DATAWEEK
ELECTRONICS & COMMUNICATIONS TECHNOLOGY

31 January 2018

FEATURING: • Telecommunications, Wireless, IoT, RF & Microwave
• Optoelectronics, Photonics, Displays & Lighting

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Through its partnership with Libelium, Arrow Altech Distribution is enhancing its presence in sensor-to-cloud-to-analytics IoT technology platforms. This spans the gamut of environmental sensors, and includes lightning sensors, air sensors for detecting PM2.5 and PM10 suspended particulates, water temperature, dissolved oxygen and water acidity, air pressure, humidity and temperature, and UV sensors. Find out more on page 16.

For more information contact Gyula Wendler, Arrow Altech Distribution, +27 (0)11 923 9600, gwendler@arrow.altech.co.za.

Looking into the MQTT protocol, using LTE for M2M comms, and a warning on cheap antennas.

Includes a Microchip tutorial on designing a dimmable lamp with four LEDs.
IoT protocols battle it out

As the number of Internet of Things (IoT) applications grows, so too does the number of protocols supporting this proliferation. While each protocol has its own strengths and weaknesses, the resulting alphabet soup is becoming difficult for engineers to keep a handle on. In our ‘Telecommunications, Wireless, IoT, RF & Microwave’ feature in this issue, we examine a couple of these in particular.

The first of these articles, by Quectel, looks at MQTT (MQ Telemetry Transport) protocol. Based on a publish/subscribe messaging system, MQTT is optimised to connect physical-world devices and events with enterprise servers and other consumers, and is ideal for connected devices that place a premium on bandwidth and battery power.

The second article, by u-blox’ Stefano Moioli, covers the more widely known Long Term Evolution (LTE). Although LTE is better known for its adoption in the mobile consumer market, the growing variety of LTE categories being developed specifically for IoT applications will surely stand it in good stead. One of the most popular of these categories is proving to be Cat NB1, also known as Narrowband IoT or NB-IoT, which is currently being trialled by South African mobile operators and can take advantage of existing cellular base station infrastructure.

Those are far from the only protocols of interest to the IoT market, of course. In a new market report, Research and Markets found that much of Europe and many parts of the Asia Pacific region are covered with Sigfox and LoRa networks, with Low-Power Wide Area (LPWA) services offered by key telecom operators. In the US, LoRa will have the largest private unlicensed industrial LPWA network growth, and LTE-M1 will do the same for licensed public networks.

LoRa’s chirp spread spectrum advantages, deep building penetration, open source networking and suitability for private and public networks has attracted thousands of developers and the world’s largest network operators. In October 2017, the LoRa Alliance announced the availability of three LoRaWAN specifications for its 500 members offering passive and active roaming, standards for backend interfaces and regional radio parameters that makes moving devices between LPWANs worldwide seamless.

Multi-radio modules are creating new opportunities for industrial IoT developers. The first variation is multi-radio LPWA modules with integrated short-range radios such as Bluetooth Low Energy (BLE) and 802.15.4. Another trend is LPWA hybrid modules where two LPWA radios are used: a low bit rate radio for long device lifetime functions and a high bit rate, low latency radio for advanced functions and over-the-air updates.

The Research and Markets report predicts that, by 2025, industrial connected wireless sensing, tracking and control devices will approach half a billion, up from 35 million in 2017. LPWA technologies such as LoRa, Sigfox, LTE-M and NB-IoT are expected to make up most of this growth, and industrial LPWA device connections will make up 1 in 4 by this time.

On another note, as has become tradition, January sees us publishing our Electronics Manufacturing & Production (EMP) Handbook, the fourth time we have done so, a copy of which you will have received together with this, the year’s first issue of Dataweek.

I would like to take this opportunity to wish all Dataweek readers a successful, safe and productive 2018.
South Africa
- Reunert delivered strong results for fiscal 2017, with revenue of R9,77 billion representing a 15% year-on-year increase and profit increasing by 19% to R1,14 billion. Headline earnings per share were R6,97, a 5% improvement over 2016. The applied electronics segment’s revenue increased by 14% to R1,7 billion, while operating profit reduced by 10% to R276 million due to lower export orders in the first six months. The strong Rand negatively impacted export margins particularly in the areas of export fuzes, mining surveillance radars and electronic subassemblies.
- During the six months ending 31 August 2017, Altron delivered a 5% increase in revenue to R6,8 billion and a 19% increase in EBITDA to R501 million. According to chief executive Mteto Nyati, this growth was driven by the performance of the group’s international operations, and work continues to deliver consistent double digit growth rates at the EBITDA level. “We are placing more emphasis on cross-selling and upselling as one Altron,” he stated. “Furthermore, we want to build on our innovation heritage and leverage our R&D capabilities to deliver solutions that have a positive and meaningful impact on society.”

Overseas

Business
- Analog Devices announced financial results for its fourth quarter and fiscal year 2017, which ended 28 October 2017. Revenue for the quarter totalled $1,54 billion, up 8% sequentially and 54% year-over-year, while annual revenue surged 49% higher than the previous year to reach $5,1 billion. Looking ahead to the seasonally slower first quarter of fiscal 2018, the company is planning for revenue to be in the range of $1,44 billion to $1,54 billion.
- For the fourth quarter of Infineon Technologies’ 2017 fiscal year, revenue fell sequentially by 1% to 1,82 billion Euros, a seasonally atypical decrease which the company attributed to a significantly weaker US dollar in the period from July to September. Net income also decreased quarter-on-quarter, from 253 million Euros to 176 million Euros, and earnings per share fell from 0,22 Euros to 0,16 Euros.
- Microchip Technology reported net sales of $1,01 billion for the second quarter of its fiscal year 2018, which was up 4,1% sequentially and up 16,2% from the year-ago quarter. Net income was $189,2 million, or 77 cents per diluted share, up from $35,6 million, or 15 cents per diluted share, in the prior year's second fiscal quarter.

Companies
- In what would be the largest tech acquisition of all time, Broadcom has launched an unsolicited $103 billion bid to acquire its larger rival Qualcomm. Given that Qualcomm is itself in the process of trying to acquire NXP Semiconductors, a combination of the three companies would be the third largest global chip company. The proposal comes at a relatively slow time in terms of acquisitions in the semiconductor industry, but analysts think a Broadcom- Qualcomm deal is unlikely to come to fruition. Qualcomm’s share price is currently in decline as it battles a series of patent disputes with companies including Apple.
- XP Power has acquired the business and assets of Comdel, a Massachusetts, US-based designer and manufacturer of radio frequency (RF) power supplies. Comdel will become the RF Power Division of XP Power and Comdel's CEO, Scott Johnson, will remain with the business to head up the new division. The deal also brings new customers to XP Power, particularly in photovoltaic and induction heating industries.
- Dialog Semiconductor has completed its acquisition of Silego Technology, a pioneer in integrating multiple analog, logic and discrete component functionality into a single chip. The deal was sealed with a cash payment of $276 million with additional contingent consideration of up to $30,4 million.
- Premier Farnell celebrated the sale of its 10 millionth Raspberry Pi, less than six years after it first began producing the computers. The company now sells over 50 000 Raspberry Pi computers each week to makers, industry and education across the globe. It has been working with the Raspberry Pi Foundation since the launch of Raspberry Pi 1 Model B in 2012 and has a global agreement for the manufacture, distribution and exclusive customisation of the Raspberry Pi.
- STMicroelectronics has acquired software-development tools specialist Atollic, for $7 million in cash plus a deferred earn-out of up to $1 million. Atollic is the supplier of TrueSTUDIO, a professionally recognised and highly regarded integrated Development Environment (IDE) for the embedded development community focusing on ARM Cortex -M microcontrollers, like ST's 32-bit STM32 family.
- Silicon Labs announced a definitive agreement to acquire Sigma Designs for $7,05 per share in a cash transaction valued at approximately $282 million. Sigma Designs provides solutions for the connected home including Z-Wave, a leading Internet of Things (IoT) technology for smart home solutions. Z-Wave supplies some of the world’s largest ecosystems of smart home IoT products with more than 2100 certified, interoperable devices available from more than 600 manufacturers.

Industry
- The Semiconductor Industry Association (SIA) announced worldwide sales of semiconductors reached $377 billion for the month of November 2017, an increase of 21,5% compared to the November 2016 total and 1,6% more than the October 2017 total. All major regional
markets posted both year-to-year and month-to-month sales increases in November, with the Americas market leading the way. Regionally, year-to-year sales increased in the Americas (40.2%), Europe (18.8%), China (18.5%), Asia Pacific/All Other (16.2%), and Japan (10.6%).

• Integrated circuit sales for automotive systems and the Internet of Things are forecast to grow 70% faster than total IC revenues between 2016 and 2021, according to IC Insights. ICs used in automobiles and other vehicles are forecast to generate worldwide sales of $42.9 billion in 2021 compared to $22.9 billion in 2016, while integrated circuit revenues for Internet of Things (IoT) functionality in a wide range of systems, sensors and objects are expected to reach $34.2 billion in four years compared to $18.4 billion in 2016. Between 2016 and 2021, automotive and IoT IC sales are projected to rise by compound annual growth rates (CAGRs) of 13.4% and 13.2%, respectively, compared to 7.9% for the entire IC market, which is projected to reach $434.5 billion in four years versus $297.7 billion last year.

• Worldwide semiconductor revenue totalled $419.7 billion in 2017, a 22.2% increase from 2016, according to preliminary results by Gartner. Under supply helped drive 64% revenue growth in the memory market, which accounted for 31% of total semiconductor revenue in 2017. The largest memory supplier, Samsung Electronics, gained the most market share

<table>
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<th>Rank</th>
<th>Vendor</th>
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<th>Revenue 2016</th>
<th>2016-2017 growth (%)</th>
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Source: Gartner (January 2018)

and took the No. 1 position from Intel, while other major memory vendors, including SK Hynix and Micron Technology, also performed strongly in 2017 and rose in the rankings (see accompanying table).

Technology

• Using flexible conducting polymers and novel circuitry patterns printed on paper, researchers at the Georgia Institute of Technology in the USA have demonstrated proof-of-concept wearable thermoelectric generators that can harvest energy from body heat to power simple biosensors for measuring heart rate, respiration or other factors. Because of their symmetrical fractal wiring patterns, the devices can be cut to the size needed to provide the voltage and power requirements for specific applications. The modular generators could be inkjet printed on flexible substrates, including fabric, and manufactured using inexpensive roll-to-roll techniques. The research was supported by PepsiCo and the Air Force Office of Scientific Research.

Georgia Institute of Technology researchers demonstrated paper-based, wearable thermoelectric generators that can harvest energy from body heat.
Comtest Solutions recently hosted Bird Technologies’ sales manager, Mike Gathergood, at its Gauteng offices, as part of an extensive tour across the EMEA region he services, with a two-pronged objective. The main focus of his visit was the launch of Bird’s new Channel Power Monitor, combined with some product training on the Site Hawk and Signal Hawk devices, followed up with meetings with both dealers and clients.

“I’m particularly excited about the launch of Bird’s new Channel Power Monitor, designed for monitoring the individual transmission sites and antennas of critical communications systems, such as the TETRA Systems used by the various emergency services. The system can also be used to monitor the mission-critical radio systems of airports, sea ports, coastguards and private security companies,” commented Gathergood.

The system monitors critical communication transmissions and alerts operators to a fault, for example if the transmitter’s power output has been reduced, or if there is a fault on the antenna or cable. Corrective action can be taken before the end user is even aware there is a problem, with the optimum being a no-outage result.

The device is connected via an IP network back to a central monitoring site and incorporated into whatever network management system the end user is using, and it is also compatible with SNMP. The goal is to proactively look after the remote sites, so rather than users calling in faults while responding to an emergency call or trying to land an aircraft, there is an awareness of the situation before the user becomes aware of it, and maintenance can be planned ahead. Very frequently, these initial incidences start slowly and spiral downward over a period of time before actually causing a failure, and this system allows for identification and action-taking.

Gary Casper, Comtest product manager added, “Comtest has a couple of upcoming exhibitions – the Fibre-to-the-Home conference and Africa Telecoms – and this information boost will be incorporated into our offering. Mike has specialist knowledge and expertise in essential technical details, so that the Comtest team has an in-depth understanding of the Bird product range, and especially the new Channel Power Monitor, enabling the team to recommend the right product to our customers.”

For more information contact Comtest, +27 (0)10 595 1821, sales@comtest.co.za.

www.dataweek.co.za
SKA confirms synchronisation system designs

One of the most critical and challenging design aspects of the Square Kilometre Array (SKA) radio telescope project, namely time synchronisation, came a step closer to resolution recently when the board of the SKA’s international Signal and Data Transport (SaDT) consortium selected the synchronisation distribution system designs to be used for both SKA telescopes, endorsing the decision of a panel of leading experts in the field of time synchronisation.

While optical fibres are incredibly stable and suited to transport data, mechanical stresses and thermal changes do affect the fibre, degrading the stability of the transmitted signals over long distances. The long distances between the SKA antennas means radio waves from the sky reach each antenna at different times. With eventually thousands of antennas spread over continental scales and therefore thousands of kilometres of fibre, one of the most complex technical challenges for the SKA to function properly is to make sure the signals from the antennas are aligned with extreme precision to be successfully combined by the SKA’s supercomputers.

"Given the scale of the SKA, this is an engineering problem that hadn’t really been faced before by any astronomical observatory," said André Van Es, the SaDT engineering project manager supervising the consortium’s work for SKA Organisation (SKAO).

To achieve this level of precision or ‘coherence’ across the array, the SKA requires a synchronisation distribution system that suppresses these fibre fluctuations in real time. “The performance required is for less than 2% coherence loss. Bearing in mind a 1% loss is equivalent to losing two dishes or antenna stations, it’s crucial that we get this right for the telescopes to be effective," explained SKAO timing domain specialist Rodrigo Olguin.

The pulses sent by the synchronisation distribution system travel to each antenna using the optical fibre network also used for transporting astronomical data to the SKAs central computer. The system then takes into account the mechanical stresses and thermal changes in the fibre and corrects the timing difference to make sure all signals coming from the antennas are digitised synchronously.

An optical fibre-based synchronisation distribution system designed by a team from the International Centre for Radio Astronomy Research (ICRAR) in Perth was selected for the SKA-mid dishes in South Africa, and a system designed by Tsinghua University in Beijing for the SKA-low antennas in Australia. “This decision based on the SKA’s requirements combines both cost-effectiveness and reliability of the designs, resulting in an optimal two-system solution for the telescopes," explained Van Es.

According to Dr Sascha Schediwy from ICRAR and the University of Western Australia, ICRAR’s frequency synchronisation system continuously measures changes in the fibre link and applies corrections in real-time with fluctuations of no more than five parts in one-hundred trillion over a 1-second period. To put that in perspective, he points out that a clock relying on a signal of that stability would only gain or lose a second after 600 000 years.

Dr. Bo Wang of Tsinghua University explains: "Our system employs a frequency dissemination and synchronisation method that features phase-noise compensation performed at the client site. One central transmitting module can thus be linked to multiple client sites, and future expansion to additional receiving sites can be realised without disrupting the structure of the central transmitting station."

The very accurate timing and synchronisation systems will enable the SKA to contribute to many fields, from mapping the distribution of hydrogen in the universe over time to studying pulsars and detecting gravitational waves on a galactic scale, making it complementary to the LIGO and VIRGO gravitational wave observatories. "The technologies behind these synchronisation systems are also likely to find applications beyond astronomy. Think about currency trading, which requires extreme accuracy in transactions," added Van Es.

For more information visit www.skatelescope.org
Monash offering engineering degrees

Monash South Africa (MSA) has announced its academic offering for 2018 will be expanding, by offering engineering degrees within its expanded Faculty of Business, Engineering and Technology.

The first intake into the greater engineering faculty will be in February 2018 and all classes forming the Bachelor of Engineering in Electrical and Electronic Engineering programme will be conducted on campus, at MSA in Ruimsig. Laboratory work will be conducted at state-of-the-art laboratories off campus.

The programme will prepare graduates to assume engineering positions within private consultation firms and development laboratories, large and small private enterprises involved with the design, development, production and marketing of electronic and electrical systems, subsystems and components of products.

MSA is the first private higher education institution to offer a Bachelor of Engineering (BEng) programme that is reviewed by the Engineering Council of South Africa (ECSA). The BEng in Electrical and Electronic Engineering programme is accredited by the CHE and endorsed by ECSA. ECSA is the only signatory in Africa to the Washington accord, to which this degree is aligned. The accord allows for international recognition of engineering qualifications within the agreements.

“The shortage of skilled engineers has a widespread effect on South Africa and the African continent at large, affecting the country's functioning in the globalised business environment and economy. Upon graduating with this degree, your skills will be in high demand, making you sought after by potential employers,” explains Yashin Brijmohan, executive dean, MSA.

This will be a full-time programme of a minimum of four years in the mainstream programme and a minimum of five years in the extended programme, giving graduates an NQF Level 8 qualification.

“Opportunities may also be available in government and non-profit organisations. Private consulting positions or creating opportunities in an entrepreneurial role are further options. Graduates may also choose to pursue a career in academia, either as a discipline-specific lecturer or researcher. Through further study and experience, your opportunities may expand to include registration as a professional engineer, and progression toward the Government Certificate of Competency and research,” concludes Brijmohan.

For more information visit www.msa.ac.za.

NWU speech research group joins engineering faculty

The Multilingual Speech Technology research group (MuST) within the North-West University is joining forces with the NWU Faculty of Engineering in 2018. This research group focuses its efforts on the creation and use of speech technologies and the study of the underlying machine learning principles. The group has a specific interest in deep learning techniques and their application in various domains, including speech and language processing.

The group has a long history of developing speech technologies for the lesser-resourced languages of the world. Although the applications it develops focus mostly on South African languages, the group has worked on 26 different lesser-resourced languages as part of the US IARPA Babel project, including diverse languages such as Amharic, Dholuo, Igbo, Javanese, Kurdish and Mongolian.

In 2016, MuST collaborated with Google to create new South African voices speaking four South African languages: Sesotho, isiXhosa, English and Afrikaans. It also recently completed the development work on a speech transcription platform for South African languages. The project was executed in close consultation with the reporting unit of National Parliament, and includes workflow management and various text and speech processing features, including automatic speech recognition.

When considering the current engineering research projects, MuST was a natural fit with the faculty of engineering. The senior research staff in MuST all have an engineering background, with formal PhD qualifications in electronic and computer engineering. As MuST delivers postgraduate rather than undergraduate students, the partnership with the faculty of engineering provides them with access to students with exposure to the appropriate undergraduate syllabus. In turn, the faculty gets to collaborate on high-profile research projects, new sources of research topics and funding, and a unique network of collaborators.

MuST is the NWU node of the Centre for Artificial Research (CAIR), a national research network hosted by the CSIR and mostly funded by the Department of Science and Technology (DST). As such MuST has access to attractive bursaries for post-graduate studies in the field, and an impressive network of scientists working on various aspects of AI. According to Prof Marelie Davel, director of MuST, the plan for 2018 is to intensify the machine learning aspect of their research focus.

For more information contact Professor Marelie Davel, MuST, +27 (0)28 312 1907, marelie.davel@nwu.ac.za.

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Company profile: Connector Technology

Stretching back to 1992, Connector Technology has been providing customised connector, cabling and harnessing solutions for the South African electronics manufacturing industry.

Today the company has a national footprint with a presence in Johannesburg, Durban and Cape Town.

According to co-founders Mark Rishworth and Jackie Booysen, the company is focused on serving its clients, with a specific aim of finding solutions to its clients’ specific needs in terms of what is going to work, what will be reliable etc. It then sources high-quality connector, cabling and harnessing products at competitive pricing to provide a lasting solution. “We aim to keep our clients in the long term so we build trusted relationships,” explains Rishworth.

In a sense, the company’s roots date all the way back to 1976, which is when Rishworth started working in his father’s connector business. “When my father sold the business to American company Molex, I resigned and started my own business as I believed there was an unfulfilled niche for a truly South African connector and harnessing business in the market. Our clients in South Africa have specific requirements, which we could fulfil then by sourcing the best available products from around the world. We continue to do this today,” he states.

Today, Connector Technology serves numerous sectors, including lighting, home automation, business equipment, automotive, security, mining, medical, telecoms and military, with a diversity of products sourced from a range of international distributors and assembled in South Africa. The company has invested in an extensive line of automatic, semi-automatic and manual tooling, and is equipped to process and terminate products offered by Molex, TE Connectivity, Hirose, J.S.T, Delphi and others.

“Ultimately we aim to support and grow the local electronics industry,” says Rishworth. “We do this by providing high-quality, reliable solutions for the long term. We genuinely want our clients to be successful, and to think of us as providing that personal touch which is so rare in today’s market. In a market that is more and more commoditised, we are unique in that we work with the client to understand their requirements. We design solutions for the long term, and then source good quality products at fair prices. We also offer unparalleled technical expertise; for example we are one of the only companies that can crimp down to 1 mm pitch.

“We have a proven track record with our clients, many of whom have been with us for many years. We believe that we offer the best value, both in designing solutions and delivering quality products. We are able to guide our clients through the minefield of compatibility, minimum order quantities, long delivery lead times, quality and pricing issues that can arise when dealing with a range of international distributors.”

As to what the future holds for Connector Technology, Rishworth emphasises the need to keep a finger on the pulse of future trends. “The trend in the electronics industry is towards smaller and smaller form factors,” he clarifies. “As one of the few companies to be currently crimping down to 1 mm pitch, we are on the leading edge of this trend and plan to maintain this advantage through continuous improvements in our technical expertise. We plan to remain in our niche providing high-quality connector and harnessing solutions for the long term.”

For more information contact Connector Technology, +27 (0)11 608 1375, contec@global.co.za
ULP benchmarking tool for STM32 microcontrollers

EEMBC’s new version of the ultra-low-power ULPBench benchmark for embedded microcontrollers now focuses on peripherals including ADC, SPI, PWM with timer and RTC.

With manufacturers able to publish scores for supply voltages below 3,0 V, STMicroelectronics’ STM32CubeMonitor-Power graphical software tool can be used with the STM32 Power Shield to execute ULPBench tests and confirm that STM32 products offer strong performance at any voltage as well as in the core profile at 1,8 V. STM32CubeMonitor-Power enables developers to swiftly analyse the low-power performance of target boards. This software tool acquires power measurements through the X-NUCLEO-LPM01A specialised intermediate board, and displays these measurements using an intuitive graphical interface. Dynamic measurement of current covers a range from 100 nA to 50 mA, while STM32CubeMonitor-Power allows updating of acquisition parameters, and data rendering in real time. Execution of EEMBC ULPBench tests is also supported to provide an accurate ULPMark score directly.

Reception of power measurements is done by an X-NUCLEO-LPM01A board at up to 100 kHz. Intuitive navigation into data is possible using mouse-based zoom and move functions, and control of all X-NUCLEO-LPM01A functions (such as acquisition frequency, supply voltage, triggers, and others) can be done from the graphical interface.

For more information contact Robin Scholes, Arrow Altech Distribution, +27 (0)11 923 9600, rscholes@arrow.altech.co.za

ALTIBUS

IDE supporting RISC-V architecture

SEGGER Microcontroller announced the new RISC-V edition of its multi-platform Embedded Studio integrated development environment (IDE).

SEGGER Embedded Studio is the first professional IDE which supports the open source RISC-V CPU architecture.

Embedded Studio for RISC-V comes with the same features and benefits of Embedded Studio for ARM and Cortex-M and makes it painless for users to transition between both architectures.

J-Link combined with Embedded Studio allows for unlimited breakpoints in Flash memory, eliminating hardware breakpoint limitations, and the ability to write custom loaders using J-Link’s Open Flash Loader to support any type of Flash memory storage. Embedded Studio features multiple means of application analysis, such as memory use and stack analysis.

One way to easily experience RISC-V and Embedded Studio is with the Digilent Arty-A7 ARTY development board which has the SiFive E31 Core IP deployed, including integrated Flash programming, debugging and Flash breakpoints. With straightforward licensing, free for educational and non-commercial use, Embedded Studio is ideally suited to university courses and for professional development in equal measure.

For more information contact CST Electronics, +27 (0)11 608 0070, sales@cstelectronics.co.za

Altium releases Altium Designer 18

The rapidly expanding global PCB market has spurred remarkable advancements in the world of electronic design, with new products that are more sophisticated, more compact, and more complex than ever before. To meet the needs of today’s engineer, Altium has rolled out the most powerful, modern, easy-to-use release of Altium Designer to date.

By leveraging feedback from the user community and with significant efforts in research and development, Altium Designer 18 delivers key updates and performance enhancements, along with new and improved features that significantly increase design productivity.

This release simplifies the overall design experience with a modernised user interface that improves user commonality across all design domains, making it even more intuitive and accessible. In addition to the modern user interface, this version features the much-anticipated upgrade to 64-bit architecture combined with multi-threaded task optimisations, enabling users to design and release large, complex boards faster.

This upgrade fully equips engineers to tackle even the most complex PCB designs, with key performance optimisations and increased user control through every stage of the design process.

Altium Designer 18 not only features huge structural improvements, but also includes major updates to ActiveRoute, a user-guided routing engine that now supports length tuning and pin swapping, enabling users to quickly produce high-quality routes. The ACTIVEBOM editor also features several enhancements including a new BoM rule checker that allows designers to easily verify each BoM line item. Users can also design and release large, complex boards faster than ever before using the new multi-board assembly capability and real-time connection management.

The new technologies introduced in Altium Designer 18 are available now as a free upgrade for existing Altium Subscription customers on the Altium Downloads page.

For more information contact EDA Technologies, +27 (0)12 665 0375, sales@edatech.co.za
In parallel with the PTXdist-based board support packages (BSP) for ARM modules, the embedded specialist, TQ, is now also making available a corresponding Yocto Metalayer. Support will initially be provided for the current products, TQM6x, TQM6ULx, TQM7x and TQMLS102xA.

In the last two years, TQ says it has encountered increasing demand for Yocto. Because of the growing number of projects, the company is offering a Yocto Metalayer based on Yocto 2.1 (Krogoth) for the ARM modules. Yocto Project users can include the Metalayer to make it very easy to create boot loader and kernel binaries tailored to the corresponding TQ module. The TQ BSP layer thus provides a solid basis for the production of customer-specific BSPs for the use of TQ modules in the widest variety of customer applications.

Chip manufacturers such as Texas Instruments and NXP support the Yocto Project and offer corresponding BSP layers for their respective evaluation boards. These BSP layers make the support available for the CPUs concerned and are thus the foundation for module-specific BSP layers. These in turn form the starting point for customer-specific BSPs for embedded systems using a TQ embedded module.

When using embedded systems, Yocto provides the advantage that porting of the operating system to customer-specific hardware is simplified. Meanwhile, Yocto has a good infrastructure that also permits the management and creation of platform-independent projects. With Yocto, a stable basis was established for build systems in the embedded systems field, which, amongst other things, takes into account aspects such as licensing issues.

Yocto support for embedded ARM modules

An electronics manufacturer you can rely on, with 25 Years’ of experience and counting
Rigol Technologies introduced its new DS2000E series oscilloscope, a 2-channel scope available in either 100 MHz or 200 MHz bandwidths. With a real-time sample rate of 1 GSp/s (on both channels), memory depth of up to 28 Mpts standard, and waveform capture rate up to 50,000 wfms/sec, the DS2000E provides the raw instrument performance required to meet today’s more advanced debug challenges.

The instruments feature a large 8” WVGA intensity graded display, complete network connectivity, hardware waveform record/playback, serial trigger and decode, and other advanced analysis capabilities, at a reasonable price point.

The 200 MHz model provides full 5X oversampling at 200 MHz on both channels and is supported with Rigol’s established UltraVision architecture, providing enhanced signal fidelity.

Until the end of March 2018, Rigol will provide a free option upgrade with the purchase of any new DS2000E. This bundle includes all serial decode (RS232, I2C, SPI, CAN) and advanced triggering options.

For more information contact Coral-i Solutions, +27 (0)11 315 5500, sales@coral-i.co.za

TEWS released a new standard single-wide PCI Mezzanine Card (PMC) compatible module designed for industrial, COTS and transportation applications.

The TPMC532 provides 16 or 8 channels of simultaneous sampling, true differential bipolar 16-bit analog input, 8 or 4 channels of simultaneous update single-ended unipolar/bipolar 16-bit analog output and 14 channels of tri-state 5 V tolerant TTL digital input/output. All signals are accessible through a Mini D Ribbon (MDR68) type front I/O connector. The PMC connectors P11 and P12 provide access to the control logic via a 32-bit, 33 MHz PCI link.

The ADCs offer true differential inputs with software selectable ±5 V and ±10 V bipolar; the maximum sample rate of the ADCs is 200 KSp/s and they offer an oversampling capability with a digital filter. The DACs offer software selectable 0-5 V, 0-10 V, 0-10,8 V, ±5 V, ±10 V and ±10,8 V output voltage ranges (individual setting for each of the four channels of each DAC). The settling time is typically 10 μs and the DAC channels are able to drive a load of 2 kΩ, with a capacitance up to 4000 pF.

Each TPMC532 is factory calibrated. The correction data is stored in an on-board serial EEPROM unique to each PMC module. These correction values can be used to perform a hardware correction of every analog-to-digital and digital-to-analog conversion. Additionally, a temperature sensor on-board can be used to compensate temperature-dependent errors.

The board provides two sequencers, one for A/D conversions and another one for D/A conversions. To perform periodic simultaneous conversions the conversion rates are programmable and can be output to other modules on PMC back I/O connector P14 or front I/O connector DIO pins for synchronisation purposes. The TPMC532 can also operate as a target which means that the conversion rates can be sourced from P14 or front I/O, created by another module.

A frame trigger signal, which can also either be generated by the TPMC532 and output on P14/front I/O or generated by other modules and input from P14/front I/O, can be used to synchronise ADC frames and DAC frames. The signals on PMC back I/O connector P14 are ESD protected and driven or read by tri-state 5 V tolerant TTL buffers.

The TPMC532 provides input and output FIFOs to be able to collect ADC frames and to output DAC frames. Data transfer on the PCI bus is handled by TPMC532 initiated block transfer mode DMA cycles with minimum host/CPU intervention.

The 14 digital TTL tri-state I/O lines with 4,7 kΩ pull resistors are ESD protected. The voltage the pull-up resistors are connected to is programmable by software and can be 3,3 V, 5 V, GND or floating level (one common setting for all fourteen digital I/Os).

All 14 DIos can be programmed to have their digital I/O transmitters enabled or disabled individually per I/O line. The digital I/O receivers are always enabled, so each DIO level can always be monitored and can generate an interrupt triggered on rising edge, on falling edge or both. Additionally, a debounce filter can be configured to eliminate bounce on the digital I/O lines.

The TPMC532 operates from -40°C to +85°C. In order to support long term programs, the TEWS modules have a 5 year warranty. Extensive software support for major operating systems such as Windows, Linux, VxWorks, Integrity and QNX is available.

For more information contact Rugged Interconnect Technologies, +27 (0)21 975 8894, sales@ri-tech.co.za

For more information contact Coral-i Solutions, +27 (0)11 315 5500, sales@coral-i.co.za
Microchip’s Power Delivery (PD) Controller, UPD360, is a USB-IF certified USB Type-C™/PD Controller. UPD360 integrates the functional blocks required for USB Type-C and PD communications, which includes VCONN FETs and port power controllers. UPD360 can operate in a standalone mode or a companion mode, interfacing to MCUs, embedded controllers or USB hubs over I²C/SPI interface. UPD360 can be designed into applications that require USB connectivity, alternate protocols (viz. Display Port) and manage power (as a Source or Sink) up to 100 W over USB Type-C connectors.

**Highlights**
- USB Type-C and power delivery functionality
- Integrated power switch
- Integrated VCONN FETs
- Dead battery support
- I²C/SPI interface

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## Single-wire serial EEPROM

New from Microchip comes a single-wire, two-pin EEPROM device with a 2.7 V to 4.5 V operational voltage range. The AT21CS11 is ideal for identifying and authenticating remote items, such as cartridges or cables, where space for electronic components is limited.

This is the second single-wire EEPROM offered by Microchip, and extends the operating voltage to 4.5 V, making it suitable for lithium-ion battery-powered devices such as disposable medical devices and e-cigarettes.

Each chip contains both a pre-programmed unique serial number and five EEPROM memory sections. Any, or all, of the memory sections can be permanently locked by the end-equipment manufacturer to allow tracking of products and the identification of attachments to assist with counterfeit prevention. The EEPROM is ideal for customers who need to warranty their product or prevent counterfeits and ensure proper continued operation of their goods through authorised replacements.

The new device connects to a system through a single input/output (SI/O) wire that serves as both the communication and the power supply to the part. Needing only one wire and a ground allows makers of Fibre to the Home (FTTH) cable-ends to add critical cable characteristic parameters to different cable types. The SI/O wire also enables a simple two-point mechanical snap-in or twist-on connector for disposable devices where larger three-, five- or eight-wire solutions become impractical.

By locating the EEPROM in a detachable cable or cartridge, manufacturers can create attachments that can be easily identified or authenticated. The device has 1 Kbit of EEPROM memory (four sectors of 256 bits each), a 64-bit serial number and 128 bits for extra user-programmable tracking memory. The extra memory allows designers to add unique identification and operating parameters, such as consumption and usage information, in locations that can be remote from the main electronics.

For more information contact Tempe Technologies, +27 (0)11 455 5587, willem.hijbeek@tempetech.co.za

## Zero-drift nanopower op-amp

Texas Instruments has introduced an operational amplifier (op-amp) combining ultra-high precision with the industry’s lowest supply current.

Boasting exceptional power-to-precision performance, the LPV821 zero-drift, nanopower op-amp is designed for use in precision applications such as wireless sensing nodes, home and factory automation equipment, and portable electronics.

Consuming only nanoamps of supply current, while providing the high-precision benefits of optimised offset, drift and 1/f noise (flicker noise), the LPV821 is beneficial for applications where both precision and low power are essential system needs, including industrial gas detectors, field transmitters and battery packs.

TI’s zero-drift technology delivers a low initial offset of 10 µV and an offset drift of 0.02 µV/°C, eliminating temperature drift and flicker noise, and enabling engineers to attain the highest DC precision and dynamic error correction. Additionally, self-calibration technology helps engineers save system development cost and speed time to market.

An input bias current of 7 pA and low flicker noise at 3.9 µVp-p enables operation with high-impedance sensors, delivering more accurate measurements in precision systems. Engineers can pair the LPV821 with the TLV3691 comparator or ADS7142 analog-to-digital converter to program a threshold that will automatically wake up a microcontroller, further reducing system power consumption.

For more information contact EBV Electrolink, +27 (0)21 402 1940, capetown@ebv.com

## Non-volatile memory ICs

Adesto Technologies’ DataFlash is a family of non-volatile memory devices with low power requirements and smart features for higher system efficiency and lower system costs. The DataFlash E-series offers a range of features and options including capabilities such as wide VCC voltage (1.65 V – 3.6 V) and an ultra-deep power-down mode that operates at below 400 nA.

The E-Series products also include smart features to improve system performance such as efficient byte-write that doesn’t require large block erase, and an industry standard erase-suspend-resume command. Comprehensive security and unique ID features protect the device from outside tampering.

For more information contact Conrad Coetzee, Arrow Altech Distribution, +27 (0)11 923 9600, ccoetzee@arrow.altech.co.za
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AAD offers developers a robust IoT sensor platform

Sensing devices are at the heart of Internet of Things (IoT) technology innovation, and Arrow Altech Distribution (AAD) is enhancing its presence in sensor-to-cloud-to-analytics IoT technology platforms.

This spans the gamut of environmental sensors, and includes lightning sensors, air sensors for detecting PM2.5 and PM10 suspended particulates, water temperature, dissolved oxygen and water acidity, air pressure, humidity and temperature, and UV sensors.

As the manager of the company’s wireless department, Gyula Wendler, explains, “This technology opens up a broad range of opportunities for engineers and developers serving industries that are working on solutions for the environmental challenges that threaten food security and other critical environmental aspects of life as we know it, as well as the way we are impacted by our cities, roads and workplaces.”

Those building IoT solutions in this space want to deliver sensory products to the market quickly and cost effectively. With AAD’s sensory IoT solutions they are able to gather accurate and reliable sensory information in real-time and use this to create ready-to-deploy IoT applications and devices, making use of an open data-sharing infrastructure and AAD’s sensor-to-cloud-to-analytics technology stacks, tools and platforms.

In bringing this technology to its market, AAD partners with Libelium, a global company that is able to ‘connect any sensor to any cloud platform using any wireless technology’ making IoT more widely accessible. Libelium has assisted organisations in deploying remote sensing solutions in applications including forestry, agriculture, environmental monitoring, smart manufacturing and traffic control since 2006. Its hardware is designed to minimise power consumption, further contributing to the reduced environmental footprint that serves as the underlying philosophy in its market value proposition.

AAD’s IoT offerings, in turn, include a comprehensive range of hardware components, development platforms and software tools linked together by supporting services. Its eVolve platform, which includes Arrow Connect, provides customers with a complete ‘sensor-to-sunset’ solution that simplifies the specification, creation, management and operation of IoT networks throughout their working life.

“By harnessing and giving expression to sensing innovation through our respective capabilities, Libelium and Arrow play a significant role when it comes to providing a robust technology framework and infrastructure platform, available as an off-the-shelf IoT solution requiring minimal design effort prior to deployment,” says Wendler.

For more information contact Gyula Wendler, Arrow Altech Distribution, +27 (0)11 923 9600, gwendler@arrow.altech.co.za

Development kit for smart passive sensors

A complete wireless battery-free sensing solution kit (SPSDEVK1) from ON Semiconductor allows the company’s innovative Smart Passive Sensors (SPS) portfolio to be rapidly integrated into Internet of Things (IoT) applications. The kit is plug-and-play ready for users to immediately measure, aggregate and analyse the data for various IoT applications.

SPS wireless and battery-free sensors enable the monitoring of various parameters, such as temperature, pressure, moisture or proximity at the network edge where running wires or replacing batteries may be impractical. When interrogated by an RF reader (the ON Semiconductor TagReader), the SPS harvests energy from the measuring signal, and then rapidly delivers a reading from the sensor. This cost-effective solution has significant benefits over other technologies, and offers the potential to revolutionise low-power IoT sensing designs.

The SPSDEVK1 is a complete sensing solution that includes a UHF SPS reader hub (SPSDEVR1-8), eight UHF antennas (SPS1DEVA1-W), 50 temperature sensors (SPS1T001PCB), a 12 V d.c. power supply and an Ethernet cable. Also included is TagReader software, an application specifically developed for reading SPS that enables the full functionality of the tags, giving a comprehensive system solution.

The software automatically detects the type of tag that is connected and reads sensor data graphically over time. A graphical user interface (GUI) allows all system parameters related to the measurement process to be configured and re-configured as needed. As a result, even first-time users can quickly and easily configure a system to measure, aggregate and analyse data for multiple fully wireless, battery-free IoT applications.

For more information contact EBV Electrolink, +27 (0)21 402 1940, capetown@ebv.com
It is difficult for the end customer to determine if it is due to the antenna, or if the problem is with the connected equipment e.g. LTE/Wi-Fi router, M2M gateway, etc. To illustrate the extent of the problem, Fourie points to the case of one antenna which is being sold internationally as being an 88 dB antenna. He says this is a ludicrously high gain being claimed, and in reality it is a low gain antenna with very poor characteristics for its type. "The quoted 88 dB is physically impossible even for an antenna hundreds of times larger in size. This is how far some suppliers will go to market their antennas, and they are quite successfully selling these antennas to unsuspecting consumers. A consumer could have purchased an antenna with much lower gain specifications from a reputable supplier and the customer experience would be much better," he says.

As a further example, Fourie mentions another dubious antenna which was tested, which was an almost exact copy of a Poynting registered design for an older version of its antenna. To another supplier based in Asia produced an antenna which unsuitably copied. "Customers are purchasing this type of antenna at a much higher gain than the one it copied. "Needless to say, this antenna was not even tested as it would have been a waste of time," says Fourie.

Another example where an alleged copyright infringement was investigated, was where a company based in Asia produced an antenna which was an almost exact copy of a Poynting registered design for an older version of its antenna. Even though the antenna was almost a one to one copy, it performed poorly when compared. The company producing this antenna marketed the antenna at a much higher gain than the one it copied. "Customers are purchasing this type of antenna with poorer performance for almost the same price as the real thing, just to save a few bucks," Fourie warns.

In closing, Fourie advises that consumers rather purchase from reputable companies. "The antenna might be a small portion of the cost of a communications system, but it can have devastating effects which can compromise the value of the entire system," he concludes.

For more information contact ICORP Technologies, +27 (0)11 781 2029, enquiries@icorptechnologies.co.za
The term Internet of Things (IoT) is used to describe the practice of connecting devices through the use of the Internet. The IoT is already connecting computing devices, appliances, humans and other living beings through the Internet. Accumulating data and knowledge through these Things would improve a vast array of items and experiences throughout the world. The IoT is made of events and signals of many different kinds and requires a standardised mode of communication.

In a report published by IBM on the future of the Internet of Things, the number of connected devices is forecast to surpass 30 billion in 2020, up from 2.5 billion in 2009 and 10 billion today. The connected devices need a protocol with which to communicate only when it is required. Devices with constrained resources should be able to communicate with various other heterogeneous devices.

MQ Telemetry Transport Protocol (MQTT or simply MQTT) is described on the mqtt.org website as a machine-to-machine (M2M) or IoT connectivity protocol. This protocol is so lightweight that it can be supported by some of the smallest measuring and monitoring devices, and it can transmit data over far reaching, sometimes intermittent networks.

MQTT is a publish/subscribe messaging transport protocol that is optimised to connect physical world devices and events with enterprise servers and other consumers. It is designed to overcome the challenges of connecting the rapidly expanding physical world of sensors, actuators, phones and tablets with established software processing technologies. These principles also turn out to make this protocol ideal for the emerging M2M or IoT world of connected devices where bandwidth and battery power are at a premium. The following are the five most important things to know about MQTT protocol.

**MQTT publish subscribe architecture**

The MQTT messages are delivered asynchronously (‘pushed’) through publish subscribe architecture. The protocol works by exchanging a series of MQTT control packets in a defined way. Each control packet has a specific purpose and every bit in the packet is carefully crafted to reduce the data transmitted over the network. An MQTT topology has a server and a client, each of which communicates through different control packets. Table 1 briefly describes each of these control packets.

**Ideal for constrained networks**

MQTT control packet headers are kept as small as possible. Each MQTT control packet consists of three parts: a fixed header, a variable header and a payload. Each packet has a 2 Byte fixed header, while not all packets have the variable headers and payload. A variable header contains the packet identifier if used by the control packet. A payload up to 256 MB could be attached in the packets.

Having a small header overhead makes this protocol appropriate for IoT by lowering the amount of data transmitted over networks constrained by factors like low bandwidth, high latency, data limits and fragile connections.

**Quality of Service**

Quality of Service (QoS) levels determine how each MQTT message is delivered, and must be specified for every message sent. It is important to choose the proper QoS value for every message, because this value determines how the client and the server communicate to deliver the message.

Three QoS for message delivery could be achieved using MQTT:

- **QoS 0 (At most once)** – where messages are delivered according to the best efforts of the operating environment. Messages loss can occur.
- **QoS 1 (At least once)** – where messages are assured to arrive but duplicates can occur.
- **QoS 2 (Exactly once)** – where message are assured to arrive exactly once.

There is a simple rule when considering the performance impact of QoS, namely ‘the higher the QoS, the lower the performance.’ MQTT provides flexibility to the IoT devices, to choose the appropriate QoS they would need for their functional and environment requirements.

**Table 1. MQTT control packet types.**

<table>
<thead>
<tr>
<th>Control packet</th>
<th>Direction flow</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONNECT</td>
<td>Client to server</td>
<td>Client request to connect to server</td>
</tr>
<tr>
<td>CONNACK</td>
<td>Client to server</td>
<td>Connect acknowledgement</td>
</tr>
<tr>
<td>PUBLISH</td>
<td>Client to server or server to client</td>
<td>Publish message</td>
</tr>
<tr>
<td>PUBACK</td>
<td>Client to server or server to client</td>
<td>Publish acknowledgement</td>
</tr>
<tr>
<td>PUBREC</td>
<td>Client to server or server to client</td>
<td>Publish received (assured delivery part 1)</td>
</tr>
<tr>
<td>PUBREL</td>
<td>Client to server or server to client</td>
<td>Publish release (assured delivery part 2)</td>
</tr>
<tr>
<td>PUBCOMP</td>
<td>Client to server or server to client</td>
<td>Publish complete (assured delivery part 3)</td>
</tr>
<tr>
<td>SUBSCRIBE</td>
<td>Client to server</td>
<td>Client subscribe request</td>
</tr>
<tr>
<td>SUBACK</td>
<td>Client to server</td>
<td>Subscribe acknowledgement</td>
</tr>
<tr>
<td>UNSUBSCRIBE</td>
<td>Client to server</td>
<td>Unsubscribe request</td>
</tr>
<tr>
<td>UNSUBACK</td>
<td>Server to client</td>
<td>Unsubscribe acknowledgement</td>
</tr>
<tr>
<td>PINGREP</td>
<td>Client to server</td>
<td>PING request</td>
</tr>
<tr>
<td>PINGRESP</td>
<td>Server to client</td>
<td>PING response</td>
</tr>
<tr>
<td>DISCONNECT</td>
<td>Client to server</td>
<td>Client is disconnecting</td>
</tr>
</tbody>
</table>
Bluetooth 5 development kit

RS Components is making available the Pioneer Kit development platform for the PSoC 6 MCU from Cypress Semiconductor. PSoC 6 is purpose-built for IoT with an ultra-low-power, flexible architecture and integrated security features required for next-generation IoT devices.

The CY8CKIT-062-BLE kit has a PSoC 63 device on-board, with Bluetooth 5 ready to go, creating a powerful launchpad for developing IoT devices. Cypress’ S12 Mb Quad-SPI NOR Flash memory and EZ-PD CCG3 USB Type-C controller with power delivery are also available on-board. Smart power options are provided too, with support for a rechargeable LiPo battery and a supercapacitor that can be used as backup power.

Users can also refine the user interface for their new applications by taking advantage of the on-board capacitive-sensing buttons, sliders and proximity sensor based on Cypress’ CapSense technology, and the 2.7” E-Ink display shield (CY8CKIT-028-EPD) included in the pack. This board plugs into the platform’s Arduino UNO v3 shield headers, which simplify the plug. This board plugs into the platform’s display shield (CY8CKIT-028-EPD) included in the pack.

The PSoC 6 BLE Pioneer Kit contains everything users need to get their applications up and running, including essential software. There is a comprehensive software development kit (SDK) containing header files, startup code and fully integrated middleware, called the Peripheral Driver Library (PDL). The PDL helps quickly take control of the flexible peripherals of PSoC 6 MCUs.

The new PSoC 6 MCU will also soon be available from RS, for customers to implement their projects developed using the PSoC 6 BLE Pioneer Kit. The PSoC 6 architecture integrates a 150 MHz ARM Cortex-M4 core and 100 MHz Cortex-M0+ to allow compute tasks to be assigned efficiently for optimum performance and power. Active power can be as low as 22 µA/MHz on the ARM Cortex-M4 and 15 µA/MHz on the Cortex-M0+ cores, and dynamic voltage and frequency scaling ensures maximum energy efficiency as the load varies.

The devices also feature a hardware-based trusted execution environment (TEE), which addresses IoT security challenges without requiring external memory or a secure element. The PSoC 6 TEE supports state-of-the-art security features such as secure boot, secure data storage, and advanced cryptographic algorithms.

Leveraging the flexibility of Cypress’ programmable-SoC philosophy, the latest PSoC 6 generation also allows designers to take advantage of software-defined peripherals to create custom analog front-ends (AFEs) or digital interfaces. The new devices also support Cypress’ popular CapSense touch technology, giving the option to provide sleek, smooth user interactions where needed.

For more information contact RS Components, +27 (0)11 691 9300, sales.za@rs-components.com
LTE is key to the future of M2M communication

By Stefano Moioli, director product management cellular, u-blox.

As the Internet of Things (IoT) grows and matures, numerous wireless protocols are jockeying for position in the arena of M2M (machine to machine) communication. The most qualified one today is one you may not have expected: LTE. Most of us know LTE (Long Term Evolution) as the protocol used to connect smartphones to the Internet, but its applications go far beyond smartphone connectivity. High-speed LTE is also well suited to vehicle communications, where it can enable advanced telematics or Vehicle-to-X (V2X) communication.

Its high data rates, low latency, and ability to work well even while moving at high speeds make it an ideal protocol for connecting vehicles.

But LTE is not just about speed. New, lower power and low data rate versions of LTE are well suited to IoT applications, because they provide affordable, long-range connectivity while consuming little power.

LTE for the connected car

While LTE is mostly used in phones today, soon it may be the primary technology millions of cars use to connect to the cloud – and each other. We think of LTE as a smartphone technology, but the high speeds and low latencies of LTE make it extremely well suited to automotive and vehicle applications.

In addition to being fast, LTE also has long range, excellent cell tower hand-off performance, and the ability to function while moving at high speeds. These characteristics make it an ideal protocol for automotive connectivity, as well as vehicle connectivity in general.

The applications of LTE in the automotive environment are varied, and include Wi-Fi hotspots, advanced infotainment and navigation, telematics and V2X communication. These applications need not be mutually exclusive, as the bandwidth of the latest generation of LTE modules is enough to support multiple use cases simultaneously.

Wi-Fi hotspots

Wi-Fi hotspots are the most obvious, yet also one of the most effective applications of LTE cellular technology for automotive. LTE provides speeds equivalent to modern wired broadband connections. This amount of bandwidth allows multiple users and applications to share a connection with minimal performance impact. Multiple video streams can be viewed simultaneously, and all this can happen without impacting other connected applications currently running.

Automobile hotspots have advantages in connection stability and signal reception compared to hotspots generated by smartphones. LTE modules in cars can take advantage of much larger, external antennas, and power consumption isn’t limited by small cellphone batteries. This allows for reception even in parking garages and other challenging environments.

Infotainment and navigation

LTE provides enough bandwidth for advanced infotainment and navigation services. Real-time street imagery or video can be streamed to aid navigation. Video conferencing will be possible for passengers or when the vehicle is parked. High-resolution satellite imagery and map information can be downloaded on the fly.

For lower bandwidth applications like real-time traffic information, LTE connectivity trumps 2G or 3G connection with fast, low-latency updates over a reliable connection that just works. As a forward-looking standard, LTE technology also benefits from network longevity.

Advanced telematics

Telematics is another area which benefits heavily from LTE connectivity. The cellular connection allows for detailed real-time vehicle location and diagnostic information to be uploaded to the cloud. This kind of information can benefit both consumer and commercial use cases.

Consumers benefit from knowing the location and status of their vehicle. Parents for instance may want to know the location of the family car and its diagnostics information. Live feeds from in-car or dash-mounted cameras can also be invaluable for communication or guidance, and also for emergency personnel responding to an accident.

For commercial fleets, more detailed telematics information can help managers improve driver and fleet efficiencies. Diagnostic information can help fleet managers monitor vehicle health more accurately to keep vehicles on the road. Video feeds from in-car, dash, or truckbed-mounted cameras allow fleet managers to communicate more effectively with drivers, provide remote guidance, or monitor work (such as cargo loading/offloading) remotely.

V2X communication

One of the most exciting developments with LTE is its capability for improving advanced driver assistance systems (ADAS) with the coming introduction of LTE for V2X communication. Planned for the upcoming Release 14 of the 3GPP standard, LTE for V2X is designed to let vehicles communicate with other vehicles and the world around them. This information can be used to prevent accidents, improve traffic flow, and gather useful information to make journeys safer, faster and more efficient.

Whereas LTE communication is normally from end-user devices to a base station, V2X communication will add a device-to-device direct communication mode. By allowing communications between devices directly, ultra-low latencies can be possible for vehicle-to-vehicle (V2V) communication. This will allow split-second communications to happen for collision avoidance or hazard warnings that happen too fast to be reacted to by a normal human driver. V2V communications can be invaluable for avoiding accidents at blind

Stefano Moioli.
intersections, road hazards around the bend, and other dangerous situations where visibility is obstructed. It can also improve traffic flow by coordinating vehicle movement speeds, provide context-aware information such as road works warnings, and traffic light timings.

**LTE for connecting the IoT**

While high-speed LTE makes sense for the connected car, there are many other IoT use cases where the bandwidth of high-speed LTE is unnecessary and would be cost prohibitive, but the ease of use and reliable performance of in-place cellular infrastructure is invaluable. For this reason, many IoT deployments today, from smart grids to asset trackers and security, still rely on 3G or even 2G cellular connectivity.

These legacy technologies provide the convenience of cellular technology, and are fast enough for medium- and low-bandwidth applications. However, network longevity is a key challenge. Industrial product lifecycles are much longer than consumer devices. Once deployed, an industrial device may be expected to work for 5 years, 10 years, or more. But as network operators complete the transition to LTE, 2G and 3G, networks are being sunset around the world. Devices made today can no longer depend on legacy cellular technology to be supported in the long term.

To meet the needs of these medium- and low-bandwidth M2M applications as well as open up LTE to new ultra-low bandwidth use cases, the 3GPP has standardised new categories of LTE. These new standards are designed for reliably and affordably delivering lower data rate connectivity. They meet the needs of devices relying on previous generation cellular technologies, and also expand LTE to support ultra-low bandwidth applications.

**LTE Cat 1**

With performance of 10 Mbps down / 5 Mbps up, LTE Cat 1 meets the needs of medium- to low-bandwidth applications. It offers reliable levels of cellular connectivity with network longevity, and affordable hardware, as modules cost significantly less than the faster LTE Cat 4+ modules used in smartphones. In addition to lower costs, LTE Cat 1 also uses significantly less power than Cat 4+, which is critically important for battery-powered IoT devices.

Cat 1 LTE is suitable for industrial applications ranging from surveillance video feeds to alarm systems, telematics, ATMs and more. Hardware costs are low enough that it can be deployed either for gateway connectivity or at the per-device level.

Network providers are seeing the potential of Cat 1 technology for IoT applications and most major network operators have deployed it around the world.

**NB-IoT (LTE Cat NB1)**

NB-IoT (Cat NB1) is a new, exciting addition to the LTE cellular standard. Using a significantly different physical and link layer protocol but still taking advantage of cellular base station infrastructure, it achieves ultra-low-power connectivity using simple, affordable radio modules.

The low data rate protocol is extremely energy efficient, making battery lives of 10 years or more possible. Performance is only 27.2 Kbps down and 62.5 Kbps up, but for many IoT sensing and measuring devices, these metrics are more than enough.

In addition, the narrowband nature of the technology along with a sub-gigahertz frequency band deployment allows for great signal penetration. This makes NB-IoT a perfect protocol for smart metering, security systems, and other applications which often require devices to be in recessed, indoor, or underground locations where traditional radio technologies have trouble reaching.

NB-IoT is currently being adopted by operators such as Vodafone, T-Mobile, China Telecom, LGU+, KT, Softbank and many more.

**LTE Cat M1**

While NB-IoT is in theory a perfect protocol for many IoT sensor applications, there are some barriers to adoption. While certain carriers already have base stations which support it, other carriers need to upgrade their base station hardware to support it. However, there is another air interface that has some features which NB-IoT lacks and which has been adopted by a different set of network operators.

Enter LTE Cat M1. This protocol exists at a bandwidth level between Cat 1 and NB-IoT. Instead of tens of kilobits, Cat M1 supports up to 375 Kbps either way in half-duplex mode. Like NB-IoT, it also has strong penetration and very good range.

Because of the bandwidth difference, Cat M1 will be more power efficient for medium-bandwidth IoT applications, while NB-IoT will be more power efficient for ultra-low-bandwidth IoT applications. Both protocols support smart power saving modes and, designed appropriately, can enable devices with battery lives of around 10 years.

Besides bandwidth, Cat M1 is also suitable for mobile applications as it is able to hand off between cell towers from a moving vehicle without dropping the connection – something NB-IoT is not capable of. Additionally, Cat M1 can support voice functions, making it well suited for applications such as alarm or emergency response systems.

Cat M1 infrastructure is also easier to implement for many mobile network operators. While NB-IoT requires a hardware upgrade for some carriers, Cat M1 support often just requires a software upgrade. In North America, several carriers have already deployed nationwide Cat M1 networks.

Because Cat M1 and NB-IoT network coverage tends to vary depending on geography, another option for device designers today is to support both. Multi-mode modules like the u-blox SARA-R4 support both Cat M1 and NB-IoT, making it easy to design one device that works worldwide.

**Not just for smartphones**

LTE, the fast cellular networking technology we all know and love, is evolving its capabilities far beyond the smartphone. Higher speed variations are the perfect platform for connected car applications and the release of LTE for V2X will only expand the applications of cellular networking technology for the automotive use case.

At the same time, new, low-speed categories of LTE expand its reach and its capabilities. Category 1, Cat M1 and NB-IoT allow LTE to serve low power and low data rate applications with the reliability of cellular connectivity, well into the future.

For more information contact Andrew Hutton, RF Design, +27 (0)21 555 8400, andrew@rfdesign.co.za
Adding smart wireless connectivity to an LED lightbulb

From the days of incandescent bulbs to fluorescents to LEDs, the latter might be one of the most significant advancements the common light bulb has undergone in 140 years of existence. More specifically, smart LEDs are opening up uses for light bulbs that Edison never dreamed of.

But connected lighting has been around for a long time, so why hasn’t it taken off the way other consumer-oriented technology has during the Internet age?

One barrier to entry has been the level of effort required to install connected lighting. It simply wasn’t a do-it-yourself proposition. You had to replace a switch, which means cutting electricity to that switch, removing it, then requiring a completely new switch. This level of home improvement is beyond most homeowners.

Another thing keeping this market gravity-bound has been cost. Like anything, as the price to consumers comes down, adoption rates increase. New switches, wiring, and the cost of labour for installing hardwired circuits wasn’t cheap, and even with the onset of LEDs, cost remains an obstacle. But that’s changing now.

In 2014 standard LED bulbs were $25 apiece, compared to about $2 today. A typical US home has 40 sockets, so imagine dropping $1000 on bulbs for your house. Multiprotocol support, and the flexibility and ease of use this brings, is becoming a differentiator to provide better user experiences and enhanced uses cases. This can be about simply doing Bluetooth commissioning for ZigBee, or it can be about running both ZigBee or Thread and Bluetooth at the same time.

Besides costs, LED bulbs are truly do-it-yourself solutions: simply screw it into an existing socket and you have instant connectivity through your smartphone. LEDs also have the advantage of connectivity becoming so ubiquitous – virtually anyone with a smartphone is familiar with using connectivity as a utility. So LEDs alone deliver on two significant barriers: simple installation and ease of use.

Another barrier, the disparate protocol standards out there, is also being solved. Most of today’s connected light bulbs use either ZigBee or Bluetooth with low energy functionality. Connected switches may use proprietary protocols as well as ZigBee. Multiprotocol has become important because while each standard has its advantages and disadvantages, manufacturers aren’t interested in betting on one protocol over another at the risk of being left behind.

This is why solutions that give developers the flexibility to decide which protocol is the best fit for their application are going to open the market up in ways that until now have been unavailable. Another factor in choosing a single wireless protocol is the regional preferences. For example, ZigBee has a strong presence in the United States but it is not prevalent in Asia, so vendors might be forced to build one version of a product that uses ZigBee in North America and another version that uses Bluetooth with low energy functionality in Asia. This is where vendors like Silicon Labs are helping.

For example, if a customer buys a light that uses ZigBee exclusively, they would need to be sure they were connecting to an existing ZigBee network or gateway. But with multiprotocol support, the end user doesn’t necessarily have to know what kind of network they’re connecting to.

But if that vendor supports ZigBee as well as Bluetooth, that changes the landscape. The device will default to Bluetooth and be controlled via a smartphone app. That app could then search for other networks and join the ZigBee network when it identifies it. Then it’s configured, or bootloaded, and appears as a ZigBee device. The end user doesn’t need to know what’s happening or bother with anything other than interfacing with the app.

Similarly, adding a gateway extends the network beyond the local network. By connecting your lighting network to a router, you can then control and monitor your devices from outside the home. And all of this happens without the user even being aware of all the connectivity hocus-pocus happening behind the scenes. It just works. The flexibility and ease of use of multi-protocol compatibility is now a differentiator for better user experiences and enhanced use cases.

Adding smarts to a dumb LED light bulb

LED light bulbs have now gone through many generations and have better colour balance, improved reliability and lower cost. There are many LED light bulb manufacturers and they are looking at how they can create a more innovative, smart connected light bulb.

Adding smart wireless connectivity to an LED light bulb presents some design challenges. RF modules for ZigBee and Bluetooth Smart are readily available. From a high level, it seems like it might be easy to just add an RF module to an existing design.

LED light bulbs have an electronic ballast which typically includes a power management IC (PMIC) and some high-voltage discrete components. The electronic ballast typically drives...
the LEDs with a constant current to achieve a constant brightness that does not vary with input voltage or temperature. The electronics also provide good power factor and work with conventional wall-mounted dimmers.

The PMICs typically include an auxiliary power supply to power the PMIC itself. The PMIC auxiliary supply can also power an MCU, wireless SoC or RF module. The auxiliary supply is typically a poorly regulated supply of 10 to 15 V. Therefore, a linear regulator is required to lower this voltage and provide a well regulated 3 V or 1,8 V supply.

The second challenge is how to switch the LED off or dim the LED. One method is to add a MOSFET between the LED cathode and ground for the MCU to switch off or PWM the LED. This presents some issues if the PMIC was originally designed for a constant load. Disabling the PMIC would also disable the auxiliary supply and is not an option.

The first few generations of smart connected LED bulbs will incorporate ballast electronics with PMIC that were designed from the ground up for smart bulbs. These designs will include an always-on, well regulated low-voltage supply and the ability to control LED intensity without requiring extra MOSFETs.

Energy efficiency standards such as the EPAs Energy Star program and California Energy Commission’s (CEC) Title 20 Appliance Efficiency programme have strict requirements for standby or vampire current. Energy Star’s ‘Product Specification for Lamps Version 2.0’ requires a standby power of less than 500 MW. The CEC’s Title 20 is even more stringent and requires a standby power of less than 500 MW.

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While the wireless transceiver power consumption is well below the limit, it is still a challenge to convert the AC line voltage down to the RF transceiver voltage. The auxiliary supply needs to convert this voltage and provide a well regulated 3 V or 1,8 V supply.

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Over-the-air updates
Finally, future-proofing existing devices is one of the chief advantages of over-the-air capabilities. Transferring a new image to a wireless device without requiring external memory means vendors will be able to teach existing devices new tricks.

As mentioned earlier, it is not uncommon for a home to have 40 light bulbs. When the latest Bluetooth standard comes out it would be quite a hassle to manually convert each bulb, but now that is not necessary. By using a common bootloader for all wireless standards, the designer is no longer limited to just updating to the latest version of ZigBee or Bluetooth, etc., but will be able to move from ZigBee to Bluetooth and back again as needed.

For more information contact NuVision Electronics, +27 (0)11 608 0144, gdeklerk@nuvisionelec.co.za.

For more information contact NuVision Electronics, +27 (0)11 608 0144, gdeklerk@nuvisionelec.co.za.

Tough, lightweight 2,4 GHz patch antenna
Built to be tougher and lighter than traditional ceramic materials, Taoglas’ new Terrablast range is designed to bring lightweight durability to meet the needs of the UAV and automotive industries. Using a unique polymer dielectric material which makes it 30% lighter than traditional ceramic antenna technologies, the Terrablast material has ultra-impact resistant characteristics to withstand drops, falls and impacts.

One of the first products in the range, the WTSP.2400 2.4 GHz patch antenna, is a right-hand circular polarised design useful for constantly moving mobile applications where the orientation to the transmitter or receiver changes, ensuring a drop of only approximately 3 dB from maximum performance compared to potential drops of 60 dB or more if using a linear polarised solution.

Compared to using a traditional ceramic patch antenna of the same size, this Terrablast patch antenna weighs just 5.6 g compared to an equivalent ceramic patch of 8.5 g. This antenna works well without modifications in most environments but can be tuned and further optimised to different ground-planes and enclosures if required. Custom antenna modifications, such as pin length modifications, are subject to possible NRE and minimum order quantity.

For more information contact Andrew Hutton, RF Design, +27 (0)21 555 8400, andrew@rfdesign.co.za.

Teledyne Storm Microwave harness products are deployed in defence and space applications where minimal risk of failure and high levels of reliability are an absolute must. These assemblies provide high-frequency RF performance, operating up to and above 40 GHz.

These harness solutions provide for plug and play deployment for fast installation and replacement. The keying feature ensures accurate connector alignment for improved RF performance, as well as providing correct channel to channel mating, avoiding crossed connections.

Multi-channel interconnects can be used to solve a variety of design challenges. These harnesses provide a connection that requires minimal installation tools and delivers a compact connector footprint. It removes the risk of crossed channels and misconnection with simplified wire management and routing. This enables fast installation or replacement of systems.

These multi-channel harnesses are found in a wide range of airborne, ground and sea-based systems. To meet the requirements of mission-critical applications, the harness assemblies are manufactured in a carefully controlled environment. When necessary, the coaxial cables are terminated and tested within a class 10 000 clean room.

For more information contact Conical Technologies, +27 (0)12 347 5035, andrew@rfdesign.co.za.
4G/LTE antennas
Antenova showed off a brand new pair of high performing 4G/LTE antennas at this year’s Consumer Electronics Show (CES) in Las Vegas.

Suitable for PCBs as small as 60 mm and for use in 3G and MIMO applications, the two antennas are similar – the difference being that Inversa is built for the USA market while Integra is for European and Asian markets.

Both antennas are available in left and right versions to provide more options for placement on the PCB, and can be used singly or in pairs for MIMO. Both use beam steering to ensure good isolation and cross correlation, and achieve high performance.

Inversa, part numbers SR4L034-L/SR4L034-R, measures 28,0 x 8,0 x 3,3 mm and covers the USA bands 698-798 MHz, 824-960 MHz, 1710-2170 MHz, 2300-2400 MHz and 2500-2690 MHz.

Integra, part numbers SR4L049-L/SR4L049-R, measures 23,0 x 8,0 x 3,3 mm and covers the bands 791-960 MHz, 1710-2170 MHz, 2300-2400 MHz and 2500-2690 MHz, used in Europe and Asia.

Antenova has designed these antennas for use in small trackers, OBDs and other similar devices where space is limited.

For more information contact ICORP Technologies, +27 (0)11 781 2029, enquiries@icorptechnologies.co.za.

Flexible antennas provide application flexibility
The FlexPiFA from LSR is an industry-first flexible planar inverted F antenna (PIFA). The 2.4 GHz antenna is ideally suited for use with 2.4 GHz applications such as Wi-Fi 802.11 b/g/n and Bluetooth, and is ideal for Wi-Fi applications across both bands, such as 802.11 ‘a’. Both the 2.4 GHz and dual-band 2.4/5 GHz FlexPiFA deliver strong performance in challenging environments, providing flexibility to solve real-world antenna design challenges.

The PIFA design provides consistent performance across a broad array of environments and enclosures – plastic, metal or even body-worn applications. With the ability to be flexed in either concave or convex directions, without sacrificing antenna performance, the small size and adhesive backing give further mounting flexibility within a product design.

For more information contact Carl van der Merwe, Avnet South Africa, +27 (0)11 319 8600, carl.vandermerwe@avnet.eu.

Wireless power transmitter
The LTC4125 wireless power transmitter, made by Linear Technology, brings performance and simplicity to the transfer of up to 5 W of power wirelessly to an electrically isolated receiver capable of that power level. It is a monolithic driver that controls the current flow in a series-connected transmit coil LC network.

The 4 x 5 mm, QFN-20 packaged chip features auto-resonant switching, allowing it to automatically adjust its driving frequency to match the LC network resonant frequency. It also implements foreign object detection, and auto-resonant switching improves performance with mismatched resonant components and poorly coupled coils. The LTC4125 completes a simple wireless power solution when combined with one of Linear’s wireless power receiver ICs.

For more information contact Conrad Coetzee, Arrow Altech Distribution, +27 (0)83 746 2616, ccoetzee@arrow.altech.co.za.

IoT module supporting Amazon Web Services
NXP Semiconductors introduced the LPC54018 MCU-based IoT module with onboard Wi-Fi and support for the newly launched Amazon FreeRTOS on Amazon Web Services (AWS) – offering developers universal connections to AWS.

Amazon FreeRTOS provides tools for users to quickly and easily deploy an MCU-based connected device and develop an IoT application without having to worry about the complexity of scaling across millions of devices. Once connected, IoT device applications can take advantage of the capabilities of the cloud or continue processing data locally with AWS Greengrass.

The cost and complexity to develop, deploy and manage secure connected nodes have continued to gate the market from realising the true potential of the IoT. Reducing these complexities, AWS and NXP enable developers to create secure, cost-effective IoT solutions, increasing the accessibility of node-to-cloud connection for engineers.

Amazon FreeRTOS enables security-sensitive orchestration with the edge cluster to further leverage low latencies in edge computing configurations, which extends AWS Greengrass core devices’ reach to the nodes. Distributed and autonomous computing architectures become possible through the consistent interface provided between the nodes and their gateways, in both online and offline scenarios.

NXP’s IoT module, co-developed with Embedded Artists and based on the LPC54018 MCU, offers unlimited memory extensibility, a root of trust built on the embedded SRAM physical unclonable functions (PUF) and on-chip cryptographic accelerators.

For more information contact EBV Electrolink, +27 (0)21 402 1940, capetown@ebv.com.
How to build a dimmable lamp with four LEDs

Mihai Cuciuc from Microchip Technology shows how to control individual LEDs to simulate an incandescent lamp.

Custom colour temperature lighting can be obtained by mixing the outputs of four individual white LEDs with different parameters. This can be used to build a dimmable lamp with a particular colour temperature or use a dynamic model that simulates an incandescent lamp whose colour temperature changes as it is dimmed.

The method can produce adjustable colour temperature lights using LEDs with known parameters as well as part of an automated setup to yield consistent lighting sources by measuring and calibrating unknown LEDs.

**Colour temperature**

The colour temperature of a light source is the temperature of a black body that radiates light that is close to the colour of the light source. To define the distance between two colours, a parametric way of defining colours is needed, such as the CIE 1931 xy colour space shown in Figure 1.

This colour space provides a simple mechanism that aids in colour mixing. Figure 1 also shows the Planckian locus defined by the possible colours of a black body as its temperature changes. The colours that this application tries to achieve lie on the Planckian locus.

The use case for this application is that the light source should be configured starting from a colour temperature. Planck’s Law describes the spectral power distribution of a black body of a specific temperature.

**Light output**

Since this application allows the configuration of the colour temperature, for consistency it would be desirable to have the same luminous flux range for any colour temperature chosen. This requires an extra normalisation step at the end of the colour mixing process to bring the maximum luminous flux to the same value for all possible colour temperatures.

Simulating an incandescent lamp requires an additional scaling factor for each colour temperature that needs to be computed. The chosen dimming mechanism models a black body whose power output is being controlled by a slider. This allow linking of the colour temperature with the luminous flux output in a natural manner, using the Stefan-Boltzmann Law, which states that the power radiated by a black body is proportional to the fourth power of its temperature.

For this application, the power is linearly varied between two arbitrary values and the corresponding temperature is bounded such that the colour temperatures can be rendered by the combination of LEDs. The coordinates in the CIE 1931 colour space that correspond to each temperature can be computed. The tristimulus value is proportional to the luminous flux for a given power emitted by the LED. Since the colour mixing algorithm produces relative intensities of the individual LEDs, this proportionality allows the computing of a scaling factor for each colour temperature that applies to all LEDs.

**Mixing colours**

Starting with a desired colour defined by its coordinates in the CIE 1931 colour space, the LED coordinates can be computed by first checking if the point lies within any of the triangles defined in the CIE 1931 colour space by the coordinates of three of the available LEDs. For all the triangles that contain the point, the individual LED contributions can be computed. It is then a matter of selecting the configuration that yields the maximum output for the chosen LED.

Table 1. LED coordinates in the CIE 1931 colour space and their luminous flux values, measured at 350 mA.

<table>
<thead>
<tr>
<th>LED</th>
<th>x</th>
<th>y</th>
<th>Y (Luminous flux [lm])</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.4498</td>
<td>0.4204</td>
<td>107</td>
</tr>
<tr>
<td>1</td>
<td>0.5612</td>
<td>0.4332</td>
<td>84.4</td>
</tr>
<tr>
<td>2</td>
<td>0.3917</td>
<td>0.3888</td>
<td>114</td>
</tr>
<tr>
<td>3</td>
<td>0.3233</td>
<td>0.3352</td>
<td>134</td>
</tr>
</tbody>
</table>
LED dimming values can be obtained from the flux values under the following conditions:

- Flux output approximated to be proportional to LED die current.
- All maximum luminous flux values are given at the same die current from LED measurements.
- Application only requires relative flux, with the colour defined by the proportions of fluxes, not their absolute values.

The last step is to scale these dimming values such that they lie between zero and the maximum value usable for the LED PWM. The values obtained after this step can be used to yield a constant luminous flux of any colour temperature. Further scaling can allow dimming on a single colour temperature, or these values can be used with the scaling factors computed to simulate an incandescent lamp.

Hardware

This application can use a modified Microchip lighting communications main board with the four Cree LEDs in Table 1 (on page 25) whose colour temperatures in the CIE 1931 colour space have been measured. The board can supply a maximum current through each LED on the order of 200 mA. The colour coordinates are assumed constant with varying currents and the luminous flux values proportional to the current.

Within these assumptions, the currents needed to mix the outputs from the LEDs into a particular colour temperature become easily computable. Using the four LEDs in Table 1, just a small subset of colours from the CIE 1931 colour space is available. This subset is the bounded area delimited by the coordinates of the individual LEDs. Figure 2 shows this area as the part of the Plankian locus that can be reproduced using this step.

The application can reproduce light with the colour temperature between 2100 K and 5700 K with constant luminous flux. When simulating an incandescent light, each colour temperature is associated with a relative luminous flux. The colour temperature is dictated by the power of a virtual black body configured using the slider on the board.

The simulation of an incandescent lamp starts with the user selecting a slider position. This is translated into a colour temperature that can be used to pick both a scaling factor for all LEDs as well as individual scaling factors for each one.

The lamp has three modes of operation that the user can switch through:

1. Simulating an incandescent lamp: This both dims and changes the colour temperature according to the proposed model.
2. Constant luminous flux: This mode allows the user to pick a colour temperature using the slider while keeping the luminous flux at the maximum.
3. Dimming with constant colour temperature: This mode performs dimming while using the colour temperature chosen in the previous mode.

Conclusion

Controlling the individual LEDs to simulate an incandescent lamp requires a considerable amount of computation, which can be performed offline and stored in a Microchip PIC microcontroller at compile time. A PC application is available that computes these tables based on user configuration of the LED parameters. A screenshot is shown in Figure 3. The application’s output consists of a number of constants grouped in six tables. These need to be copied from the application into the source file for the firmware. The application can be used with other LED parameters since these are fully adjustable, as is the colour temperature range.

For more information contact Tempe Technologies, +27 (0)11 453 5587, willem.hijbeek@tempetech.co.za.
TRIAC dimmable LED drivers

RECOM recently introduced four new LED drivers with 9 W, 12 W, 18 W and 25 W outputs. They deliver 1% to 100% leading-edge or trailing-edge TRIAC-controlled dimming at affordable prices. These LED drivers are designed for either retrofit or new installations and allow the user to set the lighting atmosphere and mood in homes, spotlighting and furniture installations.

The new RACT series are low cost, triac-dimmable LED drivers available with constant current outputs ranging from 300 mA up to 1400 mA. Both leading and trailing edge phase angle control makes them suitable for many standard dimmers for a wide range of applications. The RACT series is ideal for indoor locations up to 50°C ambient temperature and is certified for building into furniture for applications such as dimmable shelf lighting, cove lighting or accent lighting. Integrated cable clamps and extra-large screw terminals make for an easy installation. The Class II (double insulated) design means that no earth connection is required. They are CE marked (LVD + EMC + RoHS) and have IEC61347-1/IEC61347-2-13 CB reports. RECOM offers a 3-year warranty as standard.

For more information contact Willem Schmidt, Arrow Altech Distribution, +27 (0)11 923 9600, wschmidt@arrow.altech.co.za.

Reflective sensor immune to ambient light

The OPB9000 from TT Electronics is a reflective, CMOS logic output sensor with programmable sensitivity, output polarity, and drain select. The sensor features 25+ kilolux ambient light immunity along with a wide operating temperature range.

Factory calibrated to offer plug and play detection, it can be re-calibrated in a matter of milliseconds with a single command for specific application requirements. This self-calibration feature eliminates the need to constantly recalibrate as the LED ages, saving valuable time and effort.

Temperature compensation and automatic gain control features enable it to function reliably in the most demanding and dynamic environmental conditions where consistent performance from sensor devices is critical. The 6 µs response time ensures high-speed detection for time-critical applications.

The OPB9000 eliminates circuit complexity and reduces board space requirements by up to 80% with its fully integrated analog front end and digital interface. It combines an infrared emitter and integrated logic sensor in a miniature 4.0 x 2.2 x 1.5 mm surface-mount package.

The OPB9000 removes the need for peripheral circuitry like op-amps, data converters and comparators, as all analog signal conditioning is integrated in the IC. The sensor is suitable for a variety of applications including industrial printing, dispensing, manufacturing automation, safety and security devices, and portable lab/medical equipment.

For more information contact TRX Electronics, +27 (0)12 997 0509, info@trx.e.com

Low-profile light pipe

VCC has developed a rigid light pipe that delivers bright, focused light and eliminates glare and shadowing. The LPCR series features a low-profile Fresnel lens that offers a 160 degree viewing angle.

Ideal for a wide range of medium- to high-volume applications, the 4.34 mm diameter pipe easily extends light from the board to the desired surface. No physical connection between the light pipe and LED (SMT or through-hole) is required, providing versatility for assembly. The front panel mounting light pipe features crushable ribs that also simplify installation and maintenance.

For harsh, high-vibration applications, the LPCR series is available with an optional retainer (RTN_150, RTN_250) to ensure secure and uniform placement of the light pipe to the panel. It is available in a wide range of standard lengths from 3.2 mm to 25.4 mm, as well as custom lengths to simplify PCB positioning in relation to the display panel.

Made of optical grade polycarbonate 94V-0 clear material, the LPCR series is compliant with RoHS and REACH requirements.

For more information contact Mimic Components, +27 (0)11 689 5700, sales@mimic.co.za.
TDK has debuted CeraCharge, said to be the first solid-state rechargeable battery in SMD technology. Depending on requirements, the number of charge/discharge cycles this battery is able to perform ranges from several dozen to up to 1000. With its compact EIA 1812 package (4.5 x 3.2 x 1.1 mm) it offers a capacity of 100 µAh at a rated voltage of 1.4 V.

This battery is also capable of delivering currents in the order of several mA for short periods. Thanks to the SMD technology, placement of the battery is easy and it can be processed using reflow soldering techniques, which in turn reduces the production cost of the end product.

In contrast to most common technologies, CeraCharge is a solid-state rechargeable battery with no liquid electrolyte. The battery is based on a multilayer technology, similar to MLCCs. This means that a relatively high energy density and smallest volume are combined with the safety and high-volume manufacturing benefits of ceramic multilayer components. In addition, the use of a solid ceramic element as an electrolyte rules out the risk of fire, explosion, or leakage of liquid electrolyte.

To increase the capacity and the voltage, any number of individual CeraCharge components can be connected in series and parallel. This opens up a wide range of possible applications – particularly in devices intended for the Internet of Things. These include, for example, real-time clocks, Bluetooth beacons, wearables or systems for energy harvesting.

XP Power is releasing its new GCU500 series of 500 W AC-DC power supplies with leading features including a size of just 83.8 x 165.1 x 39.3 mm.

Conveniently fitting into 1U systems, these rugged products are ideal for high-reliability but cost-sensitive industrial applications such as robotics and renewable energy.

Dual fusing, low leakage current and input/output isolation of 2 x MOPP (Means Of Patient Protection) allow use in critical medical applications such as ventilators and medical carts in hospital environments. The products meet the latest ‘third edition’ of medical standard IEC 60601-1 including risk management. Unlike many competing products, the GCU500 series is rated for safety at high altitudes – 4000 m for medical and 5000 m for IT.

Latest resonant conversion and synchronous rectification techniques result in very high efficiency, up to 93%, giving low running cost, reduced operating temperature, extended lifetime and energy savings. Mechanical form factor is a U-channel weighing just 748 grams maximum with screw terminal connections for the main output. Input connections are Molex type or screw terminals when the optional fan is fitted.

Operating temperature range is -40°C to +70°C with full power available up to +50°C. The input voltage range is 80 to 264 V a.c. with full output power maintained down to 90 V a.c. and just a 20% reduction at 80 V a.c. A useful 250 W is available without fan cooling. The products provide a single main output of 12, 15, 18, 24, 36 or 48 V d.c. with convenient 5 V standby and 12 V fan supplies, and feature remote on/off and power fail signalling as standard.

The latest EMC standards are met for both industrial and medical applications, including the stringent class B level for conducted emissions to EN55011/32, and medical 4th edition. Internal protection features include over-voltage for the main output with short circuit and overload for all outputs and an overall over-temperature limit.

For more information contact Vepac Electronics, +27 (0)11 454 8053, sales@vepac.co.za

www.dataweek.co.za
REDFIT IDC is a solderless reversible direct plug-in connector with SKEDD technology and insulation displacement connection. The SKEDD contacts are plugged directly into the plated through-holes of a PCB.

A complete part and a potential error source is eliminated. This results directly in higher process reliability, savings in space, material and process costs.

www.we-online.com/REDFIT

- SKEDD Direct Plug-in Technology
- IDC Connection
- Solderless Solution
- Simple to Plug & Unplug
- Min. 10 Mating Cycles
- Reverse Polarity Protection
Sensata Crydom’s CX Series SIP solid state relay (SSR) is ideally suited for high density PCB applications where a maximum of 5 A of current is required. The SSR utilises a back-to-back SCR output which provides added reliability in commercial and heavy industrial applications.

The relay has a high surge current rating and is available with a zero voltage (resistive loads) or instantaneous turn-on (inductive or phase controlled loads) output. It is available with a wide range of AC and DC outputs to suit most applications. All relays in this range are UL, CSA and VDE rated.

For more information contact TRX Electronics, +27 (0)12 997 0509, info@trxe.com
Panel voltmeter with E-Ink display

The PanelPilot SGD 21-B from Lascar Electronics, a leading maker of display panels for industrial applications, is a low-cost and ultra-low-power single-channel voltmeter with a sleek monochrome E-Ink display.

E-Ink displays are typically used in a range of electronic consumer devices – most notably in a leading e-book reader product – but are now starting to see use in industrial applications. These types of displays have two major advantages over alternative technologies: firstly, they are readable even in extreme sunlight; and secondly, they offer very low power consumption.

The PanelPilot SGD 21-B comes with a 2.1” dot-matrix display with a 250 x 122 pixel resolution. The product takes advantage of the PanelPilot B Windows-based platform, which allows users to configure and customise a range of Lascar compatible displays with the click of a mouse. The use of pre-loaded display layout templates, which are configurable for further customisation, enables users to get up and running very quickly, without writing any code.

High-speed board-to-board connectors

Hirose has introduced the ER8 series of connectors that supports high-speed transmission of more than 10+Gbps for industrial applications.

The 0.8 mm pitch ER8 contacts are optimised for signal integrity performance to ensure reliable high-speed transmission performance. They are rated to 0.5 A, 100 V, and 100 mating cycles. The connector also features an excellent insertion loss to crosstalk ratio with a 5-aggressor differential far end crosstalk (FEXT) that meets the IEEE802.3ap specification for 10+Gbps and more.

The self aligning connectors have mating/unmating forces up to six times greater than typical micro pitch connectors. In addition, the ER8 series has an increased contact wipe and insertion depth, making them ideal for applications that require high mating cycles and resistance to shock and vibration.

The ER8 series is available in parallel (mezzanine type) and right angle versions. The vertical connectors are offered with the number of contacts ranging from 10 to 120, while the right angle version is currently offered with 120 contacts. Featuring low profile stacking heights from 7 mm to 12 mm, the ER8 meets the size requirements of a wide range of applications, including servo motors/amps, car navigation, medical equipment, broadcasting equipment, POS terminals and industrial machinery.

For more information contact Barry Culligan, Otto Marketing, +27 (0)11 791 1033, contact@otto.co.za

For the new PanelPilot SGD 21-B, the software platform enables users to choose from a selection of analog and digital voltmeter apps, and then customise labels, scaling and alarms for their own specific application. The device allows the setting of two alarm levels with a dedicated alarm output and a configurable digital I/O pin. A splashscreen can be added to display on power-up. Once the app is complete, it can be uploaded to the SGD 21-B display using a USB cable.

Key to the product is its 4 to 9 V d.c. power supply and its very low power consumption, which means it can be used in mobile applications that are powered by batteries. The display measures 73.8 x 37.5 x 10.8 mm and has an operating temperature range of 0°C to +40°C.

For more information contact RS Components, +27 (0)11 691 9300, sales.za@rs-components.com.

www.dataweek.co.za
The nRF52832 SoC from Nordic Semiconductor is a powerful, highly flexible, multiprotocol SoC ideally suited for Bluetooth low energy, ANT and 2.4 GHz proprietary ultra-low-power wireless applications. Built around a 32-bit ARM Cortex-M4F CPU with 512 KB + 64 KB RAM, the device has hardware support on-chip for Bluetooth 5; this includes high throughput and advertising extension. The 2.4 GHz radio has high definition RSSI and highly automated functionality, including EasyDMA for direct memory access during packet send and retrieve. Nordic provides protocol stacks for Bluetooth low energy, while ANT protocol stacks are available from ANT.

RF Design, +27 (0)21 555 8400.

Preventive healthcare and continuous monitoring solutions for wearable health and fitness applications can be designed with the MAX86140 and MAX86141 optical pulse oximeter/heart rate sensors and the MAX30001 electrocardiogram (ECG) and bioimpedance (BioZ) analog front end (AFE) from Maxim Integrated Products. Through compact, low-power solutions, these devices enable accurate monitoring of vital signs to monitor wellness/fitness and prevent health problems before they even begin. The MAX86140 and MAX86141 can be used to measure PPG signals on the wrist, finger and ear to detect heart rate, heart rate variability and pulse oximetry. The MAX30001 measures ECG and BioZ on the chest and wrist to detect heart rate, respiration and arrhythmias.

CST Electronics, +27 (0)11 608 0070.

Taiyo Yuden announced the launch of Bluetooth 5 modules EYSHCNZWZ (9.6 x 12.9 x 2.0 mm), EYSHUNZWZ (5.1 x 11.3 x 1.3 mm) and EYSHSNZWZ (3.25 x 8.55 x 0.9 mm). These modules, compatible with the latest wireless communication standard Bluetooth 5, are ideal for various small, thin devices including wearable devices, healthcare equipment, smartphone peripherals and IoT-related devices. The EYSHSNZWZ module utilises Taiyo Yuden’s unique shield mould technology to reduce its volume to about one third that of the EYSHJNZWZ, the smallest module from its conventional module lineup. The company believes this to be the world’s smallest volume for a Bluetooth module with an integrated antenna.

Avnet South Africa, +27 (0)11 319 8600.

Microchip announced an expansion to the PIC18 product line with a new family of 8-bit microcontrollers (MCUs) that combine a Controller Area Network (CAN) bus with an extensive array of Core Independent Peripherals (CIPs). A key advantage of using a K83 MCU in CAN-based systems is that the CIPs provide deterministic response to real-time events, shorten design time and can be easily configured through the MPLAB Code Configurator (MCC) tool. The new family is ideal for applications using CAN in the medical, industrial and automotive markets, such as motorised surgical tables, asset tracking, ultrasound machines, automated conveyors and automotive accessories.

Tempe Technologies, +27 (0)11 455 5587.

STMicroelectronics recently launched the all-in-one Bluetooth 4.2 module SPBTLE-1S, designed to speed up prototyping and developments while reducing costs. The module measures only 11.5 mm x 13.5 mm x 2 mm and includes the BlueNRG-1 SoC as well as a power supply filter, the oscillators for the MCU, the baluns, the filters used for matching networks and reducing harmonics, and even the ceramic antennas. Its range of operating supply voltage from 1.7 V to 3.6 V means the same module accepts a wide variety of power sources, from AAA batteries to coin cells. The component is also compatible with numerous interfaces, such as UART, SPI or I2C.

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