinator, prof. Carlos Balaguer of UC3M (General Chair of IROS 2018). BADGER will be present at the IROS 2018 Conference, both through a BADGER booth at the IROS Exhibition space, as well as through a BADGER paper that has been accepted for publication in the conference (oral presentation)

- **BADGER Consortium meeting at CERTH-ITI, October 23-24 – Thessaloniki, Greece**

  The next meeting of the BADGER Consortium has been planned to take place on October 2018, in Thessaloniki, Greece,. The meeting will be hosted by the Information Technologies Institute of the Centre for Research and Technology Hellas (CERTH-ITI)

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BADGER Project

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Initial working prototypes of BADGER components under way

The BADGER project has started to produce initial, working prototypes of components that will gradually constitute the overall integrated BADGER system.

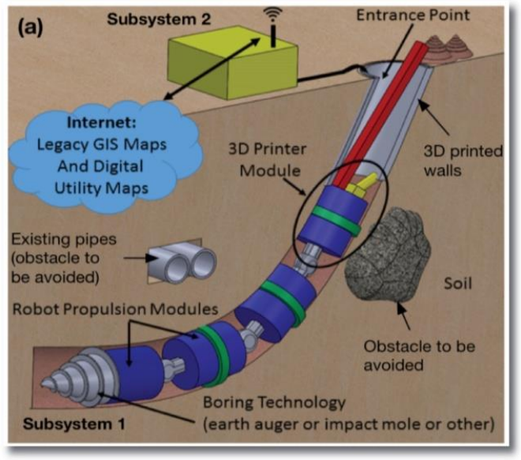
Among others, initial prototypes of the surface rover module, the end user interface, as well as of components of the subsurface robot have been developed.

During the project meeting that accompanied the mid-term project review, held in Leganes, Madrid, Spain, during the first week of July, live demonstration of a series of initial prototypes of BADGER components took place.

ROBOT FOR AUTONOMOUS UNDERGROUND TRENCHLESS OPERATIONS, MAPPING & NAVIGATION

The aim of BADGER is to design and develop an integrated underground robotic system for autonomous construction of subterranean small-diameter and highly curved tunnel networks in urban environments. For that, advanced robotics control techniques will be used such as localization, mapping and autonomous navigation; sensor fusion including underground odometry and geo-radar; adaptation behaviours for different soils; machine learning.

tasks in different application domains of high societal and economic impact including trenchless constructions (cabling and piping installations), search and rescue operations, remote science and exploration applications, among others. In this scope, we will go a step further from existing trenchless excavation and environment mapping technologies, by introducing technical approaches and latest innovations inspired by the most advanced robotic technologies. .



We envision an underground robotic system that autonomously navigates in the subsurface by pulverizing, removing and pushing through the subsurface soil, while at the same time the system uses advanced sensing modalities, perception techniques and cognition to localise itself, map and understand the working environment and make decisions on how to better pursue its goals.

BADGER

BADGER at Glasgow Science Festival Sunday

On June 10, 2018, The BADGER project was presented at the Glasgow Science Festival Science Sunday on the 10th of June. This yearly event allowed the UoG to engage with the local community and discuss the BADGER project with the general public.

The feedback on the day was positive and the UoG BADGER team came up with a number of activates that helped people understand what the BADGER project is doing and how the project is being approached.

The idea of BADGER was received well by all that stopped at the event and it was great to see the enthusiasm for this type of work; something that has a noticeable impact on people's lives.

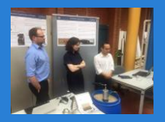
Reed more…

BADGER School Talk

The BADGER project and its novel approach towards underground trenchless operations, was introduced to 10-12 year old students, at a school talk that took place on 02/02/2018, in Glasgow, Scotland.

BADGER meets in Madrid

A BADGER meeting was held at the premises of UC3M, in Leganes, during the first week of July 2018, along with the mid-term project review. A series of live demonstrations of preliminary H/W and S/W components of the overall BADGER system were performed by the BADGER partners.



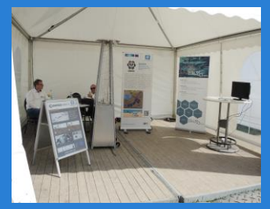
BADGER at the Global Robot Expo

This year's Global Robot Expo was held in Madrid, on 18-20 April 2018. This has become a fully professional event for all the innovators who want to generate business in robotics. GR-EX is also the place for knowledge-sharing with speakers from all over the world taking the stage to discuss the trending matters in the industry. Robotnik had a booth at the Expo to show its technologies and talks and leaflets of BADGER were given to attendees.

GLOBAL ROBOT EXPO
INTERNATIONAL EXHIBITION ON ROBOTICS

BADGER at the Tracto-Technik "hands on days"

TRACTO-TECHNIK GmbH & Co. KG organized the "HANDS ON DAYS" event from the 9th until the 13th of April 2018. It is an internal exhibition for international customers and interested persons for trenchless technologies manufactured by TT. At this exhibition the machines from TT are presented also into the test field as well as lectures to different themes are held.



The BADGER consortium was represented in this event by researchers of TT, who presented the vision, the main objectives and the desired future impact of the project. Specifically, the presenter focused on the main objective of the project that is the development of an intelligent underground robotic system capable of autonomous trenchless operations, mapping and navigation, aiming to improve the quality of life of citizens by automating civil and environmental applications, reducing traffic congestion and pollution of urban environments and by replacing human workers on hazardous jobs such as mining, quarrying and search & rescue.

Badger at the National Robotic Days

Robotnik participated at The 2018 National Robotics Conference, which has been organized by the Spanish Automation Committee (CEA), took place in Vallladolid in 14-15 June 2018. CEA, through its Robotic Thematic Group (GTROB), promoted these conferences to give visibility and show the activity that takes place in robotics (research, technological transfer, etc).The sessions were open to the participation of the entire scientific community, of associations, of consortia, of companies and of research groups interested in robotics. In this event the last results of national and international projects were presented. Robotnik was showing some robots at the event and BADGER leaflets were given to the attendees

This issue's highlight
BADGER WORKSHOP at the ERF 2018

BADGER organized a workshop in the European Robotics Forum 2018 (ERF2018), which was held in Tampere, Finland on 13-15 March 2018, entitled "Intelligent trenchless underground robotic systems". The aim of the workshop was to present a new robotic domain such as intelligent underground robotics.

EUROPEAN ROBOTICS FORUM
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The workshop consisted of several slots that presented, on one side, the end-users needs and requirements and advanced industrial technologies in the field, and, on the other side, the new research approaches in autonomous undergoing drilling, inspection and navigation. The presentations were structured in 50-50% industry-academia format and included results and case-studies of different projects, including some undergoing EU ones. In this scope, the project included among others presentations of the H2020, EU-funded projects VAMOS, Hephaestus and Unexmin.

BADGER exhibition at IROS 2018

The BADGER consortium will participate at the exhibition of IROS 2018 with a stand, aiming to exhibit the basic technological advances achieved during the project's lifespan. Videos, live demos and hardware components from the novel boring underground robot are planned.

IEEE/RSJ International Conference on Intelligent Robots and Systems
IROS2018.org / October 1 – 5, 2018 / Municipal Conference Centre / Madrid, Spain
MADRID 2018 IROS

BADGER at the IEEE SIMPAR 2018 conference

CERTH has participated in the 6th IEEE International Conference on Simulation, Modeling and Programing for Autonomous Robots (IEEE SIMPAR 2018), presenting the paper: "Surface/Subsurface Mapping with an Integrated Rover-GPR System, A Simulation Approach", which was authored by G. Kouros, C. Psarras, I. Kostavelis, D. Giakoumis and D. Tzovaras

IEEE International Conference on Simulation, Modeling, and Programming for Autonomous Robots
SIMPAR Brisbane 2018

BADGER paper at IROS 2018

A paper submitted by CERTH, entitled as: "**3D Underground Mapping with A Mobile Robot and a GPR Antenna**" has been accepted for oral presentation at IROS 2018, to be held at Madrid, on 1-5 Oct.

The paper, introduced for the first time, a novel integrated framework for subsurface mapping by exploiting a surface operating mobile robot with a Ground Penetrating Radar (GPR). The mobile robot tows the GPR antenna, which is mounted on a specifically designed trailer, and is utilized as the mean to cover the surface area, while at the same time the antenna scans the subsurface by emitting electromagnetic pulses.

The outcome of this procedure is a joint surface/subsurface metric map that accurately represents the buried infrastructures. Semantic annotations are also provided.

BADGER paper at ICCAIRO 2018

The BADGER paper entitled "**Ground Penetrating Radar Image Processing towards Underground Utilities Detection for Robotic Applications**", authored by E. Skartados, I. Kostavelis, D. Giakoumis, A. Simi, G. Manacorda, D. Ioannidis, and D. Tzovaras, has been published in the 2018 International Conference on Control, Artificial Intelligence, Robotics & Optimization 2018 (ICCAIRO 2018)