The University of Coimbra, Portugal, comprises eight Faculties, more than 2000 teachers and 22,000 students. Founded in the year 1290, the University of Coimbra is the oldest in Portugal and one of the oldest in the World. The University of Coimbra develops high added-value activities in partnership with over one thousand national and international organizations. It is an institution dedicated to creation, transmission, critique and dissemination of culture, science and technology. The University of Coimbra’s international prestige is the result of a set of multiple factors, which includes the cosmopolitan character of its academy (with over 70 nationalities).

Contact: Jorge Sá Silva, sasilva@dei.uc.pt

Now approaching its 50th year, Lancaster University is a world-class centre for teaching and research and is located on a beautiful campus in the North West of England. Lancaster University is committed to pursuing international research at the highest level. As a leading research-led university, we have students from over 100 countries studying at our UK campus and teaching and research partnerships across the globe. We have over 12,000 students across one of the safest campuses in the UK, 92% of Lancaster University graduates go into work or further study we have a community of over 100,000 alumni in 138 countries. Our research and teaching also has a significant impact on society and the economy through our work with business and other organizations.

Contact: Utz Roedig, ut.roedig@lancaster.ac.uk

Founded in 1845, University College Cork (UCC) currently has 19,000 students in four colleges: Arts, Celtic Studies and Social Sciences, Business and Law, Medicine and Health, and Science, Engineering and Food Science. UCC has an established international profile for its research activity, currently with the highest level of peer-reviewed research income amongst Irish universities, and ranking 188th in the recent QS world university rankings. UCC is a performer and is recognized for its teaching quality and the level of research it undertakes. The University is a major player in our recent research on Vehicular Networks, Mobility issues and wireless networks have been playing a significant role in our recent research on Vehicular Networks, Mobility issues and wireless networks have been playing a major role in our recent research on Vehicular Networks, Wireless Sensor Networks, and Delay Tolerant Networks.

Contact: Lars Wolf, wolf@ibk.cs.tu-bs.de

Sines refinery began operating in 1978. Covering 320 hectares area, Sines refinery has a storage capacity of three million m³, of which 1.5 million m³ is crude oil, and the rest is final and intermediate products such as gas, gasoline and diesel. The refinery comprises 27 process units. With a distilling capacity of over 8 million tons a year, or 220,000 barrels a day, Sines refinery is one of the largest in Europe. Sines refinery produces Gasoline, Diesel, LPG, Fuel oil, Naphtha, Jet fuel, Bitumen, and Sulphur.

Contact: Luís Pedro Silva; luis_pedro.silva@galpenergia.com

The GINSENG consortium consists of the following eight institutions:

1. University of Cyprus is one of the youngest institutions of higher education in Cyprus and has been recognized for its teaching quality and the level of research it undertakes. The Lab performs research in the fields of Business Intelligence and Future Manufacturing.

Contact: Anja Juget, anja.juget@sap.com

2. The University of Coimbra is the oldest in Portugal and one of the oldest in the World. The University of Coimbra develops high added-value activities in partnership with over one thousand national and international organizations. It is an institution dedicated to creation, transmission, critique and dissemination of culture, science and technology. The University of Coimbra’s international prestige is the result of a set of multiple factors, which includes the cosmopolitan character of its academy (with over 70 nationalities).

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Key Achievements

- A wireless sensor network that offers performance control for message delivery delay and reliability.
- A set of technology innovations that offer an exploitation opportunity for European companies.
- Evaluation in a real-world deployment at an oil refinery.

Technical Approach

GINSENG involves several innovations and a fresh approach to wireless sensor network research. First, GINSENG adopts a planned approach for sensor node deployment to enable performance control. The second basis of GINSENG is software components with assured performance, including operating systems and protocols for radio medium access. The third basis of GINSENG is a set of algorithms that ensure control with respect to network topology and traffic. These three components enable the possibility to deploy sensor networks with assured performance. Recognizing the inherent uncertainties of the real-world, GINSENG also provides mechanisms and tools to perform performance debugging of deployed systems.

To encourage exploitation of the research outputs, GINSENG integrates with existing industry IT systems through distributed middleware. The applicability of the technology developed in GINSENG is proven in a performance-critical real-world application: in the context of the GALP oil refinery in Sines, Portugal, the end-to-end solution is used to monitor and control industrial processes. The GINSENG solution comprises sensor network software that executes on wireless sensor nodes, and middleware/backend software that is hosted on Internet-attached computers. The sensor nodes run the Contiki embedded operating system with real-time extensions, together with the GINSENG TDMA-based medium access control protocol (GinMAC), dynamic topology control algorithm, overload control code, node mobility, and performance debugging support. The distributed middleware provides stream processing and other capabilities to a variety of network applications, currently for plant control room personnel, for plant life-cycle management, and for plant life-cycle management.

Scientific, Economic and Societal Impact

GINSENG has enabled the academic partners to work on state-of-the-art research problems that have yielded innovative solutions and experimental software. For example, extensions to the Contiki system, the GinMAC protocol, dynamic topology control, and performance debugging. This has led to peer-reviewed publications and open-source software. Industry partner SAP will use middleware developed in the GINSENG project in their “Real-World Integration Platform”. Industry partner Petrolgal is evaluating GINSENG as a cost-effective and complementary technology to their conventional wired network of 35,000 sensors at the Sines refinery, and will use the demonstration system to impress upon their equipment suppliers their expectations for performance control in future product offerings. By enabling the use of WSNs in industrial applications, GINSENG will allow European technology companies to exploit the project outcomes to introduce products that advance the state-of-the-art. Once productized, this has the potential to significantly reduce the operating costs of European industry, thus improving their global competitiveness. More generally, GINSENG can extend beyond industrial scenarios to other application domains where performance-control is required, such as health informatics, worker safety and emergency response, thus offering to improve human work and living environments.

Facts

Exploitation

The GINSENG project has created significant knowledge in the areas of wireless sensor networks and industrial monitoring and control. This intellectual property is available for exploitation by hardware and software developers in the form of license agreement or commercial agreement with technical assistance.