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Nimbus / TEC Centre Newsletter

The Nimbus centre was co-funded by the Irish Government's Programme for Research in Third Level Institutions Cycle 4 and the European Regional Development Fund 2007 – 2013.

Over sixty five researchers are involved in NIMBUS, carrying out research, teaching and knowledge transfer to industry in the area of networked embedded systems. Research focuses on hardware, systems integration and networking in application fields such as energy, health, biomedical, manufacturing and on the technologies that will underpin the emerging Internet of Things.

Nimbus Centre Profile

On September 20th, 2010, the Nimbus Research Centre was formally opened by Minister for Enterprise, Trade and Innovation, Mr. Batt O'Keeffe. The NIMBUS Centre (www.nimbus.cit.ie) is one of Ireland's few research centres devoted to the field of embedded electronic systems. The Centre brings together CIT's existing Centre for Adaptive Wireless Systems (CAWS), the Smart Systems Integration Group (SSIG) and the Technologies for Embedded Computing (TEC) Centre and houses them in a recently completed research building on the CIT campus. The TEC Centre (www.tec-centre.ie) acts as the commercialisation arm of the Nimbus Centre.

The strategic focus areas of the centre will be based on three application research strands underpinned by the enabling technologies of adaptive wireless systems, smart systems integration and intelligent control systems.

The main application areas are:

- Smart Energy Management Systems
- Infrastructural Security and Personal Safety Systems
- Smart User Interfaces



Sensing Position for Vertical Slice of Arup Building



Deployment of test system in ARUP, London

A multi-hop wireless sensor network to monitor light levels across multiple floors has been deployed in the ARUP headquarters, London.

This research is funded as part of ITOBO, an SFI Strategic Research Cluster for Sustainable and Optimised Building (<http://zuse.ucc.ie/itobo/>) and includes research focused on ubiquitous wireless sensing infrastructure to support opti-

mised building energy management and operation.

The wireless devices have been deployed in appropriate sensing locations to gather environmental sensory data such as temperature, humidity, light, voltage and also network statistics. This wireless deployment provides a flexible, cost-effective solution for ARUP to monitor building data. This

data is then analysed to support energy saving decision making while maintaining the comfort levels of the building occupants. The system was developed by researches from Nimbus CIT, IRUSE UCC, 4C UCC and CCSL UCC. For more details contact Dr. Alan McGibney (alan.mcgibney@cit.ie).

In Hand Guides Ltd—Case Study



In Hand Guide prototype unit

"For a small 'start-up' company like In Hand Guides the support of a centre such as a TEC Centre is invaluable, not only for prototype development but also in assistance in both defining business possibilities and in defining research solutions etc.

It also helps that you are open, friendly and available to meet at short notice because access and the ability to move at short notice is a great help to a start-up."

Trevor Winckworth, In Hand Guides Ltd



TEC Centre Researcher testing an In Hand Guide prototype unit

An innovative use of new technology has allowed Cork company In Hand Guides Ltd to create a portable digital audio device that is being used for tourist guides in locations as diverse as Hill of Tara Ireland, the London Eye and the Sydney Tower Australia.

In 2007 Trevor Winckworth, Company Founder, contacted the TEC Centre in Cork Institute of Technology for advice on the development of an audio guide targeted to the tourist/lifestyle sector. He met with a team of researchers in Embedded Systems who were able to advise on the possible technical approaches to be followed.

The Enterprise Ireland Innovation Voucher scheme was seen as the best vehicle for funding the project. The voucher scheme helps to create linkages between SMEs and Knowledge Providers. The project scope was defined after a series of brainstorming and focused discussions. The project was divided into several workpackages which were then broken down to show clear milestones and deliverables. The project resulted in the development of a proto-

type audio device with head set and volume controls. The prototype allowed the company to demonstrate basic functionality to prospective customers. As a result of the successful development of the prototype it was possible to create an improved device which was manufactured in China. Thus the project succeeded in bringing a technical concept envisioned by In Hand Guides into an actual product, ready for market.

This project led onto a further project funded by an Enterprise Ireland Innovation Voucher in 2009. In Hand Guides had an objective of combining their existing Smart Audio Solution with E-ticketing functionality. Another function of the audio guide could be to act as the customer's pass to major attractions using an RFID contactless approach, similar to the smart ticketing solution provided by the London Underground Oyster Card. The project resulted in the development of a prototype which combined ticketing functionality with the audio guide. These tickets would be an embedded function of the audio guide itself with the possibility of "topping" up the card

to allow access to other sites and areas. The RFID functionality would also enable the audio to turn on once swiped into the relative attractions. The TEC centre was able to provide In Hand Guides with experts in embedded systems development and also to provide expertise in areas such as RFID and wireless technologies. All this was available under one roof and as a result the first prototype was designed and ready for demonstration within three months of the contract being signed. Also during this time we were able to provide a technical expert when needed at any meeting In Hand Guides had with prospective clients/partners.

Using an Enterprise Ireland Co-Funded Innovation Voucher, the prototype has been optimised. An outdoor field trial was completed successfully in the Trinity College Book of Kells exhibition, Trinity College Science Museum and the Joyce Museum in Nov 2010.

Discussions are ongoing for the next phase for Innovation in the In Hand Guides device. For more details contact Liam Moore (liam.moore@cit.ie).

Peer Reviewed Journal Publications

- S. Wibowo, M. Klepal, "Rao-Blackwellized Particle Filter for Pattern Matching Indoor Localisation", UPINLBS, Finland, October 2010
- Ch. Settgaest, M. Klepal, M. Weyn, "Object Correlation Evaluation for Location Data Fusion", UPINLBS 2010, Finland, October 2010
- Cuong Do, Marcin Cychowski, Maryna Lishchynska, Martin Hill, Kieran Delaney, "Integrated modelling of nonlinear dynamics and contact mechanics of electrostatically actuated RF MEMS switches", Proc. IEEE Industrial Electronics Conference (IECON) 2010



LocON—Case Study

Large scale infrastructures that use wireless localisation, communications, security and monitoring systems to track people, vehicles and equipment are currently restricted in the efficiency of their operations due to a lack of integration between the products and technologies used.

In airports new safety regulations, A-SMGCS (Advanced Surface Movement Guidance and Control System), concerning the location of people, planes and vehicles are currently not being met by available ICT systems.

LocON is an infrastructure management software platform that has been created as part of an EU 7th Framework project.

The core technologies have been designed and developed by a team of nine European commercial and academic partners. The platform enables multiple localisation, monitoring and communications technologies, which are generating vast amounts of data to be integrated into one system. The platform also standardises the interface to the technolo-

gies that will use the system such as:

- Wireless localisation (GPS, GSM, WiFi, UWB, etc)
- Communications
- Sensors
- Monitoring Systems (CCTV)

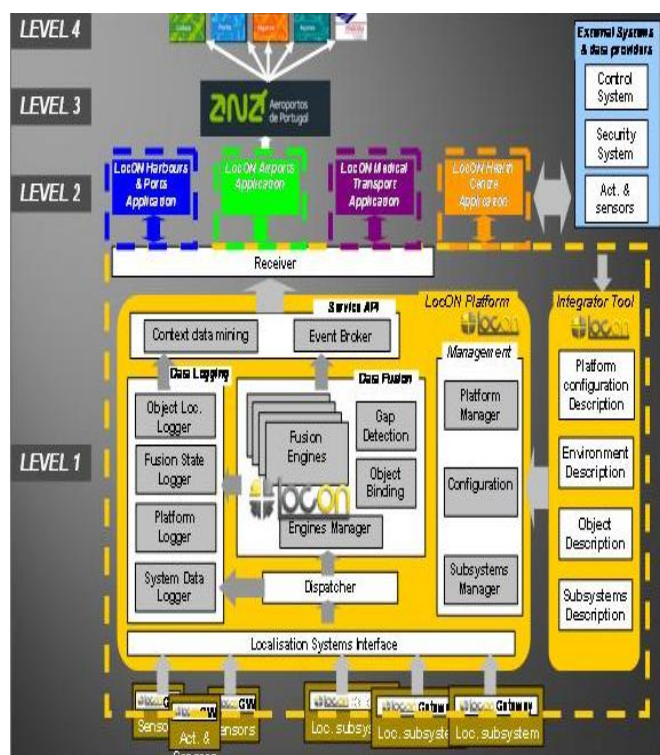
The system will enable the implementation of the A-SMGCS airport safety standard (levels 1-4).

The advantages include an increase in the reliability of position information through sensor fusion, cooperative localisation data fusion and detection of gaps or poor localisation zones. This two way system will enable applications to be developed to allow information specific to the location (such as safety or security alerts) to be sent to the users smart phone, PDA or laptop.

In November the project has produced a fully operational system. The LocON system will be demonstrated in FARO airport, Portugal in February 2011. This demonstration will involve controlling and moni-

toring vehicles and staff in the relevant security areas.

For more details contact Dr Martin Klepal, Post-doctoral Research Fellow, Nimbus Centre (martin.klepal@cit.ie).



LocON Structure

New appointment for *Implicit* Proof of Concept project

Dr Ross Gillanders joined the Nimbus Centre to work on an Enterprise Ireland-funded Proof of concept project. After gaining a BSc (Hons) in Instrumentation with Applied Physics at Glasgow Caledonian University in 2001, Ross completed his PhD in Thin Film Optical Sensors from the Department of Pure and Applied Chemistry, University of Strathclyde, Glas-

gow, in 2004. After working on fluorescence spectroscopy of supercritical fluids at the University of Bordeaux, he moved to Ireland in November 2005 to work at the Optical Sensors Laboratory in DCU. His next position was in the Department of Biochemistry at UCC developing novel polymeric optical oxygen sensors for the food industry. Currently he is

working on the optical side of the Implicit project in Nimbus, developing intelligent public lighting systems. His research interests are optical devices, sol-gel and polymer materials, analytical instrumentation, fluorescence spectroscopy and photochemistry. In his spare time he plays in a band called Beastmen and fruitlessly attempts to improve his Italian.



Ross Gillanders

Mallow Town “Connected Innovation” Project

Connected Innovation will link applied research and commercialisation programmes to active local communities through the structured deployment and trialling within those communities of numerous new potential products, services and technologies developed by Irish researchers, Irish-based companies, and ultimately by the local residents themselves. This will require the creation of clusters of practical innovation trial sites, the phased establishment of real and virtual ICT laboratories and the enhancement of business development resources in those communities. This initiative is led by Cork Institute of Technology and supported by the Mallow Development Partnership, where the first pilot in this programme will take place.

The goal of the Connected Innovation Programme is to create and sustain an innovation pipeline, ensuring that a high level of innovation and commercial output is attained and that a significant engagement is built up between all stakeholders, particularly those in the local communities. The objectives include getting ICT technologies to converge practically and quickly towards commercial solutions for Irish industry, ensuring real-time engagement with enterprises and enterprise support programmes.

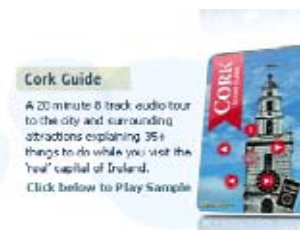
The practical implementation of the Connected Innovation Programme is commencing with a Pilot programme that is focused upon creating an innovation pipeline between the Nimbus Centre in CIT and Mallow Town Centre. Mallow has been selected as the first pilot site due to its status as a Hub town for the South West Re-

gion under the National Spatial Strategy (NSS).

The infrastructure deployment programme for the town will happen in phases, with each phase seeking to ‘install’ three systems. For the first phase, the plan is to set up:

- a wireless location tracking solution for audio guides that will be used with a heritage trail being set up in the town after Christmas (this is part of a direct funded contract with In-hand Guides - IHG, who are seeking to turn this into a product and who have agreed to locate first trials in Mallow)
- a Wi-Fi infrastructure in the centre of the town, which will act as a hub for future embedded systems and sensor technology. This is an extension of the NEMBES test-beds that are currently being commissioned
- an immersive gesture interaction environment, which will first be deployed in BCO and the move to Mallow (site to be selected). This is a collection of prototypes and demonstrators that will be built around our multitouch system. It includes other work by former students of the Media Communications Masters course in CIT who are now working with us. Its primary use will be as a tool for innovation in an entrepreneurial and educational context. The prototypes, which are substantially completed, have been funded from a number of sources, including NEMBES test bed development; further work is required to complete the implementation plan on this.

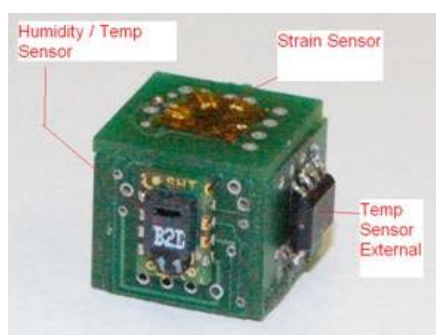
For more details contact Dr Kieran Delaney (kieran.delaney@cit.ie).



Nimbus researchers develop embedded module for reliability prognostics in electronic systems

Researchers in the Smart Systems Integration Group have developed a tiny module that can be assembled in an electronic system or product and can monitor the main causes of product failure: thermal and mechanical stress, shock and vibration, and humidity. The module, a cube measuring less than 10mm on a side, can measure in three dimensions and can be assembled as a component on a conventional circuit board or moulded into a system-in-a-package. The data from the module can be used for reliability prognostics – the real-time monitoring and forecasting of reliability. It is especially intended for safety critical and high reliability systems where early warning of potential failure is important. Prototypes of the module have been successfully tested and work is now focussing on more extensive electrical and reliability testing.

For more details contact Liam Moore (liam.moore@cit.ie).



Assembled prognostics module

Graduations

Martin Koubek recently graduated with a PhD in Electronic Engineering. Martin's work focused on vehicular active safety systems in which he developed a broadcast protocol for safety applications where oncoming and nearby drivers are warned of hazardous events on the road. His thesis was titled "Safety Data Dissemination Framework for Vehicular Networks". Martin's Research Supervisor was Dr Susan Rea, Postdoctoral Researcher, Nimbus Centre.

