THE ELECTRON

NEWSLETTER OF THE INSTITUTION OF ELECTRONICS

WHAT'S NEW IN ELECTRONICS

The What's New in Electronics Live exhibition took place at The National Exhibition Centre, Birmingham, on 9th. and 10th. May and featured around 142 exhibitors and eleven seminar presentations. Additional special features included the EMC UK Expo and Conference, the Innovation Forum, the Embedded and Developer Expo and Seminar, Round Table Sessions covering Brexit and Innovation as a Competitive Advantage, the ever-popular IPC Hand Soldering Competition, and the first networking event for female leaders in technology (FLITE).

Seminar topics included Introduction to the eCosPro Industrial Strength RTOS for the Raspberry Pi; SOMNIUM DRT: Professional Software Tools for Embedded ARM Microcontrollers; Hitex: Developing secure Microcontroller Systems with MBED TLS; Debugging and Dynamic Software Testing with VectorCast and SOMNIUM DRT; SDC Systems - Reliance Edge from Datalight - A reliable and ultra-compact File System designed for Resource-constrained Systems; ULVS - Radio Equipment Directive - Impact in 2017 and beyond; and How Digital Multimeters influence the Accuracy and Measurement Error in DC and AC Applications.

The EMCUK 2017 Training Conference covered EMC Compliance and Pre-compliance Testing, Cabling Practices for EMC, Shielding, Filtering and Suppression, and PCB Layout for EMC.

Below a review of the exhibition is presented which reflects the topical issues listed above, along with a review of a few journal articles relating to other topical subjects.

THE RADIO EQUIPMENT DIRECTIVE - IMPACT ON ELECTRONICS IN 2017

The presentation by ULVS was given by Joe Lomako, who explained how the Radio Equipment Directive (2014/53/EU) is set to replace the Radio and Telecommunications Terminal Equipment Directive (1999/5/EC) on 12th. June 2017. Member States had until 13th. June 2016 to transpose it into national law.

This Directive lays down specific requirements for safety, health protection and electromagnetic compatibility, and the speaker noted particularly that the scope of the RE-D covers anything with radio in it, not just receivers. This means that the following will now fall within the scope of the RE-D:

* Televisions and radio receivers that were not previously covered by the R and TTE Directive

* Equipment that operates at under 9kHz (not previously covered)

* Radio determination equipment

* Any other radio equipment covered by the R and TTE Directive except for fixed line terminal equipment and custom built evaluation kits

A notable additional feature of the RE-D that was mentioned by the speaker is its increased emphasis on market surveillance, an area which he noted to be "poor in the UK".

Harmonised standards were, he said, beginning now to catch up with RE-D. The European Telecommunications Standards Institute (ETSI) has submitted 124 standards under RE-D, representing around three quarters of the standards applicable to products that would otherwise require third party certification. Out of the submitted standards around 108 have appeared in the Official Journal. A few have been delayed because of technical difficulties, such as where they are difficult to understand or unclear for industry to apply. Most, however, are now published and the few that remain are expected to be resolved by ETSI in the near future.

Mr. Lomako went on to outline the obligations of 'Economic Operators' under RE-D, which include:

(i) The manufacturer or authorised representative (who is best placed to carry out the conformity assessment)

(ii) The importer (who must ensure compliance and that conformity assessment has been carried out)

(iii) The distributor (who must verify that the equipment has the CE Mark and that the importer has done its job)

The speaker noted particularly the fact that distributors now have clear responsibilities under RE-D, and that technical files are required to accompany the product.

He explained that a Declaration of Conformity was needed for ten years, and that ongoing compliance had to be maintained, along with a list of importers and distributors for ten years. Where there is 'Combined Equipment' it is necessary to look at both the radio part and the EMC part, and where there are no harmonised standards the EU's Blue Guide should be consulted.

Other Regulatory Changes

In addition to the RE-D a number of other Directives have been updated during 2016, and York EMC Services, Who exhibited at the adjoining Railtex exhibition (which is reviewed later in this issue), highlighted three of them as follows:

(a) EMC Directive 2014/30/EU which replaced the Directive 2004/108/EC on 20th. April 2016

(b) The Low Voltage Directive 2014/35/EU which replaced the earlier Directive 2006/95/EC on 20th. April 2016

(c) The Electromagnetic Fields (EMF) Directive 2013/35/EU which replaced EMF Recommendation 1999/519/EC on 1st. July 2016 and now limits levels of magnetic, electric and electromagnetic fields that are considered to be harmful to workers.

York EMC Services provide one day courses covering each of these, as well as the RE-D, and may be contacted at Market Square, University of York, Heslington, York YO10 5DD. Telephone: 01904 324 440. Email: enquiry@yorkemc.co.uk

EMC COMPLIANCE IN PROTOTYPING

With miniaturisation comes a more crowded EMC environment and the article 'Can it for Compliance' by Jonathan Newell in *Environmental Electronics 2016* explains how electronics supplier Harwin has developed a range of EZ-BroadWare that aims to assist its customers with EMC compliance when coming up with new designs:

'EZ-BroadWare Shield Cans are simply pressed onto pre-positioned surface mount EZ-Shield Clips forming a Faraday Cage around sensitive ICs and electronic circuitry, saving expensive, labour intensive secondary assembly and facilitating rework.

This simple EMC shielding technology can also be configured for new designs, and Harwin can supply developers with a shielding kit, so that engineers can create their own bespoke shielding can, before submitting a product design specification to Harwin and committing to high volume production.'

The kit uses standard SMT-mounted clips, which come in a range of sizes, applied with a shielding can formed from two 80x60x0.3mm nickel silver sheets pre-scribed on a 5mm grid:

'Taking such an approach enables application engineers to make design alterations, produce prototypes, test them, modify them and verify the final design before choosing the final configuration of the clip and can.'

The article explains how engineers previously had to order bespoke cans during development and test without being 100 per cent sure of their eventual requirements, incurring costs and creating delays.

The nickel silver material used in the kit provides effective and usable shielding with up to 24dB attenuation, depending on frequency and configuration.

NEW CONNECTOR MEETS AVIATION CHALLENGE

In the same journal the article 'Titanium keeps it all together' describes the Amphenol Titanium HTC range of aero-engine connectors currently being supplied in the UK by Astute Electronics, which have been designed to overcome a major challenge in aviation electronics:

'Aircraft engines represent one of the harshest environments for connectors and interconnection systems, something which prevents the use of standard plated aluminium alloy connectors, which can't withstand such environments. As a result, stainless steel has traditionally been used within the industry as the standard material for connection products. However, whilst stainless steel provides excellent strength and temperature stability, it is significantly heavier than aluminium and this is a major disadvantage in an application where weight is a significant factor.

In order to overcome this issue, Amphenol designed the titanium HTC connectors based on the BS EN 2997 aerospace connector standard whilst also meeting the requirements of Rolls-Royce specifications ESC20 and ESC21. The resulting product provides performance which is comparable to the stainless steel alternative, but with a weight saving of around 30 per cent on assembled connectors.'

The connectors are available in shell sizes of 08 to 24 and are already being used on major civil aerospace programmes.

Future plans include the development of hermetically sealed connectivity products for the aerospace industry. Data and power connection products with hermetic sealing have already been developed and are in use in defence programmes such as the Joint Strike Fighter and the NH90 twin-engine multi-role military helicopter, as well as civil aviation programmes such as the Airbus A380 and Boeing 787.

SOMNIUM DRT

Exhibitors SOMNIUM Technologies Limited are evolving C/C++ software development tools to a new level enabling real problems faced by embedded developers to be solved. In particular the company was showcasing its revolutionary 100 per cent industry compatible SOMNIUM DRT, which offers unique benefits to developers working with ARM® Cortex® devices.

In their SOMNIUM DRT Benchmarks Whitepaper published in March 2017 SOMNIUM Technologies make a comparison between SOMNIUM DRT and other toolchain products so as to demonstrate the fact that DRT 'builds the smallest, fastest and most energy efficient code with no source code changes required'.

The company states:

'Unlike many well-known software vendors, SOMNIUM do not put "benchmark features" in our products to change their behaviour in the presence of known tests. We don't alter the benchmark source code, and we always use the same tool options to get an honest and fair comparison.'

Small Memory Footprint for C Execution

SOMNIUM DRT uses a highly tuned and specifically configured C routine library with a reduced memory footprint:

* Over 100 per cent smaller ROM usage than with GNU Newlib

* Smaller ROM usage than GNU Newlib Nano

* Around 100 per cent smaller statistically allocated RAM overhead than GNU Newlib Nano and GNU Newlib

* Unlike vanilla GNU Newlib Nano, memory is statistically allocated (where possible) and so RAM usage is easily predicted by build time pass/fail

* Vastly smaller ROM and RAM usage than NXP RedLib

* Similar/smaller ROM usage to IAR

* Full support for C++ exception handling within the small memory footprint library

The company states:

'These memory savings made by DRT can have huge practical impact on the usability of small memory devices. DRT can save development time (by allowing software development in C rather than ARM assembly language), and increase the potential to use smaller memory (and lower cost, lower energy) devices.'

Some 20 comparisons follow and a selection of a few is given below.

Microsoft SAM Examples

Atmel START was used to create an "empty" C program including Atmel Software Framework (ASF) routines to configure the on-chip PLL to highest possible frequency on a SAMD21 device (32 KByte ROM, 4KByte RAM):

'IAR Embedded Workbench uses less memory than vanilla GNU tools from Atmel Studio, DRT does even better and uses the smallest amount of ROM'

NXP Kinetis Results

KL02 devices are quite constrained by their memory size and performance:

'Even with low-end devices, DRT provides a huge performance increase of over 50 per cent compared to vanilla GNU tools, with significant memory and energy savings.'

KV10 devices use an M0+ processor and have high performance memory systems, with a 16-entry, 4-way set associated flash cache:

'Even with this high performance hardware, DRT significantly improves KV10 performance and energy whilst reducing codesize.'

K21 devices use an M4 processor and have an extreme performance memory system with a 128-bit speculation buffer and a 16-entry, 4-way 128-bit line set associated flash cache:

'Even with the K21's sophisticated cache, DRT provides significant energy savings, whilst also reducing codesize and improving performance.'

ST Microelectronics STM32 Examples

DRT was tested with the STM32CubeMX demo examples supplied for GNU and IAR tools, which use the real CubeMX middleware widely used in real applications:

'These examples show that DRT generates significantly smaller code than IAR's proprietary non-industry standard compiler and other vanilla GNU tools. It also shows that SW4STM32 has some severe codebloat for Cortex M4 devices compared to other vanilla GNU tools.'

Traditional Tools are the Problem

SOMNIUM Technologies are particularly critical of the traditional tools that currently support embedded systems:

'Memory dominates the performance, energy and cost of embedded systems. Full optimisation requires information about the whole system, including the memory hierarchy and the entire program. Despite these facts, traditional tools ignore the problem and only consider the CPU.

Memory is the bottleneck in embedded systems. It affects the cost of the chip, its performance and its energy consumption. To break this bottleneck, DRT uses SOMNIUM's patent-protected resequencing technology. DRT combines full, industry-standard GNU compatibility with commercial-quality functional correctness, size, performance and energy.'

Further Information

Copies of the Whitepaper along with further information about the technology presented may be obtained from SOMNIUM Technologies Limited, Riverside Court, Beaufort Park, Chepstow NP16 5UH. Telephone: 0333 0 113 177. Email: sales@somniumtech.com

VECTORCAST/PROBE

One of the challenges associated with resolving defects in a fully integrated system is determining how to capture the data needed to understand the root cause of the problem. Using a debugger often changes the timing of the system in a way that masks the bug or prevents the system from running properly.

An alternative solution is to insert small blocks of trace code at key points in the source code to capture immediate data values, but this too has multiple challenges, namely that it requires developer resources to modify the code, design a mechanism for sending the captured data back to the host machine, and build the instrumented application.

These challenges are addressed by the VectorCAST/Probe:

'Using a source code browser, the user clicks the line of code where they want to add a probe and enters a code snippet. VectorCAST/Probe takes care of the compilation of the probe, the insertion into the source code, and the build of the instrumented application.

Additionally, VectorCAST/Probe provides all of the string conversion and IO functions necessary for the capture, conversion to ASCII, and output of the captured data, regardless of the run-time environment or target. Any data that is output by the probe is captured in a special section of the VectorCAST test report.'

VectorCAST/Probe is integrated with the full family of VectorCAST tools allowing probes to be inserted during unit, integration or system testing.

The company states:

'The probe insertions are controlled by the same technology that controls our code coverage instrumentation, which ensures that the probes function correctly regardless of the compiler, target processor or run-time environment.'

It is noted that during system testing it can be useful to inject spurious values in order to test error handling:

'Forcing a function return value that is out of range to validate the error handling of the calling functions is especially interesting with an embedded system where it can be difficult to force abnormal conditions due to the limited interfaces available. An example use case would be to force an out-of-range value to be returned from an analogue to digital converter to understand the behaviour of the application as this value is propagated through the system. This white-box approach to software testing is often used during low-level testing, but is much harder to accomplish during system testing. VectorCAST/Probe makes fault injection simple and repeatable.'

Two other important application areas include white-box testing and access to program internals:

'When paired with VectorCAST/QA, which automates the building and execution of system tests, VectorCAST/Probe provides a complete white-box testing methodology. Error handling portions of an application are often seen as "impossible to test" because error cases cannot be triggered in a production system. With VectorCAST/Probe system testers get unprecedented control over the application by allowing them to easily inject faults.

The hardest type of bug to fix is a bug that happens infrequently with an unknown sequence of steps as the trigger. VectorCAST/Probe gives developers complete access to the program internals to help diagnose this flavour of bugs. Developers can create a probe that is conditionally activated after a particular sequence of actions and silently captures key data for post execution analysis. The benefit of this approach is that it does not affect application performance or test activities. If the error occurs, the probe provides the diagnostic data to allow the developer to understand the issue.'

Further Information

Further information on the VectorCAST/Probe may be obtained from Vector Software Inc., Golden Cross House, 8 Duncannon Street, London WC2N 4JF. Telephone: 020 3603 0120. Email: sales@vectorcast.com

ELECTRONIC DRONES SET TO REPLACE HONEYBEES

Beekeepers in the United States have lost 44 per cent of their hives in 2015-2016 and the article 'Bees: Tech to the Rescue' by Parazad Mangi in *Professional Engineering* (May 2017) explains how scientists are addressing this problem by seeking to mass produce small electronic drones to do the job of pollinating crops.

This drastic decline in the American bee population has been attributed partly to the parasitic mite known as Varroa destructor, and partly to the increasing use of pesticides and man-made deforestation. A rising number of bees are also abandoning their hives due to so-called "colony collapse disorder".

The ingenious solution to this problem has been devised by Eijiro Miyako of the Japanese National Institute of Advanced Industrial Science and Technology in Tsukuba.

The article states:

'Miyako has developed drone bees, with their bellies covered in horsehair that has been coated with a sticky gel to pick up the pollen. When the robot lands on the next flower, the pollen rubs off - resulting in the world's first artificial pollinator.'

The author explains how Miyako purchases toy drones from an online retailer (Japanese toy company G-force). These are 1.5x1.5 cm quadcopters that weigh 15 grams each, which have already been tested on Japanese lilies. The new robotic bees are being equipped with GPS, artificial intelligence and high resolution cameras so that they can fly from flower to flower.

The ultimate aim is to create "a swarm of robotic bees that are going to self-think" as well as having the ability to recognise images of flowers that they have already visited.

ADVANCES FROM FUJI

Fuji Machine Manufacturing was one of the key exhibitors at What's New in Electronics Live.

In June 2016 the company was awarded the prestigious 2016 National Commendation for Invention from the Japanese Minister of Education, Sports, Science and Technology for its basic configuration for NXT machines, which allows modules to be lined up on bases and pulled forward. In *Fuji-SMT Magazine* Volume 12 this was described as "a breakthrough in the industry", aiming for easier maintenance by making it possible to pull modules forward while keeping the outer dimensions compact with a width of 320mm. Since its release in 2003 approximately 56,000 modules have been sold and it is estimated that half of the world's smartphones have been produced using NXT modules.

In his opening message Robotics Solutions Division General Manager, Shinsuke Suhara, states:

"As an engineer I am very proud that the technology I helped to develop was recognised with an invention award. Our next NXT modules which utilise this technology are a big hit, and are now fully recognised award-winning machines."

He then outlines the linking of systems under the Fuji Smart Factory concept, and automated processes using SmartWing:

"Built on the principles of IoT and M2M, we are strengthening our capability to link with machines from other companies using our Integrated Production System - Nexim, and thus paving the way to a fully realised smart factory. By breaking down the walls which restrict enterprise to construct an environment with freedom to connect openly, and by managing the data for processes across entire lines, the furthering of automation for changeover, maintenance and other tasks required for production will in turn give birth to a new generation of manufacturing factories. In addition to these, we have also developed a new robot for next stage processing - the SmartWing. The SmartWing will reveal new ways of automating assembly processes, raising the bar for manufacturing efficiency to be even higher than before. Virtual teaching using motion capture technology means that operation sequence settings can be performed offline without operating the robots, for safe and reliable programming."

Below a few more of the company's innovations are described.

Low-impact high-speed Placement using the H12L Head

When placing parts that are easy to break, such as thin or fragile parts, and embedded components that cannot be repaired, it is important that high accuracy placement does not exceed a specified placing pressure so as to avoid applying stress to parts.

In the past low-impact placement has been achieved by slowing the head down just before parts come into contact with the panel in order to ensure that the impact is sufficiently reduced to be able to control the placing pressure on the parts. This is fine for lowering the placement pressure when parts make contact with the panel, but more can be done to guarantee an equivalent level of pressure control to reduce low-impact placement. The new method from Fuji achieves a unique high-accuracy real-time pressure control using a combination of the H12L head and the M6 IIIL module.

The company states:

'Fuji's H12L head is the first in the world to deliver impact control in real-time. The H12L head is an effective choice for the placement of WLPs, LED dies and thin parts for which it is best if the parts do not crack or become scratched, and for parts which require high quality placement such as those used in automotive and medical products, because the H12L head has load traceability.'

New Positioning Processing (Image Matching)

When vision processing complex parts such as those used for module panels, positioning seek lines is difficult for some parts using the conventional vision type for irregularly shaped parts, and vision processing may fail even if good parts are used.

In order to solve this problem Fuji has introduced a new method, known as "image matching".

The company states:

'With this method, a part image for a good part is acquired through Nexim Part Editor and VPD Camera Stand and saved as a template image in advance. When the part is vision processed during production, on the image required for vision processing, the coordinates at which the part matches the template image the best can be determined. By using this method, users are no longer troubled with placing seek lines any more and can create shape data easily.'

Special Electrode Processing

Usually, electrodes such as leads and bumps are arranged on electric components. Leads and bumps have been used as a shape data element for parts, but some parts have electrodes with a special shape that is different from usual bumps or leads. Even if leads and bumps are defined for parts which have electrodes with a special shape, these electrodes could not be recognised as expected. Fuji has therefore developed "special electrode processing", which uses images of the electrodes with a special shape as the electrode data. Parts with special electrode shapes, which can be processed by positioning seek lines based on vision type 18, can now be processed using the electrodes for positioning and inspection.

The company states:

'Image matching and special electrode processing are available in combination for vision processing in vision type 0. With vision type 0, reference data (body, leads, bumps) used as reference for positioning can be set freely by combining two positioning processes, rough processing measurement and precise positioning measurement. Using this vision type increases the flexibility for positioning parts and is an effective response to user demand.

In addition, vision type 0 allows users to edit data using Nexim Part Editor and the on-machine editing function provided with AIMEX III and AIMEX IIIc. Different from mass production, product models are frequently changed for variable-mix, variable-volume production. Quick responses required to correct and adjust jobs for errors which occur upon product changeover greatly affect the productivity for variable-mix, variable-volume production, so the capability of editing jobs on-machine is extremely valuable.'

Further Information

Further information may be obtained from Fuji Machine MFG (Europe) GmbH, Peter Sander Strasse 43, 55252 Mainz Kastel, Germany. Telephone: +49 (0) 6134/202 105. Email: si.amlerova@fuji-euro.de

RAILTEX 2017

When The Institution of Electronics was formed Britain's railways were powered by steam and signalling was by semaphore. It was a largely mechanical and labour-intensive industry. Today, however, the situation is very different and the railways now provide one of the major growth areas for the electronics professional, as evidenced by the high number of electronics organisations exhibiting at this year's Railtex exhibition at the NEC from 9th. to 11th. May.

The exhibition featured around 470 exhibitors whilst the 44 seminars included presentations on Remote Condition Monitoring (Steve Roberts, Head of Engineering, Unipart); The Digital Railway: Increasing Capacity and improving Reliability (Mark Ferrer, Operations Director Digital Railway, Siemens Railway Automation); Industry 4.0: Embedded Technology and Condition Monitoring (Gavin Stoppel, Product Manager, HARTING); SWIFT: Superfast Wireless In-train for Future Travel (Andrew Longyear and Steve Matthews, Transportation Solution Architects, CISCO); The Connected Train (Mike Hewitt, CTO/Head of the Next Generation Networks, AD Comms); Intelligent Infrastructure - Intelligent Drones: Changing how the World makes Decisions (Phil Storr, Director UK Operations, MRL/Aerialtronics); The Digital Railway: A Toolkit of Signalling Interventions Development (Christian Fry, Director of Strategy and Market Development - S and I, Alstom); and Digital Railway Innovation (David Waboso, Managing Director, Network Rail/Digital Railway).

Some of the above topics are described below along with other electronics developments in the rail industry.

DRONES TO ASSIST IN CRITICAL RAIL INFRASTRUCTURE MANAGEMENT

The management of critical railway infrastructure is being raised to a new level by combining Unmanned Aerial Vehicle (UAV), or drone, technology with the power of cognitive learning.

Netherlands-based Aerialtronics, who design and manufacture commercial drones, along with UK partner MRL Eye, explained how future drone powered solutions can be utilised so as to provide high quality inspection data for railway applications. It was then shown how this data can be used to support rail infrastructure managers to intelligently inspect critical assets safely as well as analyse, identify and prioritise remedial actions.

Jeremy Wigmore, CEO of Aerialtronics, comments:

"The third generation Altura Zenith ATX8 sets a precedent for the design of unmanned aircraft systems, by combining state-of-the-art technology with remarkably flat, compact and lightweight design. Starting from scratch enabled a new and radical idea: develop a multi-rotor aircraft system that can meet a wide variety of commercial applications without compromising on design."

The Altura Zenith ATX8 is able to demonstrate reliability, stability and versatility even when operating with wind speeds of up to 26mph and temperatures of between -30 and +40 degrees Centigrade. It can also integrate a number of industrial sensors and cameras making it well suited for such activities as inspection, ground measurements, 3D modelling and topography surveying.

Hidden within a super flat design, the Altura Zenith ATX8 facilitates up to 35 minutes of flight time and can carry payloads of up to 2.9kg, but its real power comes from its Visual Recognition capability.

Aerialtronics was the first commercial drone manufacturer to integrate cognitive computing capabilities from IBM Watson and by integrating these capabilities with flight operations Aerialtronics and MRL Eye can assist infrastructure owners in opening up an infinite number of possibilities in terms of gaining insights into places that are not easily accessible by current working practices or human interaction.

Seminar speaker Phil Storr (see above) said:

"Instead of placing staff in hazardous or difficult to reach areas, or by stopping processes and service delivery to complete a task, UAV technology now allows key assets to be remotely inspected safely and accurately with findings reported back quickly. In turn this supports a more dynamic workflow allowing prioritisation of resources to resolve problems effectively before they impact on service delivery. Drones can capture these important images in minutes and immediately send them to the IBM Watson platform to be analysed in near real-time. This reduces the need for thousands of images to be manually reviewed for problems, for example due to corrosion, before technical teams can be deployed to site."

In the rail sector this combination of technologies enables data to be analysed quickly and specific areas of concern identified that could impact the quality, performance and integrity of critical infrastructure such as loose or fraying cabling, damaged bridge structures or ground movement.

This combination of reliable UAV technology with cognitive learning is envisaged over time to give operators increased infrastructure resilience through cost effective asset inspections, reduction of the possibility of human error , improved worker safety and, ultimately, less disruption to rail services.

Further Information

Further information on this subject may be obtained from Aerialtronics, Alfred House, Ropewalk, Knottingley, West Yorkshire WF11 9AL. Telephone: 01977 622 000. Email: reques@aerialtronics.com

LONG RANGE RADIO TECHNOLOGY ASSISTS IN REMOTE MONITORING

Railtex exhibitors ByteSnap Design showcased their advanced remote monitoring tool with ground movement sensors that is set to improve maintenance response times.

With the aid of a bridge bash demonstration it was shown how LoRa (a long range radio technology) can be applied to log data from a site up to 10km away using a battery or solar panel for power source. The demonstration showed how a sensor was used to measure collision information from a simulated bridge strike and then send the information across a radio link to a back office for analysis.

Acceleration data is collected from the stationary object and transmitted wirelessly to a receiving module. Using the receiving module, real-time information about what acceleration the object is undergoing can be processed and displayed to the user.

The company states:

'ByteSnap's remote monitoring demonstration with movement sensor shows how the technology [LoRa] can help automate and log remote events at sites. This can be used to get accurate information about events that take place for evaluating damage caused by vehicles striking bridges, failure of line equipment, land slippage and many other areas of concern that can be hard to monitor due to their physical location.'

SnapUI

In addition to the above ByteSnap has also released a new version of its user interface development framework, SnapUI, which is now supporting, notably, Raspberry Pi and is described as being "more proficient than ever at taking software to production".

The company states:

'When designing new hardware devices, keeping the user interface design in step with hardware development can be difficult. Worse, when the user interface is overlooked or is the last consideration in the design process, projects can suffer significant delays in getting product to market. SnapUI mitigates this risk by enabling development of the user interface independently of the hardware, on a reference hardware platform or widely available RaspberryPi, ready for deployment to the target device when the hardware is ready. SnapUI Raspberry Pi brings high performance to UI prototyping, with emphasis on CPU embedded chipsets.'

About ByteSnap

ByteSnap Design is a specialist in innovative embedded systems development, encompassing hardware and software design, with an international client list.

The company is an NXP Partner and an ARM Connected Community Partner. Experience ranges from electronic design through to BSP porting and mobile app development.

Awards include the 2016 Design Team of the Year, 2013 Consultancy of the Year and 'Highly Commended' for design work on electric vehicle charging posts for the London 2012 Olympic Games, at the British Engineering Excellence Awards in the respective years.

The consultancy also has experience in electronic circuit design, microcontroller design, Linux and embedded software development, and designing hardware products from wireless sensors to ruggedised tablets with multiple software projects such as developing Android BSPs through to video processing applications.

Further Information

Further information about the above may be obtained from ByteSnap Design, 2 Devon Way, Longbridge Technology Park, Birmingham B31 2TS. Telephone: 0121 222 5433. Email: info@bytesnap.co.uk

NEXT GENERATION RAIL SIGNAL PROTECTION

Bender UK unveiled its next generation rail signalling protection system, the RS4, which has enhanced sensitivity for 'first fault' location (100 kiloohms) as well as measuring capacitance, voltage and frequency, delivering data within the standard display options to provide more information with which to assess the health of the system.

The RS4 incorporates GSM-enabled data loggers that are equipped for real-time direct communication with the railway system's Intelligent Infrastructure delivering immediate notification of insulation faults that are identified by the system. The RS4 also meets new standards that are being introduced for rail safety and assurance within Network Rail's requirements for Insulation Monitoring Devices/Systems (IMDs) and Insulation Fault Location Systems (IFLSs).

The company states:

'Faults in the power system can arise from a variety of causes such as damaged cables, faulty connections, breaks in insulation and rodent damage. Where these faults lead to earth leakage from the power supply they are immediately detected by the equipment. In recent years cable theft has been another hazard for the rail network's power infrastructure and these incidents are also identified.

The RS system continually monitors insulation values to show real-time status of the power system. When the insulation value (IR) drops, the system records the fault and the Bender units put a test current signal or pulse into the system which is pulled to earth at the point where the fault exists.

Maintenance teams are guided to the area of the power system which has the fault. A portable Bender device is used to pinpoint the location by monitoring the pulse on the trackside cable. Network Rail suffers significant financial penalties for signal failures which impact on the uptime/downtime of the infrastructure, so the time taken to respond and fix the fault is crucial.'

Bender UK's field trials to prove the effectiveness of the RS system is noted in one case to have led the maintenance team to a trackside cable which was glowing hot because of an earth fault that could potentially have resulted in serious disruption to the network.

RS-PELI

Bender has also made significant improvements to the portable RS-PELI unit which now has more sensitive clamps and receiver technology. It is used at the trackside for measuring and analysing a specific section of the power network so as to prioritise installation programmes.

The unit is self-powered through connection to the trackside signal electrical network and delivers live monitoring of the system status to immediately indicate if there is an earth fault as well as the status of the insulation. The portable unit can also provide independent verification of the RS system performance.

Further Information

Further information may be obtained from Bender UK, Low Mill Business Park, Ulverston, Cumbria LA12 9EE. Telephone: 01229 480 123.

SUPERFAST WI-FI IN-CARRIAGE FOR FUTURE TRAVEL

This presentation was given by Andrew Longyear and Steve Matthews (see seminar programme above), and outlined the ground-breaking communications capability of Superfast Wi-Fi In-carriage for Future Travel (SWIFT), the prototype for which went live between Glasgow and Edinburgh during Railtex.

Funded by Cisco, Innovate UK and the RSSB, SWIFT is said to "deliver unparalleled high-speed connectivity to trains" with these trains now having the fastest Internet connection in the world at up to 1GBps.

More information is available from Cisco, 10 New Square, Bedfont Lakes, Bedfont, Surrey TW14 8HA. Telephone: 020 8824 1000.

CASE STUDY: BERNINA EXPRESS

The Bernina Express, operated by the Rhaetian Railway (RhB) serves Alpine tourist destinations. Limited mobile connectivity along its route has prevented passengers from accessing the Internet on their devices. The operator very much wanted a solution that would allow passengers to use their smart phones and tablets to view specially produced video and audio content describing, for example, scenery and points of interest, presented in sync with the train's location as determined by a Global Positioning System.

A solution to this has been provided by the Passengera platform, which has been built using a railway-compliant Advantech ITA 5730 server with Intel technology. This enables passengers to log in through a web-based app on their personal devices so as to access GPS-synchronised content over an on-board Wi-Fi network, which is integrated into the Advantech servers. Passengers receive pop-up information on their mobile devices, notifying them when GPS-synchronised content matches their current location. Up-to-the-minute route information is provided, including arrival times, along with entertainment and an interactive travel guide.

The solution also allows the operator RhB to remotely manage and update GPS-synchronised content, in addition to communicating with passengers and generating opt-in personal information. Revenue-generating opportunities are provided through in-app marketing of souvenirs and other items to passengers. Future opportunities should also allow passengers to order meals and beverages served directly to their seats.

The solution, launched in December 2016, has demonstrated value in its first few months of service by providing passenger demographic data for developing targeted promotions, demonstrating that high quality content yields increased viewership leading to higher opt-in rates with deeper passenger engagement, and improving customer satisfaction.

Railtex exhibitor Advantech state:

'Traditional web-based video and audio programming is not GPS-synchronised. Therefore, it cannot help passengers identify their location, nor is it practical due to limited Internet access along the route. RhB required a solution that did not rely on an Internet connection and which would stream GPS-synchronised video and audio, providing passengers with instantaneous information describing their view, their current location, and how long before they reach the next station.'

The Bernina Express is the first mountain train service in the world to run an infotainment platform and future plans include the streaming of GPS-synchronised video and audio on more RhB trains and on the operator's Bernina Express bus.

Further Information

Advantech manufactures a wide range of products and solutions for rolling stock and infrastructure applications, and is a global leader in industrial computing. Advantech manufactures computers and displays for demanding applications like on-board entertainment, surveillance (CCTV, NVR), passenger information, fares and ticketing(AFC) and communications products such as ethernet switches, Wi-Fi and cellular networks.

For more details contact Advantech Europe BV, NL-5692 ER SON, Eindhoven, The Netherlands. Telephone: +31 (0) 402 677 046. Email: customercare@advantech.eu

SIEMENS LAUNCHES NEXUS VOICE CAB RADIO

This year Siemens was again a prominent exhibitor at Railtex where the company launched its new Nexus Voice cab radio.

The radio represents a significant upgrade from the company's current SVR-400 model and includes a number of pieces of new hardware with a processing card, additional memory, accelerometer sensor card and two Long Term Evolution (4G and 5G) modules. This new hardware provides the platform to enable new applications to run on the cab radio, including Nexus Lodestar DAS, Nexus RCM and Nexus Connect.

Nexus Lodestar DAS provides a real-time driver advisory system delivering route information and speed advice to drivers. By promoting a consistent and economical driving style, the system enables significant energy savings to be made, train punctuality to be improved and maintenance costs to be reduced. Route data, timetable updates and temporary speed restrictions are all uploaded remotely to the system, utilising the Nexus cab radio maintenance terminal.

Nexus RCM is an in-service remote conditioning monitoring application, which detects track defects on three axes, either via the cab radio or on a stand-alone basis. By installing the system fleet-wide, Nexus RCM is able to provide a network-wide track assessment in just a few days using in-service trains. The system is also highly customisable to meet operators' different requirements and can be tailored to detect such phenomena as rough-ride, track voids, dip-track and bogie flats.

Nexus Connect provides an Ethernet 'backbone' for the train, with Ethernet bridges situated in every carriage to distribute the wireless connectivity. This 'backbone' can also be used to transfer sensor data from key on-board assets throughout the train and then onto the ground. Data from sensors measuring for example carriage and engine temperature, doors and lights, can be used as an input to predictive maintenance, with the Nexus Voice cab radio system being used as a media gateway, transferring data to and from the train.

Commenting on the launch, Sales and Marketing Manager for Siemens, Ciro de Col, said:

"These new products effectively enable current trains to become smart trains, with a number of integrated functions delivering operational and economic benefits to the train and infrastructure owners, including improved efficiency and reliability and reduced costs and train downtime. The systems are also scalable and future-proof, allowing operators to install hardware now and update at a later date to meet future requirements and includes the potential to migrate to Voice over IP technology. Although the systems are capable of transferring large amounts of data to and from the train, they are highly secure and conform to cyber-security standards."

More information is available from Siemens, Sir William Siemens Square, Frimley GU16 8QD. Telephone: 01276 696 000. Email: info.railsystems.gb@siemens.com

NEW DATA TRANSMISSION SYSTEM FOR CENTRAL LINE

London Underground has awarded EKE-Electronics Limited a project to design, manufacture and supply Central Line 92 Tube Stock's new Data Transmission System, replacing the existing system, which has been in service since the early 1990s.

The original system was delivered by EKE-Electronics Limited in collaboration with Westinghouse Signals and Brakes 25 years ago. The new Data Transmission System will include train computers, unit computers, various types of I/O modules and crew interfaces, as well as their software applications.

Further information may be obtained from EKE-Electronics Limited, Piispanportii 7, FI-02240, Espoo, Finland. Telephone: +358 (0) 9 613 030. Email: sales@eke.com

BLUETOOTH ENABLED TICKET GATES

A demonstration of Bluetooth Low Energy fare validation technology, held at the Crawley offices of Thales UK on February 9th., showed how Bluetooth could be used to improve the flow of passengers through a ticket gateline at busy stations.

Applications that are being considered include Bluetooth enabled wide access gates for mobility-impaired passengers who could benefit from not having to physically present a ticket, a 'frequent user' lane for peak hour commuters, and a 'priority gate' for first class passengers on long distance services.

The technology, also known as Keypass, combines a commercially available 3D camera with an array of sensors that can detect mobile devices where an 'm-ticket' has been activated. These sensors 'listen' via Bluetooth for valid m-tickets, associate them with a given individual approaching the gateline, and open the gate to allow the passenger through.

The Bluetooth detection, customer location and back-office software has been developed by Byte Token, the UK subsidiary of m-ticketing technology specialists Bytemark. The novel ticket gate designed by Thales uses a gantry-mounted 3D camera to track passengers through the gate, and Thales believes that the technology is more reliable than conventional sensor arrays that have difficulty detecting the form of people passing through the gate.

Byte Token is optimistic that in future the data packets transmitted from the handset to confirm location could be handled by the Bluetooth protocol as opposed to Wi-Fi, and work is continuing to improve the detection system.

Trials of the system have been instigated on the Delhi Metro, and there are plans to install it on the Amsterdam Noord-Zuid metro line where conventional sensors often miss bicycles being taken through fare gates due to gaps between wheel spokes.

MOBILE TICKETING FOR STRATHCLYDE

Rambus Ecebs is to provide the Strathclyde Partnership for Transport with its Host Card Emulation Ticket Wallet and HCE Ticketing app, as well as HCE cloud-based payments technology developed by its sister company Rambus Bell ID. These will enable passengers to load 'virtual smart cards' onto NFC-enabled smart phones, which can then be used to buy, store and use tickets.

A remote ticket download option means that passengers would not need to visit a ticket machine. Instead tickets could be selected, purchased, downloaded and used with a mobile device.

Rambus Ecebs' white label app offers a flexible interface and can be custom branded. It is integrated with Rambus Ecebs' suite of smart ticketing products, has APIs ready to connect with third-party systems, and can be used as the basis for providing passengers with access to additional services such as trip histories, account-based ticketing and journey planning.

In addition to helping public transport agencies to transition from the use of physical smart card media to virtual cards stored on a customer's own device, the app also enables collection of passenger data.

[Reference: *Metro Report International* as above]

CYBER SECURITY: A GROWING CHALLENGE FOR THE RAIL INDUSTRY

Recent ransomware attacks on the NHS have again raised the profile of cyber security in our public services and in the *Railway News* Railtex Special 2017 in the article 'Cyber Security in Rail', an interview with Alzbeta Helienek, Lead Systems Engineer for Thales, co-sponsor of the Second Annual Rail Cyber Security Summit In London on 14th. and 15th. March, is presented on this subject.

This article mentions a few actual cyber attacks on railway systems, beginning with the attack on the Seoul Subway over the course of several months in 2014 when over 60 employee computers were infected with malware, resulting in a number of data and information leaks. The article then highlights the case of a teenager who, in January 2008, used a modified television remote to hack into a Polish tramway system causing four vehicles to derail and resulting in twelve injuries. The third example concerns a railroad in the Pacific Northwest which was attacked by Hackers in December 2011 causing serious disruption to railway signals for two days.

The vulnerability of business-relevant features is highlighted with the IT infrastructure of businesses being an area that is comparatively familiar to hackers, and the highly interconnected nature of railway IT systems can mean that a hacker may be unaware of the knock-on effects that could potentially result.

On rail-specific solutions and standards Ms. Helienek is quoted as follows:

"Oftentimes when threats are identified the response is to do patch management to close the loophole. In the rail industry it can often take a long time to get approval to make changes when you have to bear in mind the safety protocols and reliability requirements."

She also clearly advocates vigilance, particularly with regard to things such as suspicious Wi-Fi names or an over preponderance of open networks, and foresees features of screenshots of suspicious Wi-Fi networks being incorporated into security campaigns such as those operated by the British Transport Police.

With regard to other potential solutions the article highlights the European Union's Horizon 2020 programme, known as Shift2Rail, which funds the CYRail Project. This was selected by the European Commission to enhance cyber security in the rail industry and was launched on October 16th. 2016. It has a project runtime of 24 months and a budget of 1.5 million euros. The project's objectives will focus on assessing the most critical railway services and the most innovative attack detection methods, determination of counter-measures and mitigation strategies, and development of resilience mechanisms.