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Tim Cook, Apple’s CEO, warns investors that revenues will miss their target. A ‘blip’ or something more serious?

NEWS  
Scientists turn everyday objects into touch input tools by using touch sound localisation technology

Researchers develop 128Mb STT-MRAM with world’s fastest write speed for embedded memory

Scientists at the University of Manchester develop low cost method to produce graphene printed electronics

After a strong growth performance in 2018 Mouser expects another good year for distributors

INTERVIEW  
Planning pays off
Despite economic and political headwinds, Plexus is well placed for future growth as Oliver Mihm, the company’s regional president for EMEA, explains to Neil Tyler

COVER  
Robotics in social care
As developed economies have to contend with an ageing population, can robots and autonomous systems help ensure the elderly have an active and fulfilling life? By Neil Tyler

INDUSTRIAL ELECTRONICS  
Modular Industry 4.0 servers
Edge servers in Industry 4.0 environments are subject to very heterogeneous requirements, as Andreas Bergbauler and Ansgar Hein explain to New Electronics

PREDICTIONS FOR 2019  
Where next in 2019?
From the first autonomous vehicles to the realisation of mobile AR devices and the commercialisation of 5G, Imagination’s David Harold looks at the year ahead

RESEARCH & DEVELOPMENT  
Hackers aim for the jackpot
There are several types of hardware attack, but hardware designers need to watch out for attacks that are aimed squarely at their circuitry, as Chris Edwards explains

IP PROTECTION  
Managing your IPR
Too often companies fail to consider their intellectual property rights, but it’s essential that they do. Myra Sae Heng and Alex Morgan explain the ‘do’s’ and ‘don’ts’

BROADCAST TECHNOLOGY  
Definition in demand
High resolution displays are becoming more important in the consumer space, as a result broadcast technology is having to evolve. Bethan Grylls investigates

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CHINA SLOWDOWN

Apple angst
TECH GIANT CUTS SALES FORECAST AS SALES WEAKEN

Last week saw a rare event – Apple announced that it was cutting its quarterly sales forecast with the company’s Chief Executive Tim Cook, in a letter to investors, saying that sales of the iPhone in China were slowing.

Apple lowered its forecast to $84 billion in revenue for its fiscal first quarter ending in December, 10 percent below analysts’ estimates of $91.5 billion.

This is the first time that Apple had issued a warning on its revenue guidance ahead of releasing quarterly results since the iPhone was launched in 2007.

At the time or writing Apple’s shares had tumbled 7 percent and since becoming the world’s first trillion-dollar company last year, the company’s shares have stumbled and are now trading around 25 percent below that peak.

Suppliers have also taken a hit with shares in IQE, Sage, STMicroelectronics, ams and Dialog all falling – ams was down a whopping 20 percent.

The letter sent to shareholders by Cook has helped to reignite concerns about slowing global economic and weakening corporate growth.

In what some are seeing as a ‘shot across the bows’ of the Trump administration, Cook has suggested that demand in the Chinese economy has been dragged down not only by a slowing economy but by the ongoing uncertainty that continues to surround U.S.-China trade relations.

China’s economy is certainly struggling and the slowdown, seen at the end of last year, has certainly been a lot sharper than many expected and that has caught out both policy makers and companies alike.

“While we anticipated some challenges in key emerging markets, we did not foresee the magnitude of the economic deceleration, particularly in Greater China,” Cook said in his letter to investors.

The US/Canadian spat with China over the arrest of Huawei’s CFO last year hasn’t helped either, with some Chinese consumers looking not to buy Apple products.

But could the blame for the slowdown in Apple sales be laid closer to home?

Apple sales in China have been struggling for some time and that can be attributed to the cost of iPhones which are now well above $1000. Are they worth that massive premium and is the company’s aggressive pricing strategy adding to its problems?

Consumers are also hanging on to their phones for longer – 3 years rather than 2 years – before replacing them and recent iterations of the iPhone have fallen short - why replace an expensive phone with a new version that’s not that different?

Both Apple and Samsung are faced with growing competition from domestic and far cheaper alternatives in the Chinese market. Samsung’s market share fell to 1 percent in the first quarter of 2018 versus 15 percent in 2013.

One week in and 2019 looks like being an interesting 12 months for the technology sector. Could the tectonic plates be moving?

Neil Tyler, Editor (neil.tyler@markallengroup.com)
Right on the money

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Touch sound localisation technology
KAIST TEAM DEVELOP SOUND-BASED TOUCH INPUT TECHNOLOGY FOR SMART TABLES AND MIRRORS. NEIL TYLER REPORTS

A team from the Korea Advanced Institute of Science and Technology (KAIST) has developed a smartphone-based touch sound localisation technology that can turn objects like furniture and mirrors into touch input tools.

The technology is able to analyse touch sounds generated from a user’s touch on a surface and identify the location of the touch input, turning surrounding tables or walls into virtual keyboards.

The most important aspect of enabling the sound-based touch input method is to identify the location of touch inputs in a precise manner (1cm error), but this can be challenging as environmental changes can affect the characteristics of touch sounds.

To address this, Professor Insik Shin from the School of Computing and his team analysed the fundamental properties of touch sounds, especially how they are transmitted through solid surfaces, where sound experiences a dispersion phenomenon that makes different frequency components travel at different speeds. Based on this work, the team observed that the arrival time difference (TDoA) between frequency components increased in proportion to the sound transmission distance, and this linear relationship is not affected by the variations of surround environments.

Using these observations, Professor Hyosu Kim has proposed a sound-based touch input technology that records touch sounds transmitted through solid surfaces, then conducts a simple calibration process to identify the relationship between TDoA and the sound transmission distance.

Tests for accuracy found that the average localisation error was lower than about 0.4cm on a 17-inch touch screen and provided a measurement error of less than 1cm, even with a variety of objects such as wooden desks, glass mirrors, and acrylic boards and when the position of nearby objects and noise levels changed dynamically.

Professor Shin said, “This is novel touch interface technology that allows a touch input system by installing three to four microphones, so it can easily turn nearby objects into touch screens.”

Molex completes Laird acquisition

Molex has completed the acquisition of the Connected Vehicle Solutions (“CVS”) division of Laird.

CVS specialises in the design, development and delivery of vehicle antenna systems, smart device integration and vehicle connectivity devices.

“This strategic move supports our solutions vision and expands our capabilities in the changing automotive market,” said Joe Nelligan, CEO of Molex.

Demand is growing for end-to-end network communications and integration across hardware, software and services in the automotive industry. Through the acquisition, Molex is looking to build on existing capabilities in developing agile connected vehicle technologies integrating the Molex 10Gbps Automotive Ethernet Network Platform and other connected mobility solutions.

Optek licenses and deploys CEVA Bluetooth IP

CEVA, a licensor of signal processing platforms and artificial intelligence processors has announced that Optek Digital Technology, a fab develops advanced multimedia SoCs, has licensed and deployed CEVA’s RivieraWaves Bluetooth 5 Dual Mode IP in its latest OTK528X multimedia System-on-Chip (SoC).

The SoC targets artificial intelligence (AI), voice and music market segments and applications including hearables, wireless speakers, on/in ear headphone, multi-channel AVR, musical instruments and voice user interfaces (VUI).

The OTK528X is fully compatible with Bluetooth 5.0 Dual Mode, including support for Bluetooth low energy links at 1Mbps, 2Mbps, 500Kbps and 125Kbps data rates. The integrated 32bit processor along with an audio DSP enable users to achieve a variety of features with outstanding performance.
World’s fastest write speed for embedded memory

RESEARCHERS DEVELOP 128MB STT-MRAM WITH WORLD’S FASTEST WRITE SPEED FOR EMBEDDED MEMORY. NEIL TYLER REPORTS

A research team from Tohoku University has successfully developed 128Mb-density STT-MRAM (spin-transfer torque magneto-resistive random access memory) with a write speed of 14ns for use in embedded memory applications, such as cache in IoT and AI.

This is currently the world’s fastest write speed for embedded memory application with a density over 100Mb and is expected to pave the way for the mass-production of large capacity STT-MRAM.

STT-MRAM is capable of high-speed operation and consumes very little power as it retains data even when the power is off, as a result it is gaining traction as the next-generation technology for applications such as embedded memory, main memory and logic. Three large semiconductor fabrication plants have announced that risk mass-production will begin in 2018.

The current capacity of STT-MRAM is ranged between 8Mb-40Mb, but to make STT-MRAM more practical, it is necessary to increase the memory density.

The team at the university’s Center for Innovative Integrated Electronic Systems (CIES) has increased the memory density of STT-MRAM by intensively developing STT-MRAMs in which magnetic tunnel junctions (MTJs) are integrated with CMOS - significantly reducing the power-consumption of embedded memory such as cache and eFlash memory.

To reduce the memory size needed for higher-density STT-MRAM, the MTJs were formed directly on via holes - small openings that allow a conductive connection between the different layers of a semiconductor device.

In the fabricated chip, the researchers measured a write speed of subarray. As a result, high-speed operation with 14ns was demonstrated at a low power supply voltage of 1.2V.

To date, this is the fastest write speed operation in an STT-MRAM chip with a density over 100Mb in the world.

BrainChip improves facial classification accuracy

BrainChip, a neuromorphic computing company, has announced the BrainChip Studio 2018.3 update for its BrainChip Studio AI-powered video analysis software.

The update includes a powerful new mode that improves the software’s face classification accuracy by between 10-30 percent.

To date, BrainChip Studio has been using spiking neural networks to enable facial classification on partial faces. This partial-face mode is useful in situations where the probe image or the extracted faces may be obscured due to hats, masks, scarves or camera angle.

BrainChip Studio 2018.3 uses a full-face mode to perform facial classifications. In situations where the entire face is visible in the probe image or in the extracted faces, this new mode provides a significant increase in facial classification accuracy. Depending on the dataset used, testing indicates this mode provides a significant improvement in accuracy, but without impacting on throughput.

According to MarketsandMarkets, the facial recognition market is expected to be worth over $7billion by 2022.

BrainChip Studio’s facial classification technology works in environments where traditional biometric-based face recognition systems have tended to fail, including low-light, low-resolution, and visually-noisy environments.

BrainChip Studio is primarily used by law enforcement, intelligence, and counter-terrorism agencies that use existing CCTV infrastructure.

Creating complex wireless communication systems

Modelithics and ANSYS are to create the first 3D electromagnetic simulation component model library that will enable customers to accelerate the design of wireless communication systems for 5G, smart devices and the industrial internet of things (IIoT).

The partnership is intended to enable the sharing of IP and increase the accuracy of the radio frequency (RF) and microwave design process.

Components used in wireless communication devices are packed tightly together in compressed packages to achieve increased functionality and product miniaturisation. The resulting component-to-component electromagnetic (EM) field interactions and coupling, which are typically ignored in a system-level modelling approach, can significantly influence circuit performance, especially at higher 5G and millimetre wave frequencies. The ability to predict these effects during simulation is critical to meeting development timelines.

Modelithics and ANSYS will create a library of models that are defined by their physical geometry and material properties and can properly simulate interactions between components and their surrounding environment. These simulation-ready 3D components can simply be added to larger system designs in ANSYS HFSS without the need to apply excitations, boundary conditions or material properties.

“Developers of discrete components can now create simulation-ready 3D components in ANSYS HFSS and provide them to end users who can reference them in larger system simulation,” said Larry Dunleavey, president, Modelithics. “Collaborating through 3D components enables vendors to provide their customers with HFSS simulation-ready models, giving them a valuable edge in first-pass design success.”
Graphene printed electronics

SCIENTISTS DEVELOP LOW COST METHOD TO PRODUCE GRAPHENE PRINTED ELECTRONICS. NEIL TYLER REPORTS

A team of scientists at the University of Manchester have found a low-cost method for producing graphene printed electronics, which could significantly speed up and reduce the cost of conductive graphene inks.

Printed electronics are seen as offering a breakthrough in the penetration of information technology into many different aspects of life, and the printing of electronic circuits is expected to help promote the spread of Internet of Things (IoT) applications.

The development of printed conductive inks for electronic applications has grown rapidly, widening applications in transistors, sensors, antennas RFID tags and wearable electronics.

Current conductive inks traditionally use metal nanoparticles for their high electrical conductivity - however, these tend to be expensive and are easily oxidised.

The team at Manchester have found that using a material called dihydrolevogucosenone known as Cyrene is not only non-toxic but is environmentally-friendly and sustainable but can also provide higher concentrations and conductivity of graphene ink.

According to Professor Zhurui Hu: “This work demonstrates that printed graphene technology can be low cost, sustainable, and environmentally friendly for ubiquitous wireless connectivity in the IoT era as well as provide RF energy harvesting for low power electronics”.

Professor Sir Krista Novoselov added: “Development of production methods relevant to the end-user in terms of their flexibility, cost and compatibility with existing technologies are extremely important. This work will ensure that implementation of graphene into day-to-day products and technologies will be even faster”.

The National Physical Laboratory (NPL) were involved in measurements for this work, and have partnered with the National Graphene Institute at The University of Manchester to provide a material characterisation service to provide the missing link for the industrialisation of graphene and 2D materials.

Professor Ling Hao said: “Materials characterisation is crucial to be able to ensure performance reproducibility and scale up for commercial applications of graphene and 2D materials. The results of this collaboration between the University and NPL is mutually beneficial, as well as providing measurement training for PhD students in a metrology institute environment.”

New antenna evaluation method

Researchers at the National Institute of Standards and Technology (NIST) claim to have developed a method for evaluating and selecting optimal antenna designs for future 5G cellphones, other wireless devices and base stations.

The new measurement-based method allows system designers and engineers to evaluate the most appropriate antenna beamwidths for real environments, potentially boosting 5G wireless network capacity and reducing cost.

“Our new method could reduce costs by enabling greater success with initial network design, eliminating much of the trial and error that is now required,” NIST engineer Kate Remley said.

This is the first detailed measurement-based study of how antenna beamwidth and orientation interact with the environment to affect mmWave signal transmission, according to NIST.

NIST measurements covers a broad range of antenna beam angles which are converted into an omnidirectional antenna pattern covering all angles equally. The omnidirectional pattern can then be segmented into narrower and narrower beamwidths.

Users can evaluate and model how antenna beam characteristics are expected to perform in specific types of wireless channels.

Sensor Fusion and Tracking Toolbox

The Sensor Fusion and Tracking Toolbox from MathWorks is intended to equip engineers working on autonomous systems in aerospace and defence, automotive, consumer electronics, and other industries with algorithms and tools to maintain position, orientation, and situational awareness. The toolbox extends MATLAB based workflows to help engineers develop accurate perception algorithms for autonomous systems.

Engineers working on the perception stage of autonomous system development need to fuse inputs from various sensors to estimate the position of objects around these systems. Now, they can use algorithms for localisation and tracking, along with reference examples within the toolbox, as a starting point to implement components of airborne, ground-based, shipborne, and underwater surveillance, navigation, and autonomous systems.

The toolbox provides a flexible and reusable environment that can be shared across developers. It can simulate sensor detections, perform localisation, test sensor fusion architectures, and evaluate tracking results.

Speaking to journalists in London at the end of last year, Mark Burr-Lonnon, Mouser's Senior Vice President of Global Service & EMEA and APAC Businesses gave an upbeat assessment of 2018 and said that the growth, currently being enjoyed by the industry and Mouser itself, would continue into 2019.

"For distributors as a whole 2018 has been a very successful year," he said, "and the market has been good for everyone. There's no denying we have benefitted, to a degree, from component shortages but Mouser's success – we've seen growth in excess of 40 per cent in 2018 and expect our revenues to exceed $1.9 billion – has been driven by an 11 per cent increase in new buyers, which is essential when it comes to attracting and retaining suppliers."

In purely monetary terms the company's revenues have surged by over $500 million in 2018, driven by some 3.9 million orders.

"With over 1 million part numbers in stock it means that stock is certainly helping to drive growth at Mouser," Burr-Lonnon explained. "Inventory and marketing have been key to our growth in the past few years and the third element, making up our business model, is providing excellent customer service that draws buyers in and then helps to keep them."

It's a model that seems to be working as by the end of 2018 Mouser saw growth of almost 50% in Europe, with a customer increase in excess of 18%. In the US and Asia growth has also been strong and is ahead 36% and 48% respectively.

"Our model seems to be working everywhere, helped by targeted customer promotions that aim to provide more of what designers need to innovate and expedite their latest projects, as well as new services and engineering and CAD tools," said Graham Maggs, Mouser’s Vice-President Marketing Europe.

“2018 has been an exceptional year for distributors, with long lead times and massive demand,” said Maggs. "2018 has been an exceptional year for distributors, with long lead times and massive demand. Growth in excess of 40 per cent in 2018 and expect our revenues to exceed $1.9 billion – has been driven by an 11 per cent increase in new buyers, which is essential when it comes to attracting and retaining suppliers."

The company’s figures across Europe certainly reflect that with UK sales up by 43.6% with an 11% customer increase, while in Germany, there was a massive 51.4% growth in sales with a 14.2% increase in customer numbers.

"That success, we believe, is due to our focus on the design engineer. The diversity of applications that rely on electronic components is huge. The roll out of 5G, smart cities and autonomous vehicles offers massive opportunities, but also requires designers to ensure that their particular implementation of these and many other technologies has a benefit over competing solutions. That requires designers to be able to access new components as early as possible in the design cycle, and also to be able to use the necessary design tools and development kits," said Maggs.

At last year’s electronica in Munich, Mouser announced that a further phase in the expansion of its global headquarters and distribution centre in Texas was being planned.

"That investment is primarily in order to house the increased stock needed to support the expansion the company is experiencing," explained Burr-Lonnon.

"As for 2019, one big issue confronting the industry will be Texas Instrument’s (TI) changed policy on distribution, which means that as a distributor we will only be able to sell to an OEM, EMS or educational account – it will have an interesting impact on the market and we could see other leading supplier following TI’s lead."

Despite international uncertainties surrounding Brexit and further unrest in Europe, aggressive trade and tariff negotiations and other global conflicts, Mouser does expect growth in 2019 to continue, said Burr-Lonnon, both for the industry and for the company itself.

"International affairs are indisputably perplexing and complex, but trade will find a way to overcome," said Maggs. "Mouser operates globally, so we are well-used to tariffs, taxes and regulations. Our great advantage is our stock position and I am confident we will rise to the challenges that will come with the new year."
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Despite economic and political headwinds Plexus is well placed for future growth, as Oliver Mihm explains to Neil Tyler.

Described as a one-stop shop Plexus provides companies with engineering, manufacturing and after-market services. Oliver Mihm, who was appointed the company’s regional president for EMEA in 2015, is responsible for the company’s European operations and has been with the company since 2000, when he joined as a design engineer.

Looking back on 2018 things have certainly gone well for the company. “Going back to 2011 we made a number of significant investments in our European operations and those investments have now started to pay off,” he says.

“In Europe, last year, we saw growth in excess of 50 per cent and, for me, what has been most pleasing has been the fact that much of that growth has been derived from existing customers.”

“That’s an important achievement as it demonstrates that our customers trust us and that our value proposition resonates with them. We’re seeing significant partnership engagement.”

According to Mihm last year was an important one for the business. “We have seen continued engagement with customers from across our four key segments: aerospace, defence, communications and life sciences, but that engagement is deepening. We are working in highly complex and regulated markets such as life science and aerospace and companies in those sectors are developing a more sophisticated approach when it comes to their partnerships. “Take healthcare; over the past two years we have noticed that as companies become more mature so their work with third parties has evolved. They are looking at how to outsource non-core activities so that they are able to focus their resources more effectively on those core activities that help to differentiate them from their competitors.

“That change in approach means that more companies are seeking more from their partnerships with the likes of Plexus. As a result we are finding ourselves in discussions with executive teams at a much earlier stage and those discussions now focus on how to deepen and broaden our engagement.”

“We take an architectural approach when we take on a client’s project. Once that’s understood we are able to make a detailed assessment of their requirements and can then make a firm commitment as to what can be delivered and in what specific timeframe.”

The evolving engagement with customers is coming from two angles, according to Mihm. “We talk about a deeper relationship with our customers and that involves Plexus engaging with them when it comes to developing their own technical road-maps, but it’s also from a capability perspective too.

“One of the biggest trends with regards to this is the realisation among companies that they need to better mitigate risk and we are seeing a big push in terms of dialogue and the need to reassure customers. For example, in terms of data security, having a savvy IT team or having a culture that ensures that even the individual is trained and made aware of risk.”

Macro-economic issues

Since 2016 global macro-economic issues have loomed large and have influenced companies in terms of how they operate, where their manufacturing footprint should be and how they should look to better manage their supply chain.

“Issues like Brexit and trade disagreements between the US and China have all accelerated that process,” according to Mihm. “High level political and economic issues are raising concerns and are sowing a degree of confusion.”

“Take Brexit, for example, our customers are concerned about how they will fulfill orders placed in the UK and Europe and what the costs of trade will mean for their operations.

“Plexus is in a stronger position than most as we have operations in both the UK and Europe – Plexus established a German subsidiary in 2011, has continued to invest in its UK facilities and has a manufacturing operation in Romania – so most of our customers are confident of working with us.”

Plexus has also invested in its ‘go-to-market’ and customer facing teams and is looking to invest further in its physical infrastructure to meet the increased demand it’s seeing, with significant additional capabilities being developed in the Far East.

Mihm makes a wider point regarding Brexit in that in the company’s discussions with customers there appears to be little rigour when it comes to planning their operations post March 29, when the UK officially leaves the European Union.

“There is a not insignificant risk that there will be problems with goods crossing borders or with the movement of goods getting snarled up in bureaucratic red tape,” he suggests.

“While we have reached out to our customers to better understand how they will look to ensure the security of supply, I think we have been surprised at the lack of urgency and a failure to engage more fully.”

Of course some sectors are better prepared than others. Mihm points to the aerospace and defence sectors.

“I think there’s a degree of apathy when it comes to Brexit and a
Oliver Mihm is regional president, EMEA for Plexus. Having joined the company in 2000 as a design engineer, he progressed through the company taking a number of leadership roles. He served as senior vice president of global engineering solutions and was given oversight of the industrial and commercial sector in 2014. In 2015 he was promoted to his current role, with responsibility for providing strategic leadership within the EMEA region.

Well-placed

Mihm says that Plexus is well placed, whatever happens post-Brexit, and the company continues to invest heavily in its facilities and capabilities.

“We’ve noticed a trend in which our partnership with regulated businesses is growing significantly and our engagement on the engineering front has seen demand take off - product and manufacturing services are driving growth.”

One of the biggest challenges for Plexus remains finding high quality talent, as he explains.

“Whether in the UK, Germany or Romania it’s a challenge and not just in finding engineering or technical experience but when it comes to the leadership and management skills required to deliver our services.

“One of our key objectives when it comes to recruitment is better brand recognition of Plexus. While we have university affiliations, a number of apprenticeship programmes and sponsor numerous competitions our brand recognition remains low and needs to be improved. Last year we attended electronica – for only the second time – to raise awareness and the company’s profile.”

2019 and beyond

Looking to the future Mihm is optimistic.

“For Plexus Europe remains a high growth market and the sectors we are addressing are rooted in strong growth, which we expect to continue.

“Risks associated with the supply chain, whether economic or political, will remain significant, but for a business like ours we are well placed and able to provide the flexibility that customers need.

“Mid to low volume highly complex products are what we are good at, along with repeatability and assured quality, and that will be something we will continue to invest in.”

Oliver Mihm

Oliver Mihm is regional president, EMEA for Plexus. Having joined the company in 2000 as a design engineer, he progressed through the company taking a number of leadership roles. He served as senior vice president of global engineering solutions and was given oversight of the industrial and commercial sector in 2014. In 2015 he was promoted to his current role, with responsibility for providing strategic leadership within the EMEA region.
Robots and autonomous systems, together with artificial intelligence, connected data and digital infrastructure could have the potential to revolutionise the way in which social and medical care for the elderly is delivered.

The rising costs of care and the need to provide much better levels of support for a growing ageing population, not only in the UK, but around the world, means that the development of these types of technology should be developed as a matter of priority by governments and health providers.

The problem is not so much that we are living longer but we are doing so with debilitating illnesses that not only undermine our health but also our mental capabilities. So, how do we help the elderly to live more fulfilling lives and not simply look to better manage physical or mental decline as we age?

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Japan is currently facing a rapidly 'grey ing' market due to its ageing population. Many older people in Japan do not know how to take care of their health. Kohjiro Ueki, director of the Diabetes Research Center at the National Center for Global Health and Medicine in Tokyo, stated, “Japan is a super ageing society and many older people don’t know how to take care of their health.”

Speaking to Forbes magazine, Ueki talked about the impact of diabetes on the country’s ageing population, with over 10 million people suspected of having the disease. Costs associated with the disease are soaring, but it can be easily managed. In response, Ueki and his colleagues have developed an app, which is being deployed in a controlled trial called ‘Prevention of Worsening Diabetes Through Behavioural Changes’, which uses an IoT self-monitoring system to monitor eating habits.

The app records step counts, monitors physical activity, diet, body weight and blood performance. That data is collected and then uploaded to the Cloud and monitored by the individual’s doctor. The trial involves over 2000 people and is one year into a two-year trial period.

The IoT has enabled doctors to better manage their patients and more sophisticated algorithms are planned that could see users receiving messages to boost their exercise levels or seek help.

The ‘Prevention of Worsening Diabetes Through Behavioural Changes’, is a Japanese trial that uses an IoT self-monitoring system to combat diabetes.

Trialling technology
This is just one of many trials involving technology that is intended to help the elderly cope with long term illness or to improve their quality of life.

For example, smart tags, inserted into clothes or shoes, are being used to monitor the movements of dementia sufferers.

Successful ageing is defined as including a low probability of disease and disease-related disability, a high level of physical and cognitive functioning and an active engagement in life.

Robots could be used to assist people as they age helping them to maintain both physical and social activity, ensuring that they eat and drink appropriately and could help to promote a feeling of control and empowerment, that people tend to feel they lose as they grow older.

There are already a growing number of robotic devices that can help in the home, and robotic and autonomous systems are expected to be incorporated into everyday devices enabling independent living.

Future homes are likely to integrate technology into consumer devices expanding their functionality and ease of use. Items of furniture with embedded intelligence are now appearing. Tables, for example, are being developed to act like robots – coming to the user.

One project – iDress – is intended to develop a proactive system capable of assisting someone trying to dress, while exoskeletons are being developed to help elderly people with walking difficulties, increasing their independence and motor function. In time they could be used to replace wheelchairs.

Elderly people who are socially isolated are at much greater risk of developing a variety of ailments and while robots are good at improving an elderly person’s movement they can also play a role in keeping elderly people engaged both socially and mentally.

With more elderly and rising numbers of healthcare challenges technology, in the form of more portable and easier-to-use devices, could help to blur the distinctions seen between social and health care as more assistive robotic medical devices are deployed to monitor conditions in the home.

Researchers at Imperial College London have developed a robotic rehabilitation tool for stroke sufferers, for example, which helps them to improve their hand function.

Rehabilitation, such as for stroke sufferers, can often require long term supervision and support, robots and virtual reality are seen as enabling the healthcare system to provide much improved long-term support, especially if that support has been customised to meet the needs of the individual patient.

Japan is one of a growing number of developed countries that is having to confront the problem of an ageing population – and with over 25 per cent of the population over 65
Loneliness and social isolation are known to have a serious impact on the health of the elderly and there are worries that as the population ages, so the problems associated with social isolation will only increase. Japan, as we have seen, is facing a ‘greying’ crisis, and as a result has invested heavily in developing social care robots that are able to serve, communicate with and provide emotional support.

In Germany the Fraunhofer IPA has developed a Care-o-bot that has been deployed in a number of assisted living facilities and are able to carry food and drink to residents, while at the same time providing entertainment in the form of memory games.

Importantly, the robot has been programmed to keep its distance from residents, use limited gestures and reflect emotions and show that it understands and demonstrates what it intends to do.

CT Asia Robotics has developed a personal assistant that can help the user to remember to take pills and tracks their health. It can take calls from family and doctors too.

These devices are all suitable for use in a communal environment but robots designed for use in the home will need to be able to do far more.

One example is the ElliQ, which is an interactive robot that comes with an integrated tablet – not only does it track pill usage, monitor and take phone calls and the like, but it can act as a companion. It does this by providing updates on the weather or by suggesting outdoor activities and uses machine learning to better understand a user’s preferences.

**Doubts?**

But while the demand for robotic solutions is growing there are doubts about this so-called robotic revolution. Many medical professionals argue that the use of robots only compounds the problems of isolation and that people will need people in order to ensure their emotional and psychosocial well-being. Whatever the concerns, however, research does point to the fact that the use of social robots really can address issues of care and isolation and while there are some who are concerned by the deployment of robots to address these problems, the majority of robotic researchers tend to be in favour of their use.

Robot companions, which use artificial intelligence, are increasingly being used and these devices are able to interact with people on their own.

Examples include pet-like companions such as Aibo and Paro and MiRo, the latter is manufactured in the UK by Consequential Robotics, which is a spin out from the University of Sheffield.

MiRo is a fully programmable autonomous robot with six senses, eight degrees of freedom and an innovative brain-inspired operating system and was developed to provide a platform suited for developing companion robots.

According to the company, MiRo is based on a simple premise, which is that animals have the social qualities that are desirable in social robots that they are robust, good at communicating and adaptable.

Using that approach the robot is suited to robot-human interaction.

Although they can offer limited interaction these ‘pets’ have been shown to reduce feelings of loneliness and in one test case, involving the use of robotics dogs in a UK care home, brought increased levels of happiness and comfort.

**ElliQ** is an interactive robot that can track pill usage, monitor and take phone calls and act as a companion.

When it comes to controlling robots the growing use of voice commands is proving a benefit, as many elderly people find using a touchscreen difficult.

Portsmouth University is developing speech and tablet interfaces for assistive robots that can operate inside and outside the home and is part of a much wider project being funded by the European Union, Robot-Era.

For people with conditions that affect their ability to speak clearly a team at the University of Sheffield is developing Automatic Speech Recognition technologies.

The research being undertaken into social robots is only just the beginning, but while humans are still better at providing the care and social contact needed by the elderly, robots will certainly be able to fill many gaps as the technology evolves and develops.

Should robots replace social and care workers? That’s a loaded question and most professionals would argue that there needs to be far more effort to address the wider public’s anxieties around the use of robots.

Building safety and trust in their deployment will be crucial if they are to be accepted into people’s homes. That safety needs to encompass mechanical safety, software safety and physical safety when robots have to interact with the wider world.

While there’s a long way to go, the opportunity to use robots and autonomous systems in social care in the coming decades are profound and they are likely to have a significant role to play in enabling the elderly to grow old actively and to do so with dignity.
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Modular Industry 4.0 Servers

Edge servers in Industry 4.0 environments are subject to very heterogeneous requirements, as Andreas Bergbauer and Ansgar Hein explain.

The requirements associated with edge servers in Industry 4.0 are varied and include 10GbE connectivity, as well as the need for a wide variety of interfaces that need to be integrated at the process and field level.

A new modular micro server looks to leverage as many off-the-shelf components as possible and enable cost-effective OEM systems.

The design, from congatec and iesy, is based on two standards, the Mini-STX and COM Express Type 7 Server-on-Modules.

Both performance and bandwidth demands are increasing as more and more data has is processed in real time in Industry 4.0 factories and, at the manufacturing level, there are additional requirements through vision-based, collaborative robotics, and other situational awareness and deep learning applications.

All this means that we need a new level of embedded computing at the micro server level to fit between the process and management levels. However, these servers cannot follow the standard design of actively cooled rack servers for well air-conditioned server rooms that exclusively connect their clients via 10GbE, rather they must be able to integrate other peripherals of devices, machines and systems.

While it is possible to do that with an industrial rack system that’s both expensive and less space-efficient, highly compact micro server designs that meet the needs of factory operators are seen as a significantly better solution. But balancing the flexibility of a modular system with the advantages of an extremely compact box server can be problematic.

The solution? An ultra-compact micro server platform that can be customised and is largely based on standardised off-the-shelf components!

Form factor

The 5x5 specification developed by Intel back in 2015 provides a board and system standard that is suitable for robust micro server platforms at the edge of the industrial process control level. It opens up a new class of system designs between the established ATX and the ultra-compact new NUC form factor. The boards of this new specification measure 140mm x 147mm – that is 5.5in x 5.8in, which explains the name 5x5.

They are called Mini-STX and are about 30% smaller than the smallest ATX compatible form factor Mini-ITX, whilst offering twice as much area as NUC boards with a footprint of around 100mm x 100mm.

A maximum TDP of 65 watts is specified for 1-litre mini PCs, significantly more than NUC PCs allow and sufficient for industrial micro server applications where robust designs are preferred.

Such systems should not exceed a TDP of around ±35 watts for fanless operation. Intel has also specified the position of the processor in the Mini-STX specification, so it is possible to standardise the cooling solution of...
the housing as well as the system’s internal heat transfer system.

All these standardisations have resulted in an ecosystem of products that can be sourced as complete solutions, reducing engineering costs and improving design security.

**Industrial-grade design**

This specification has been used by iesy, and its partner congatec, for the design of new embedded micro servers for Industry 4.0 applications. They have adapted it to the high demands in the industrial environment which means a consistent design for the extended temperature range (-40°C to +85°C), robustness against temperature fluctuations and electromagnetic interference, as well as shock and vibration resistance.

Other supported requirements include an industrial-grade wide-range power supply (16-32 VDC) and an extremely small footprint so that the system can be mounted in any control cabinet.

Unlike commercial Mini-STX designs with processor sockets, in this case the processors aren’t assembled using sockets but Server-on-Modules. This brings even greater scalability across processor sockets and chip makers and allows even more flexible and cost-effective micro server variants, which is important for industrial batch sizes.

Another advantage of modules lies in additional design protection due to the maturity of the embedded PICMG computing standard which has been established for many years. The new PICMG COM Express Type 7 standard, whose pinout supports up to 4x 10GbE interfaces and with up to 32 PCIe lanes also offers the necessary flexibility to integrate customer-specific high-performance interfaces. The sandwich of carrier board, module and cooling solution means it measures just 55mm in height.

Equipped with 16-core Intel Atom C3000 processors, the fully enclosed, fanless housing can be connected directly, so that such a system design is extremely flat and can be mounted anywhere on a machine, system or wall. You don’t need a control cabinet with rugged external plugs to be able to mount these micro server boxes like a surface-mounted electrical junction box or a standard switch, thereby providing micro server performance via 4 x 10GbE Ethernet connections anywhere on the factory floor.

**The micro server in detail**

The new micro server provides high performance by using the COM Express Type 7 conga-B7AC module based on the Intel Atom C3000 processor. With processor power consumption starting at just 11W TDP, the system offers 4x real-time 10GbE network performance and up to 16 cores, which is suitable for processing many smaller packet sizes in parallel. Compared to other multi-core solutions, the costs and power consumption are significantly lower and makes it possible to roll out very high network bandwidths and storage capacities far into the industrial field.

The system will be available in eight different Intel Atom server processor versions – from the 16-core Intel Atom C3958 to the quad-core C3508 processor for the extended temperature range (40°C to +85°C). All offer up to 48 GB of fast 2400 DDR4 memory, which can be designed with or without Error Correction Code (ECC) depending on customer requirements. The 10GbE interfaces are standards integrated via SFP+ cages, enabling network connection via both fibre optic and copper cables. In addition, the carrier board provides 2x 1GbE and 2x USB 3.0 interfaces for service and peripherals.

One of the 1GbE ports is connected to the integrated board management controller and can therefore be used for server-typical remote management tasks. The system further offers a VGA output and a serial interface for local administration.

For custom extensions, the carrier board provides three M.2 slots. Two of them are designed for M.2 2280 cards with key M and 4 PCIe lanes or 1x M.2 slots. Two of them are designed for storage media. The third M.2 slot accepts M.2 3042 cards with key A. With 2x PCIe, 1x USB 3.0 and PC, it can connect both storage media and other peripherals. The feature connectors also provide GPIOs, PCIe, SM and LPC buses.

If the Server-on-Modules require active cooling - for example, with a 16-core Intel Xeon D processor - optional CPU and system fans can also be supported and controlled.

This means these embedded micro servers offer the same server-class performance that up to now only fully-featured 19 in rackmount servers were able to provide. Today, they can be mounted anywhere and even integrated into autonomous vehicles.
Where next in 2019?

From the first autonomous vehicles to 5G and the realisation of mobile AR devices, here’s what to look out for in the year ahead, according to David Harold

The robo-taxi is set to become a reality in 2019 and convoys of semi-autonomous lorries will appear on highways.

There are many invested parties and joint ventures targeting the introduction of these self-driving vehicles, with the likes of Volvo, Ford, Lyft, DiDi, Daimler, GM and Uber aggressively driving this market forward. As for the mass market; that time when you’ll be able to walk into the showroom and ‘drive’ out with an autonomous car, the jury is still out. Those with large investments to recoup are bullish, while more conservative elements are seeing the beginning of the S-curve pushed out a few years. All-in-all, it looks like there will be interesting times ahead in the automotive space and a very dynamic few years are in store for both the industry and potential car and/or taxi users.

The technology used in autonomous vehicles will not only change the way cars and trucks are driven, but also the financial landscape of how vehicles are bought, operated and insured just as radically as the technology under the bonnet or behind the dashboard.

Autonomous delivery vehicles, robots and trolleys will become the norm

Research from the Office for National Statistics (ONS) found that throughout 2018 the retail industry in the UK alone saw record online spending, increasing to 18.2% compared to 4.7% om 2017. Therefore, the need for autonomous delivery vehicles, robots and trolleys is clear to keep up with the consumer spending and demand.

The move will be driven by the likes of Amazon and the large logistics companies. One on-demand delivery company, Postmates, has unveiled an autonomous delivery robot called Serve that it’s planning to put to work in 2019. Its wheel-based bot can carry items weighing up to 50 pounds and operates with a battery that gives it a range of 30 miles, which should be enough for around 12 deliveries a day.

However, one thing we won’t see in 2019 is drone deliveries. While drone deliveries were proposed back in 2016, when Amazon launched Prime Air, however, drone-based delivery systems are still in development due to legal roadblocks.

Mobile AR to make progress

Despite all the hype and buzz around augmented and virtual reality, there was little traction in 2018 around dedicated headsets and there are a lot of pre-holiday bargains to be had. The challenge to AR and VR adoption is that it’s still not immersive enough. It’s not the graphics resolution or quality of the visuals that are letting the technology down, but rather the overall experience is still somewhat lacking – perhaps in part because there are relatively few dedicated AAA games still. Gamers are still tethered to cumbersome headsets; meantime content providers are unclear on how best to utilise the technologies for the best storytelling. Unless audio and tactile technologies develop sufficiently to enhance the visual experiences, the outlook for 2019 looks to be very similar to 2018.

However mobile phone use cases seem to be moving forward. With the arrival of AI enabled smartphones and the movement of higher performance GPUs into the mainstream applications for gaming, shopping, object identification and more are happening for mobile AR.

MediaTek’s new P90 SoC launched last month came with enhanced support for Google ARCore and Google Lens, to bring AR and Lens visual
search experiences to mid-range smartphones.

“With our latest collaboration we enable more smartphone users to experience the power of AR and Lens visual search in their daily lives,” said TL Lee head of Mediatek’s wireless business unit. “Now that Helio P90 is ARCore and Google Lens ready, we’ll be working closely with OEMs to provide them with comprehensive support so they can quickly design and bring devices to market that are optimized for AR applications and Lens.”

Imaging will increase in importance in mobile, particularly in relation to AI

Imagine being able to do a visual search on your smartphone where you can take a picture of an item, search for it online and buy it – for example, you see someone wearing a pair of shoes you like and want to buy them. You take a picture and in seconds the transaction could be completed. In 2019 we expect to see this type of application becoming more mainstream as the capabilities of smartphone SoCs improve.

According to Neal Forse, senior director, PowerVR vision & AI, Imagination: “Our PowerVR Series3NX-F is an ideal technology for this type of service. NNA is a real disruption to how vision technology has been done in the past and it is already becoming remarkably mainstream in the latest mobile processors.”

Ray tracing will gain in momentum

After a period out of the spotlight, ray tracing technology has recently come back into focus, taking up a lot of column inches in the tech press and in 2019, we expect this to continue.

The primary reason for the increase in momentum is because graphics cards for the PC gaming market have been released from NVIDIA that support the ground-breaking graphics technology. It’s still early days, and even the PC GPU giant didn’t have games at launch, proving again the difficulty of creating an eco-system around a new technology. Imagination was the first to make ray tracing technology a practical reality in 2012.

Says Nigel Leeder, EVP, PowerVR, Imagination: “Where our approach differs is that it is designed from the ground up for deployment on embedded hardware within a strict power envelope. This is a licensable architecture for bringing ray-tracing out of the high end and into mainstream gaming and computing devices.”

Industry standards relating to ethics in AI will start the legislative process

As AI systems are built and deployed, it’s vital that we quantify them so that we can design them to have awareness and avoid potential ethical bias. AI is still in its infancy, despite all the rapid advancements and there’s still so much to learn with improvements to be made. This tweaking will go on for some time, but as AI gets smarter and we’ll identify increasing numbers of ways to overcome issues such as bias. In 2019, we anticipate a switch to unsupervised training. Currently most AI models are generated through supervised training: datasets with labels provided by humans. With unsupervised training, no labels are given, and the algorithm must classify, identify, and cluster the data by itself. While this method is typically slower than supervised learning, the approach limits human involvement and, therefore, eliminates any conscious or unconscious human biases in the data.

5G will move from trials

Following years of hype about gigabit speeds that will enable consumers download movies in seconds, 5G is becoming a reality. In 2018 we had a taste of 5G as Verizon launched a home broadband service using the next-generation wireless technology and AT&T completed a live test on a 5G network using a consumer device. In 2019 will see the launch of actual 5G wireless networks along with phones that will run on them. There are commitments from manufacturers, such as LG, Samsung and Huawei for early 2019; however, the billion-dollar question is, who will be first to mass market?

Another big step for connectivity is the ability to use GNSS to connect devices in the Internet of Things directly to satellites rather than to local communications networks to enable battery powered remote IoT sensors and edge devices, wearables, health monitors, consumer mobile products, automotive after-sales products such as insurance boxes and road tolling equipment, and asset tracking devices.

Martin Woodhead, EVP, Ensigma Communications, Imagination, says: “Evolving use models mean that a growing number of battery operated products must support positioning, navigation, and timing services. Consumers want to track their devices, but don’t want to re-charge batteries frequently. In industrial environments, users need to track mobile assets to improve efficiency and reduce operational costs, but it isn’t possible to frequently change batteries across numerous devices in disparate locations. The answer is a low power GNSS solution for battery powered devices.”
Early in 2018, a crime surfaced in the US that earned the name ATM “jackpotting”. Perpetrators would target older cash machines and switch their hard drives. The malware they store simply hands over cash to thieves armed with the right codes. It is just one of a range of hardware-level attacks that are now coming to the fore.

There are two main types of hardware attack. One is to try to subvert the device in normal operation, generally by attaching something to an I/O port or to the PCB itself. This is the world that games players may know through “modchips”.

“Back in the day if you wanted to play ‘backup copies’ of your games, you’d solder some wires into your game console,” SecuringHardware researcher Joe Fitzpatrick explained at the Security Analyst Summit in spring 2018.

The extra wires and, sometimes additional ICs, would defeat the copy protection mechanisms manufacturers built into their consoles.

Counterfeiting has also become a way of employing modchips. Fitzpatrick pointed to a post on Reddit from a couple of years ago in which a user opened up some network switches carrying the Cisco brand that were bought on Reddit that looked to be sporting a modchip. The modification turned out to be a patch to fix a problem on the core PCB that allowed faulty parts to operate more or less correctly.

Such counterfeiting attempts have led chipmakers to explore the use of encryption inside a system to check whether peripherals are legitimate or have been exchanged for fakes. Initially developed for inkjet cartridges – which has a sizeable aftermarket for refilling and fakes – STMicroelectronics, for example, has the STSafe line of devices. These devices have found applications that range from gaming to medicine.

Another level of attack is to try to peer more deeply into the target in the hope of reverse-engineering the design or to pull out encryption keys and other sensitive data that should, according to the data sheet, never be recoverable once a fuse is blown or a write-only bit set. The clock signals and power rails are the main targets. A clock attack tends to consist of stopping the clock in mid-cycle or adding glitches to create ultrashort clock cycles. When it comes to power, the favoured trick is dropping the supply voltage, which prevents all or some of the active transistors from switching properly. In all these cases, logic paths start to fail. Timing is critical for these attacks, which can mean altering the power supply to take out decoupling capacitors that can smooth out the changes in power.

If hit at the right time, a processor may execute instructions incorrectly or simply run the wrong instructions. A type of attack that researchers at security consultant Riscure found worked on an older Arm processor architecture was to force the core into a privileged mode that opened up a range of software hacks. Aberrant bus activity can corrupt processor registers, I/O registers or memory that help cut the time needed to perform side-channel analysis (see “Careless whispers”, January 2018).

Some of the physical attacks are ingenious although they may turn out to have a short shelf life. Last year, Connor Bolton and colleagues from the University of Michigan and Zhejiang University found it is possible to attack hard disk controllers through the vibration sensors that are meant to protect them. Low-frequency audio with strong resonant frequencies could cause sudden movement in the read head, potentially damaging data or reducing read and write bandwidth to the point where system software times out and is forced to reset.

There are ways to protect against these attacks. An onchip clock source makes it much harder for a hacker to use that kind of attack – their only
option is to decap the chip and try to find the onchip generator. A second level of protection is often a metal shield over the most sensitive circuitry. If this is broken, the device simply refuses to start up.

Historically, the built-in reaction to glitch hacks has been as blunt as some of the attacks themselves. This is often seen with power attacks. Brownouts are tougher for any chip to deal because they stop protection circuitry in its tracks as well as the hacker’s target. But watchdog circuits can at least monitor the power rails and just reset the chip if it suspects corruption has occurred, forcing the hacker to start their attack again once the device has rebooted. With too many brownouts, it may go further.

“The chip architect is supposed to design the system such that it reacts to the indications from the processor and responds accordingly. For example, if the parity check fails then it could be that the the chip erases memory and resets,” says Asaf Shen, vice president of security marketing at Arm.

Continual resets can do a lot to slow the hacker down and maybe look for a softer target. But when dealing with attacks focused on taking over a larger system, the reaction can be as effective in enabling a denial-of-service attack. An alternative may be to use checkpoints and traps similar to those used to deal with memory errors. Whenever the system detects a glitch that looks likely to be deliberate, it invokes a trap handler that rolls back to the last known saved state. Work by Bilgiday Yuce at the Virginia Tech has followed this approach to build glitch-tolerant processor circuitry. At some point, the load may be too much. System software can analyse the pattern of events and then decide whether it is better to continue or invoke an orderly shutdown.

Although the manufacturers of microcontrollers have put protection against glitching attacks into their devices, they have typically restricted these mechanisms to the devices that present the juiciest targets for hackers. But that could change.

“As far as glitch attacks are concerned, the original targets were definitely payment oriented designs, because it is pretty obvious that those equipments provide the highest incentive for hackers to develop innovative strategies. As always with new kind of attacks, if proven successful they then develop and grow into more cost effective, more common threats,” says Gregory Guez, executive director of embedded security at Maxim Integrated.

IoT device manufacturers may find themselves having to deal with both counterfeit detection – by only enabling I/O devices that successfully respond to a challenge-response protocol or supply a valid code number – as well as glitch attacks. The key question is how much of a target a non-payment system is likely to be.

Penetrating an individual IoT device may not deliver much of a financial reward on its own, but if a low-end controller is subverted by a hacker it can support a far more damaging attack. Although apparently compromised by a network rather than a physical attack, a fish-tank’s temperature-control system provided the way into a casino’s core network – ultimately leading to servers being robbed of sensitive data. Privilege-escalation hardware attacks could be instrumental in similar hacks, leading designers to use on-chip sensors in a wider range of devices.

Arm’s Cortex M-35P was designed to come with a portfolio of options intended to fend off typical invasive and non-invasive attacks because as Shen points out: “Physical attacks are getting easier and cheaper.”

The tamper protection is on top of the existing M-series’ Trustzone software-isolation scheme and include support for parity checks on internal buses to detect the consequences of induced faults. “There are many different internal checks built into the operation of the [Cortex M-35P] that either prevent or report an invasive attack,” Shen says.

Some designers may choose to roll their own checking circuitry into ASICs and SoCs. Ramsay Allen, vice president of marketing at Moortec, which has developed a range of on-chip temperature, process and voltage sensor IP cores says the company has started to see interest from customers in using the power monitors to check for potentially malicious brownouts. In the meantime, manufacturers need to be on the lookout for the fast-changing landscape of hardware hacking – and avoid becoming the next victim in the hunt for a jackpot.
Too often companies (especially start-ups) fail to consider intellectual property rights ("IPRs") until it is too late. All businesses and especially those in a fast-moving sector like electronics, should add IPRs to their list of essential things to consider.

Properly considering IPRs early on can help to give a business a competitive advantage, safeguard its commercial interests and avoid headaches down the line. It therefore pays to have a sound grasp of the IPRs relevant to a business and an awareness of how to avoid common mistakes and pitfalls.

Benefits of considering IPRs early
The benefits of considering IPRs early on include:
- Helping to ensure the business owns or has the rights to exploit the IP assets needed within the business.
- Enabling the business to more effectively enforce its IPRs and stop others from stealing or copying the business' IP assets, which may include: its name; the names of its products or brands; its inventions; the design or look of its products; as well as things written, made or produced by the business.
- Avoiding the penalties which can come with delays (e.g. being too slow to register a trade mark and then being prevented from using that mark in the future).
- Avoiding potentially lengthy and costly disputes (or re-branding / re-designing exercises) which may arise from the potential infringement of third party IPRs.
- Putting the business in a better position to attract investment by showing that it has taken the necessary steps to protect its IP assets.

What IPRs are relevant in the electronics sector?
IPRs generally fall into two categories: registered and unregistered. In general, registered IPRs must be applied for, while unregistered IPRs arise automatically. Examples of registered IPRs include:
- trade marks (which can protect business names, product names and logos);
- registered designs (which can protect the appearance of a product including, shape, packaging, patterns, colours, and decoration); and
- patents (which can protect new and inventive products and processes).

Examples of unregistered IPRs include:
- copyright (which can subsist in writing and literary works, art, photography, films, TV, music, web content, and sound recordings); and
- design right (which protects the shape of objects).

IPRs may also arise in relation to:
- domain names (which are registered and provide an exclusive right of use for a period of time);
- confidential information (which may allow a business to stop others from misusing its secret information);
- passing off (which may allow a business to stop others from misrepresenting that their goods or services are associated with the business when that is not true); and
- licences (which may give a business a right to do something which would otherwise require permission).

Certain of these IPRs which are most relevant to the electronics sector are discussed in further detail below.

Patents
Patents protect new technological developments – i.e. “inventions”. If granted, it will give the patent holder a monopoly on commercialisation of the invention protected by the patent for a period of up to twenty years.

Owning a patent will give a business the right to prevent others from making, using, importing or selling the invention protected by the patent without the patent holder’s consent. It may also allow a business to license the invention for others to make, use, import or sell the invention and thereby potentially provide an extra stream of revenue.

Patents are expensive and
difficult to get, and only certain types of inventions can be patented. Therefore, careful consideration (and expert advice) is needed before applying for a patent, not least because a consequence of applying for a patent is that a description of the invention will be made available to the public.

**Trade marks**
Registered trade marks allow a business to protect its brand (and sub-brands). Once obtained, a registered trade mark would provide a business with the ability to take action against anyone who uses a sign identical to or confusingly similar to the registered trade mark without permission, including counterfeiters.

**Designs**
The shape of an object may be automatically protected in the UK by design right; however, it is easier to protect a design if it is registered. Once a design is registered, it allows a business to take legal action against infringement and copying in a more straightforward manner.

Registered designs have protected: mobile phones; digital cameras; remote controls; virtual reality headsets; various housings for data routers, data switches and networking interfaces; computer mice; joystick controllers; and mobile chargers. Even apps can have an element of design.

**Copyright**
Copyright can arise in, among other things, computer programs, software coding, databases, spreadsheets, screen displays, virtual reality environments, apps, content on websites or characters in games.

Copyright can allow the owner to prevent others from: copying the copyright work; distributing copies of it whether free of charge or for sale; renting or lending copies of the copyright work; showing or playing the work in public; making an adaption of the work; or putting it on the internet.

**Trade secrets**
A trade secret is a special right that can only protect certain types of information. Information is considered a trade secret if: it is a secret – i.e. not common knowledge amongst those working in that particular sector; has commercial value because it is secret; and has been subject to reasonable steps to keep it secret by the person lawfully in control of the information.

Steps a business can take to keep information secret include:
- Limiting access to such information and keeping a record of who has had access to said information;
- Implementing procedures to ensure the information is kept secret;
- Educating employees on the importance of the information and having them sign confidentiality agreements;
- Assigning a team who will be responsible for the protection of the secret information; and
- Having appropriate non-disclosure agreements in place if collaborating with third parties.

A trade secret will remain secret for as long as a business keeps it that way. Unfortunately, if insufficient steps are taken to protect the secret information and it becomes no longer secret, there may be little, if any, recourse.

**IP ownership and licences**
Central to the subject of IPRs is ownership. A business will want to ensure that it owns or has the right to use all the IP necessary to operate its business. It may also wish to ensure it owns any IP generated or commissioned by the business. Where owning the IP is not possible or practicable, a business will want to ensure it has any necessary licences.

In the UK the general default position is that an employer owns the IPRs in IP assets created by an employee during the normal course of employment. However, this presumption does not apply to contractors, and therefore any IP created by a contractor will need to be assigned to the business.

**Tips**
The reality for most businesses (and especially start-ups) is that resources are limited and IPR considerations may not be top of the to-do list. However, taking the time at the outset to consider IPRs can make all the difference in the long run. Below are some practical suggestions that a business can take in this regard:
- Consider the IPRs that may be relevant to your business.
- Seek advice early and devise an IP strategy. Consult IP counsel – through their understanding of your business they will be able to advise on developing an IP strategy that is tailored to your business’ needs. A clear strategy will mean funds can be used efficiently and allow planning for protecting other IPRs.
- Consider third party IPRs and risks of infringement. For example: performing trade mark searches may help reduce the risk of using or seeking to register a logo or sign that is identical or similar to a trade mark that has already been registered. Carrying out freedom to operate searches may help reduce the risk of infringing third party IPRs which may otherwise be infringed by the business.
- Maintain the confidentiality of valuable secret information. If collaborating with third parties, use a non-disclosure agreement.
- Consider IP ownership. Check that employment agreements do not contradict the general position in the UK that IP created by employees during the normal course of employment will be owned by the business. And, finally, check that appropriate contracts (which assign IP to the business) are in place with contractors.

If you need more details or legal advice about what action to take, then your best course of action is to contact an adviser or solicitor.

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**Image:** A graphic with the text "IP PROTECTION INTELLECTUAL PROPERTY RIGHTS"
High resolution displays are becoming more important in the consumer space, so broadcast technology has to evolve. By Bethan Grylls

Consumer interest in 4K continues to increase and by the end of 2018 4K TV shipments are expected to have passed 100 million units, according to market analysts Futuresource and they expect double digit growth through to the end of 2022.

Demand is being helped by broadcasters who are looking to introduce ultra-high definition broadcasts, with this year’s Winter Olympics and the FIFA World Cup helping to accelerate broadcasters’ plans to introduce 4K coverage.

“Broadcasters want to be able to visualise even the smallest item in an image,” says Margarita Zoussevitch, European Marketing Manager for Industrial Medical Vision at Panasonic. “Our customers – the content creators – are looking for reliable, smaller camera technologies that are also easily implemented,” - in other words, a camera that doesn’t disturb its surroundings - “and this must be combined with the highest resolution. People won’t accept any compromises.”

Zoussevitch believes the demand for high image quality is a consequence of the overall trend towards greater digitisation, and the company is responding by developing existing technology to meet user’s demands.

“Panasonic’s Full HD 3Chip micro camera is (and was) a very strong product,” she says, “but we are now focusing on 4K 3MOS – that is three CMOS sensors – and further technologies to deliver the quality users are calling for.”

The name 4K derives from the number of pixels that 4K offers - four times more than Full HD (1920 x 1080), with 4K horizontal screen resolution at approximately 4,000 pixels – with over 8.3m pixels in total.

Panasonic’s 4K Ultra HD Micro Camera (GP-UH532) has 3840 x 2160 resolution at 50/60p which means that it is capable of outputting images at up to 1600 TV lines, resulting in a picture that is a lot clearer and includes more details, according to Zoussevitch.

“This kind of resolution provides the ability to visualise areas that have not been visible before, such as an insect’s eye,” she says, confirming its use in documentary-making. But, she also admits that its suitability to broadcast is a bonus, with the camera’s main and original purpose to serve the medical sector as a high-res surgical camera.

As a result, the camera needed to be small – a quality which she also indicates is addressing a growing trend in broadcast – and it is this which Zoussevitch says makes the solution “impressive”.

“There’s a range of 4K systems on the market, but currently ours has the smallest camera head – and that’s owed to its sensor,” she says. “The camera features a 1/3-inch progressive CMOS image sensor.

“The 4K camera indicates offset technology, which is considered to be better than native technology as it allows superior colour reproduction and sensitivity.

“In this context the offset technology of the 4K micro camera with 3MOS is compared to the native technology of the 4K micro camera with 1MOS.”

To further intensify its video quality, the camera also offers the BT2020 spectrum, rather than BT709. The latter is the standard for HD TV and has been utilised for years in TV and cinema but it’s limited in terms of colour reproduction.
“Within technology development when it comes to resolution and high dynamic range (HDR) – a technology that offers clarity in a picture’s highlights and shadows – BT2020 is commonly known as standard for 4K and ultra-high definition (UHD), influencing the quality of the picture.

“It allows an expanded, wider colour space and true colour representation. Consequently, it’s true and precise in detail, and overall provides better pictures.”

Infrastructure
But in order to deliver a 4K picture, an infrastructure that supports 4K is required, adds Zoussevitch.

“It doesn’t make sense to have a 4K camera and use a HD monitor because it won’t support the resolution.” As such, Panasonic’s GP-UH532 technology provides a 4K/2K simultaneous dual channel output. This means it is compatible with the 2K infrastructure that already exists without using a down converter to create a 2K signal.

Therefore, multiple systems can be set up and combined with the 4K camera GP-UH532 to create customised solutions.

“One camera can be connected to a 4K monitor and a HD monitor, with both 4K and HD playing at the same time,” explains Zoussevitch, “which makes it a cost-effective solution.”

Also looking at cost and high resolution is ASPEED, a fabless IC-design company. But, unlike Panasonic which looks to deliver this to the content creator, ASPEED seeks to offer it to the consumer.

The company says it saw a demand for better consumer-aimed 360-cameras. As result, it launched Cupola360 – a 360-degree spherical image processor design that is said to offer better resolution.

“In the past five years, there has been an increasing number of social media and instant messaging services that have started to support 360 content,” says Joe Lee, Product Manager of Cupola360. “We live in a 360 world, so consumers require 360-cameras.”

Lee says that ASPEED identified a problem with the current consumer 360 cameras available in that they only contained two fish-eye lenses. “This meant image quality was low and often distorted when ‘stitched’ together. Only expensive, professional cameras have four to six image sensors which provide higher resolution.”

Equipped with six 5megapixel, high sensitivity sensors, the Cupola360 produces videos and photos that are designed to match the quality of professional grade 360-degree cameras.

According to Lee the company has used its experience in hardware development to design an image processor that blends multiple images in real-time, and recruited several graphics engineers to fill any knowledge gaps.

The Cupola360’s image processing hardware is literally a computer on a chip, optimised to perform the difficult image-processing tasks required to create “excellent” 360-degree video in real-time.

Unlike many competitor products, it doesn’t necessitate an external computer or mobile phone to process its images, explains Lee. The Cupola360’s SoC joins the six images together inside the camera – and does so, quickly. In fact, it does this so quickly that video can be enjoyed online even as it is being recorded, says Lee.

This capability is enabled by its built-in 2.4GHz and 5GHz Wi-Fi that allows real-time streaming, despite the high-res. While the ASPEED hardware offers HEVC H.265 compression in the camera, meaning that the high-res video is delivered in the lowest possible file size.

To further enhance its resolution, the camera also utilises WDR technology, says Lee, with the system adjusting and balancing brightness and colour across the whole 360-degree image.

Looking to the future
Looking ahead, Zoussevitch suggests that the development of 8K will be an important area of development for Panasonic. But, notes that moving forwards, it is essential to consider the entire infrastructure not only resolution.

“It is not only about providing an 8K camera, but you need 8K recording and 8K monitors on site, for example, in order to be able to visualise the whole 8K picture,” she contends.

“It is of the highest importance to listen to the user, ask for feedback and provide technology according to their needs. This all takes time of course, and must be balanced with the speed with which technology develops.”

She continues, “8K is the future for sure – and Panasonic is taking a thoughtful approach which will involve working with our customers.”.

It seems the future will be much clearer – but how long it will take until 8K becomes commercialised remains uncertain.
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