

New-Tech

Magazine

Europe

February
2019

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When Robots Can Communicate with Each Other

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Beyond Distribution - ready-to-use products



HANI Board

HMI Arrow NXP IoT

The board is based on NXP's LPC54618 high performance MCU running at 180 MHz with 512K Flash and 200K RAM. It focuses on HMI (Human Machine Interface) – supporting multiple display sizes and connectivity.

It would not be an IoT board without sensors from NXP

- > FXLS8471Q, an industrial 3-axis accelerometer
- > FXAS21002CQ, a 3-axis gyroscope
- > FXPQ3115BV, a bio compatible medical pressure sensor
- > PCT2075GV, temperature sensor
- > + TSL25711FN, light sensor

FEATURES

- > R41Z, a wireless module from Rigado, based on KW41Z from NXP which supports BLE 4.2, ZigBee and Thread protocols
- > SX-ULPGN, a Silex Wi-Fi module based on Qualcomm's QCA4010 SoC
- > CLRC663, a NXP NFC reader
- > Interfaces: 2× CAN interfaces, 10/100 Ethernet, USB host/device



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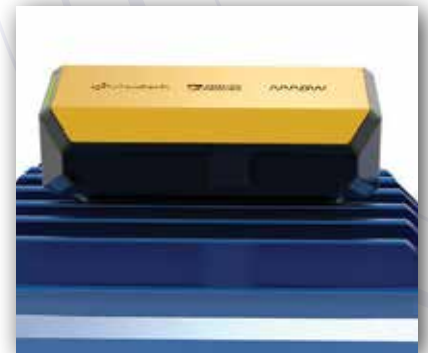
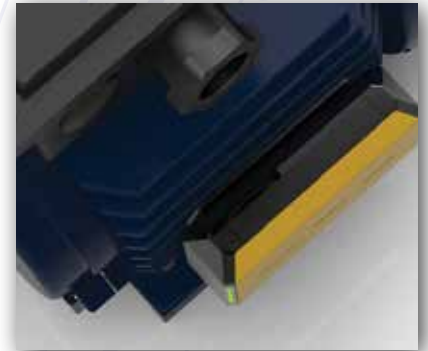


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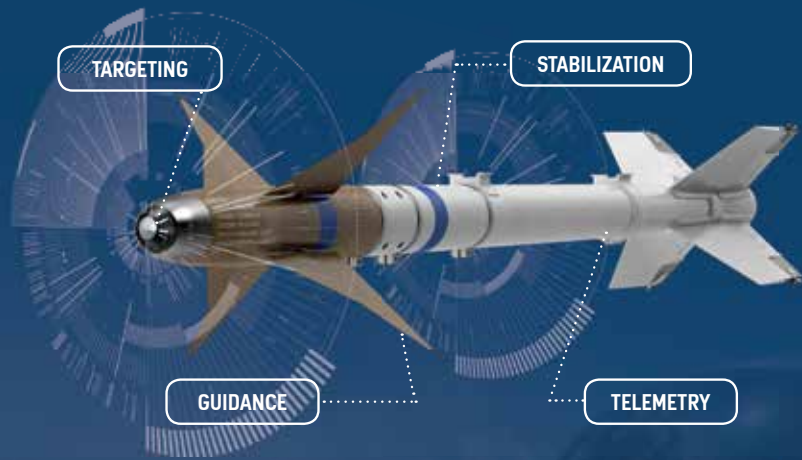


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Our specialized target audiences prefer **New-Tech Europe** because they know that our publications are a reliable source of the latest information in their respective fields. Our multidimensional editorials, news items, interviews and feature articles provide them with a full, well-rounded picture of the markets in which they operate - an essential asset for every technological leader striving to stay ahead, make the right decisions, and generate the next global innovation.

Moreover, as an attractive platform for advertisers from around the world, **New-Tech Europe** has become a hub for bustling international commercial activity. Here, through ads and other promotional materials, Israeli readers obtain crucial information about developers and manufacturers worldwide, finding the tools, instruments, systems and components they need to facilitate their innovative endeavors.

Targeting the needs of both the global and european industries and global advertisers, **New-Tech Magazines Group** constantly expands and upgrades its services. Over the years, the company has been able to formulate a remarkably effective, multi-medium mix of offerings, combining magazine publications with useful online activities, newsletters and special events and exhibitions.

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Microchip and Acacia Communications Collaborate to Enable First Flexible Rate Optical Transmission Up to 600G

FlexE and OTUCn Ecosystem Designed to Enable Market Transition to Flexible Optical Networks

As optical networks are transitioning from 100G to flexible transmission rates that scale up to 600G to support hyper-connected architectures, new flexible multi-rate optical transmission devices and software are needed. Microchip Technology Inc., through its wholly-owned subsidiary, Microsemi Corporation, and Acacia Communications, Inc. are supporting this critical transition with the demonstrated interoperability between Microchip's DIGI-G5 Optical Transport Network (OTN) processor and Acacia's AC1200 Coherent Module. The objective of the companies' collaboration is to enable the industry's first flexible rate system architectures with an established ecosystem to support the market's transition to 200G, 400G, 600G and flexible rate OTN networks built with new Flexible Ethernet (FlexE) and OTUCn protocols. By helping enable the market's transition from 100G to flexible transmission system architectures, service providers could deploy higher bandwidth Ethernet connectivity at a faster rate and at a lower cost with Optical Internetworking Forum's (OIF) FlexE protocol. FlexE was designed to provide up to 30 percent greater bandwidth efficiency compared to traditional Ethernet link aggregation (LAG) with fewer limitations. Combining it with OTUCn and tunable fractional dense wavelength division multiplexing (DWDM) transmission brings service providers the potential to improve their OTN network capacity by up to 70 percent. As the first OTN processor to support FlexE and OTUCn protocols, Microchip's DIGI-G5 delivers the silicon and software required to launch new terabit scale line cards with flexible rate optical interfaces for packet optical transport platforms. By combining the DIGI-G5 and AC1200, next generation architectures will help to support the market's growing demand for metro and data center interconnect networks requiring 100G+ connectivity that can be



rate adjusted to maximize bandwidth.

"DIGI-G5 allows our optical transport system partners to deliver terabit-class OTN switching line cards at 50 percent less power per port while enabling flexible rate ports and protocols up to 600G," said Babak Samimi, vice

president for Microchip's Communications business unit.

"Demonstrating interworking of the DIGI-G5 with Acacia's AC1200 coherent module highlights that the ecosystem is ready to support the market transition to these new protocols, rates and multi-terabit architectures."

While the DIGI-G5 processes client traffic into OTN, the 1.2T AC1200—powered by Acacia's Pico digital signal processor (DSP) ASIC—on the line card will enable the OTN connections over two 600G tunable DWDM wavelengths with flexible transmission three-dimensional (3D) shaping features.

These features, which include fractional quadrature amplitude modulation (QAM) and adaptive baud rate optimize transmission reach and capacity, approaching theoretical limits on a wide range of network configurations, in a power efficient manner.

"In addition to high capacity and density, our AC1200 module introduces several key features designed to enable network operators to optimize capacity, reach and spectral efficiency —making flexible transmission solutions up to 600G a reality," said Benny Mikkelsen, Chief Technology Officer of Acacia Communications. "With Microchip's DIGI-G5 scaling up capacity and reducing power at the same time, and the optical performance provided by our AC1200, we believe that Acacia and Microchip are helping to enable the market to scale network capacity with improved efficiency."

New site in the global battery production network: Mercedes-Benz Cars to build battery factory in Jawor, Poland

In the course of the electric initiative Mercedes-Benz Cars will build a battery factory at the Polish site in Jawor and thus extend the global battery production network of up to nine factories. "We will electrify the complete portfolio until 2022 and will be able to offer in each segment various electrified alternatives to our customers. This includes more than ten pure electric vehicles. We will produce batteries on our own, what we consider a significant success factor in the era of electric mobility. After the production of high-tech engines, we will establish additional future technology in Poland. The battery factory in Jawor is the second largest investment at this new Mercedes-Benz site," says Markus Schäfer, Member of the Divisional Board of Management of Mercedes-Benz Cars, Production and Supply Chain.

In Jawor, approximately 100 km away from the German border, a state-of-the-art engine factory is currently being built. The plant will produce four cylinder engines for hybrid and conventionally driven vehicles. This will be the first production site of Mercedes-Benz Cars in Poland and will offer more than 1.000 jobs.

"The decision of Mercedes-Benz Cars to start the production of electric batteries for a new type of vehicles in Jawor shows that companies that have started operations in our country positively assess the investment climate and want to continue to grow here. We are witnessing the 4.0 industrial revolution in which Poland plays a leading role. All the more we are glad that in Jawor will be produced not only traditional engines, but also the hearts of cars of the future, namely electric batteries", says Mateusz Morawiecki, Prime Minister of the Republic of Poland.

The engine production in Jawor will start in 2019 and supply car plants of Mercedes-Benz in Europe and around the world. With the construction of a battery factory on the existing ground at the site approximately 300 new jobs



Picture: Markus Schäfer (l.), Member of the Divisional Board of Management of Mercedes-Benz Cars, Production and Supply Chain, and Mateusz Morawiecki (r.), Prime Minister of Poland, announce the new battery factory for Mercedes-Benz Cars at the Polish site in Jawor.

will be created. The battery assembly will be equipped with cutting-edge technologies. The series production of batteries for vehicles of the product and technology brand EQ is slated at the beginning of the next decade.


"The engine plant and the new battery factory in Jawor are important parts of our global powertrain production network. With nine factories in our global battery production network we are very well positioned. It became apparent that building an engine factory in Jawor has been

a good decision. This success story will be continued with the battery factory. We are looking forward to strengthen the collaboration with the region and the Polish colleagues," says Frank Deiß, Head of Production Powertrain Mercedes-Benz Cars.

Mercedes-Benz Cars belongs to the first and biggest industrial companies in Poland who have concluded contracts with local green electricity and heat suppliers. The engine factory as well as the battery factory will be supplied with CO₂-neutral energy. Thus, within the global production network of Mercedes-Benz Cars Jawor is one of the pioneers.

Global battery production network

Daimler is investing more than one billion euros in a global battery production network, within the worldwide production organization of Mercedes-Benz Cars. At the moment the battery production network consists of eight factories at six sites on three continents:

- In Kamenz the battery production is running since 2012. Additionally a second battery factory is being built at this site. The series production will start in spring 2019.
- At the Mercedes-Benz plant in Untertürkheim two battery factories are planned.
- Currently Daimler and Joint-Venture partner BAIC together are building a local battery production at the existing location in Yizhuang Industrial Park in Peking (China). 

➔ ■ Near the existing Mercedes-Benz SUV plant in Tuscaloosa (USA) construction works of a battery factory have recently begun.

■ Together with the local partner Thonburi Automotive Assembly Plant (TAAP) construction of a battery production in Bangkok (Thailand) is underway.

■ At the Mercedes-Benz car site in Sindelfingen a new battery factory is planned.

With Jawor, the global battery production network grows to nine factories at seven sites on three continents.

Purchase of cells secures best possible technology

The intelligence of the battery is integrated in a highly complex overall system. Daimler is therefore concentrating

on the key competence of the battery assembly. Cells are an essential component of the battery. Daimler is buying the cells on the world market and is instructing the suppliers to produce based on special specifications. In this way, the company is securing itself the best possible technology. With the purchase of battery cells for more than 20 billion euros, the company is establishing the preconditions for the consistent change towards an electrical future. The cells will be used in the electric fleet of the electric smart, SUV, vans, buses and trucks (light and heavy duty version) as well as vehicles of the next generation of the product and technology brand EQ.

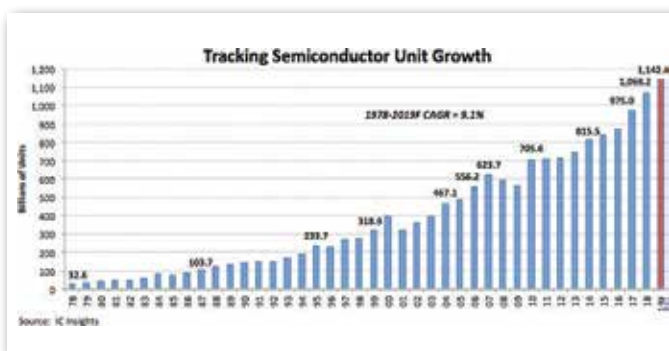
Semiconductor Unit Shipments Exceeded 1 Trillion Devices in 2018

Semiconductor units forecast to increase 7% in 2019 with IC units rising 8%, O-S-D units growing 7%.

Annual semiconductor unit shipments, including integrated circuits and optoelectronics, sensors, and discrete (O-S-D) devices grew 10% in 2018 and surpassed the one trillion unit mark for the first time, based on

data presented in the new, 2019 edition of IC Insights' McClean Report—A Complete Analysis and Forecast of the Integrated Circuit Industry. As shown in Figure 1, semiconductor unit shipments climbed to 1,068.2 billion units in 2018 and are expected to climb to 1,142.6 billion in 2019, which equates to 7% growth for the year. Starting in 1978 with 32.6 billion units and going through 2019, the compound annual growth rate for semiconductor units is forecast to be 9.1%, a very impressive growth figure over 40 years, given the cyclical and often volatile nature of the semiconductor industry. Semiconductor Unit Shipments Exceeded 1 Trillion Devices in 2018

Over the span of just four years (2004-2007), semiconductor shipments broke through the 400-, 500-, and 600-billion unit levels before the global financial meltdown caused a big decline in semiconductor unit shipments in 2008 and 2009. Unit growth rebounded sharply with 25% growth in 2010, which saw semiconductor shipments surpass 700 billion



devices. Another strong increase in 2017 (12% growth) lifted semiconductor unit shipments beyond the 900-billion level before the one trillion mark was achieved in 2018.

The largest annual increase in semiconductor unit growth during the timespan shown was 34% in 1984, and the biggest decline was 19% in 2001

following the dot-com bust. The global financial meltdown and ensuing recession caused semiconductor shipments to fall in both 2008 and 2009; the only time that the industry experienced consecutive years in which unit shipments declined. The 25% increase in 2010 was the second-highest growth rate across the time span.

The percentage split of total semiconductor shipments is forecast to remain heavily weighted toward O-S-D devices in 2019 (Figure 2). O-S-D devices are forecast to account for 70% of total semiconductor units compared to 30% for ICs. This percentage split has remained fairly steady over the years. In 1980, O-S-D devices accounted for 78% of semiconductor units and ICs represented 22%. Many of the semiconductor categories forecast to have the strongest unit growth rates in 2019 are those that are essential building-blocks for smartphones, automotive electronics systems, and devices that are used in computing systems essential to artificial intelligence, "big data," and deep learning applications.

SolarEdge Announces Closing of S.M.R.E. Spa Acquisition

SolarEdge Technologies, Inc. ("SolarEdge"), a global leader in smart energy technology, announced the closing of the previously announced acquisition of a majority stake (approximately 56%) of S.M.R.E. Spa ("SMRE"), a provider of innovative integrated powertrain technology and electronics for electric vehicles.

"We are pleased to welcome SMRE to the SolarEdge family. We believe that our technological synergies combined with our complimentary areas of expertise will empower SolarEdge's growing business group at a time when the world is undergoing a clean energy transformation and e-mobility revolution," stated Guy Sella, CEO, Chairman

and Founder of SolarEdge.

The Company's current aggregate investment to purchase the SMRE shares was increased from 51% to 56% totaling approximately \$85 million, up from the expected \$77 million, including transaction-related expenses. SolarEdge intends to purchase the remaining outstanding equity shares of SMRE that are currently listed on the Italian AIM (SMR.MI) over time through open-market purchases and otherwise, eventually resulting in SMRE becoming a wholly-owned subsidiary of SolarEdge.

Smart microrobots that can adapt to their surroundings

Scientists at EPFL and ETH Zurich have developed tiny elastic robots that can change shape depending on their surroundings. Modeled after bacteria and fully biocompatible, these robots optimize their movements so as to get to hard-to-reach areas of the human body. They stand to revolutionize targeted drug delivery.

One day we may be able to ingest tiny robots that deliver drugs directly to diseased tissue, thanks to research being carried out at EPFL and ETH Zurich.

The group of scientists – led by Selman Sakar at EPFL and Bradley Nelson at ETH Zurich – drew inspiration from bacteria to design smart, biocompatible microrobots that are highly flexible. Because these devices are able to swim through fluids and modify their shape when needed, they can pass through narrow blood vessels and intricate systems without compromising on speed or maneuverability. They are made of hydrogel nanocomposites that contain magnetic nanoparticles allowing them to be controlled via an electromagnetic field.

In an article appearing in *Science Advances*, the scientists describe the method they have developed for "programming" the robot's shape so that it can easily travel through fluids that are dense, viscous or moving at rapid speeds.



Embodied intelligence

When we think of robots, we generally think of bulky machines equipped with complex systems of electronics, sensors, batteries and actuators. But on a microscopic scale, robots are entirely different.

Fabricating miniaturized robots presents a host of challenges, which the scientists addressed

using an origami-based folding method. Their novel locomotion strategy employs embodied intelligence, which is an alternative to the classical computation paradigm that is performed by embedded electronic systems. "Our robots have a special composition and structure that allow them to adapt to the characteristics of the fluid they are moving through. For instance, if they encounter a change in viscosity or osmotic concentration, they modify their shape to maintain their speed and maneuverability without losing control of the direction of motion," says Sakar.

These deformations can be "programmed" in advance so as to maximize performance without the use of cumbersome sensors or actuators. The robots can be either controlled using an electromagnetic field or left to navigate on their own through cavities by utilizing fluid flow. Either way, they will automatically morph into the most efficient shape.

Sky and Space Global Shortlisted for the Best Mobile Innovation for Emerging Markets MWC Award

UK based Sky and Space Global Ltd. has been nominated for the prestigious Global Mobile Awards 2019 (GLOMO Awards), with winners to be announced at the Mobile World Congress held annually in Barcelona. The company is in the process of deploying 200 highly sophisticated nano-satellites above the Equatorial Belt. The



congress is being held this year on February 25-28. SAS was one of the five nominees shortlisted for an award in the category "Best Mobile Innovation for Emerging Markets", along with Huawei, Lumos, Mavenir and Yego Innovation.

The GSMA's GLOMO Awards offer organizations the opportunity to showcase the latest and best mobile products, apps, devices, services, and initiatives at the most important mobile event of the year. More than 250 independent judges from across the world are involved in the award process. The panels comprise leading industry and specific sector experts, analysts, journalists, academics and in some cases representatives from mobile operators.

"This is a great honor for SAS and underscores the huge significance of bringing connectivity to the equatorial regions of the world," says Meir Moalem, co-founder, managing director and chief executive officer at SAS. He adds that SAS is well on its way to implementing its goal of providing affordable mobile services in under-served parts of the world.

SAS, a new space company based in the UK, is listed on the Australian ASX stock exchange and plans to operate a network of 200 nano-satellites to provide around the clock

affordable voice, data, instant messaging, M2M and IoT communications. This is the essence of the company's vision for providing communication services to anyone, anywhere, and at any time. SAS' major focus is connecting billions of people that currently have little or no connectivity at all through a network of nano-satellites.

The company has European and Israeli development centers with experts in aerospace, satellites and software. In June 2017 SAS successfully launched into space its first three nanosatellites, the '3 Diamonds'.

SAS services will also bring to the equatorial region a huge range of life saving services like search and rescue, disaster management, emergency response, security alarms and recreational tracking. This is in addition to a whole range of traditional services including cellphone applications, offshore communications, smart farming, interactive TV, airplane, vessel and animal tracking, water and electric metering, grid monitoring, and ATM.

The company aims to deliver cost-effective communications infrastructure and services to those who need it most and to disrupt the telecommunications and international transport industries. Sky and Space Global Ltd owns 100% of Sky and Space Global (UK) Limited.

Sky and Space Global was founded by three Israelis: Meir Moalem, the company's Managing Director and CEO; Meidad Pariente, CTO, and Yonatan Sharma. The company's operations are managed from Israel.

Boeing Autonomous Passenger Air Vehicle Completes First Flight

Boeing NeXt program tests prototype to advance safety and technology of urban air mobility

Electric vertical takeoff and landing vehicle has design range of up to 50 miles

The PAV prototype completed a controlled takeoff, hover and landing during the flight, which tested the vehicle's autonomous functions and ground control systems. Future flights will test forward, wing-borne flight, as well [▶](#)

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→ as the transition phase between vertical and forward-flight modes. This transition phase is typically the most significant engineering challenge for any high-speed VTOL aircraft.

"In one year, we have progressed from a conceptual design to a flying prototype," said Boeing Chief Technology Officer Greg Hyslop. "Boeing's expertise and innovation have been critical in developing aviation as the world's safest and most efficient form of transportation, and we will continue to lead with a safe, innovative and responsible approach to new mobility solutions."

Powered by an electric propulsion system, the PAV prototype is designed for fully autonomous flight from takeoff to landing, with a range of up to 50 miles (80.47 kilometers). Measuring 30 feet (9.14 meters) long and 28 feet (8.53 meters) wide, its advanced airframe integrates the propulsion and wing systems to achieve efficient hover and forward flight.

"This is what revolution looks like, and it's because of autonomy," said John Langford, president and chief executive officer of Aurora Flight Sciences. "Certifiable autonomy is going to make quiet, clean and safe urban air mobility possible."

The test flight represents the latest milestone for Boeing NeXt. The division works with regulatory agencies and industry partners to lead the responsible introduction of a new mobility ecosystem and ensure a future where autonomous and piloted air vehicles safely coexist. In addition to the PAV, the Boeing NeXt portfolio includes an unmanned fully electric cargo air vehicle (CAV) designed to transport up to 500 pounds (226.80 kilograms) and other urban, regional and global mobility platforms. The CAV completed its first indoor flight last year and will transition to outdoor flight testing in 2019.

"Boeing was there when the aviation industry was born and in our second century, we will unlock the potential of the urban air mobility market," said Steve Nordlund, vice president and general manager of Boeing NeXt. "From building air vehicles to airspace integration, we will usher



in a future of safe, low-stress mobility in cities and regions around the world."

Boeing is the world's largest aerospace company and leading manufacturer of commercial jetliners and defense, space and security systems. A top U.S. exporter, the company supports airlines

and U.S. and allied government customers in more than 150 countries. Boeing products and tailored services include commercial and military aircraft, satellites, weapons, electronic and defense systems, launch systems, advanced information and communication systems, and performance-based logistics and training.

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Hailo expands Series A round to \$21M and launches Hailo-8™ Fast Track program for select customers

Israeli startup Hailo, developers of a proprietary processing architecture for deep learning on edge devices, has expanded its Series A funding round to \$21 million.

Chinese venture capital firm, Glory Ventures, led the investment-round expansion and was joined by existing and other new investors. The

investment will enable the company to expand its target markets into China and Hong Kong, complementing its existing markets in Europe, North America, Japan and Korea.

Hailo is also opening registration for the Hailo-8 Fast Track program to select customers and is offering these customers the opportunity to evaluate the initial samples of its high-performance, low-power and small-size Hailo-8™ deep learning processor.

Program participants from various sectors will also be able to develop and prototype their own deep learning products based on the Hailo-8 processor.

Beyond the value it delivers to its strategic focus, the automotive market, Hailo's breakthrough processor technology serves deep learning applications in a wide



range of other markets including surveillance, smart home, IoT and industrial, as well as robotics, AR/VR platforms and wearables.

"The expansion of our Series A round and the addition of Glory Ventures to our investor roll boosts our ability to bring out innovative, powerful and resilient deep learning processors for

edge devices, and helps us target the strategic markets of China and Hong Kong," said Orr Danon, Hailo CEO and co-founder. "The upcoming samples of our Hailo-8 processor will help players in multiple markets overcome the daunting barriers of sufficiently low power consumption, size and cost which currently prevent them from deploying intense deep learning capabilities in their edge products."

"We have been following the AI compute global landscape closely and found Hailo's technology to stand out" said Eric Yang, founding partner at Glory Ventures. "We are impressed with the Hailo team and their ability to execute. We look forward to continuing our relationship with them as AI becomes a 'must-have' technology in every camera-enabled device."

TowerJazz and Ranix announce a partnership to develop RF transceivers to be used in V2X and ETCS Systems for the Automotive Market

TowerJazz, the global specialty foundry leader, and Ranix, a total solution provider for automotive communication and IoT security, announced the development of RF transceivers for V2X (Vehicle-to-everything) and ETCS (Electronic Toll Collection System) modems for the automotive market based on TowerJazz's advanced RF manufacturing platform. Ranix's RF transceiver design is specifically customized for ETCS and V2X modems.

RF transceiver for V2X modem is targeting the growing worldwide automotive market's need for WAVE (Wireless Access in Vehicle Environments) systems. Ranix is the sole domestic Korean company providing V2X solutions for Korea's automobile market and largest manufactures, expecting to expand its presence worldwide as well. The RF transceiver for ETCS has been designed to be compliant with the Korean and Chinese market standards to [▶](#)

Latest News

→ serve both of these markets with high performance and cost-effective solutions.

As the demand for autonomous driving is increasing, there is a constantly rising need for V2X modems offering sophisticated solutions along with enhanced RF communication capabilities. Vehicle-to-everything (V2X) communication modules are in charge of passing information from a vehicle to any entity that may affect it, and vice versa. These modules incorporate specific types of communications such as V2I (vehicle-to-infrastructure), V2N (vehicle-to-network), V2V (vehicle-to-vehicle), V2P (vehicle-to-pedestrian), V2D (vehicle-to-device) and V2G (vehicle-to-grid). These systems serve a variety of today's ever evolving automotive market requirements among which are road safety, traffic efficiency, and energy savings. Visiongain estimates the market of V2X modules in vehicles to reach a 24% CAGR between 2015-2025.

"Ranix's RF transceivers are designed to provide high RF performance for our developed ETCS and V2X solutions for

the automotive market. As RF communication requirements in the automotive system become more complex, we need the optimized RF transceiver to provide excellent performance. We chose TowerJazz's automotive-qualified RF platform for its combination of good performance and top accurate models. This collaboration between Ranix and TowerJazz was a natural fit and we look forward to cooperate as strategic partners," said SoungWook Choi, CEO, Ranix Inc.

"We are delighted to cooperate with Ranix in designing RF transceiver modems for the automotive market. TowerJazz's reputable and highly accurate PDK modeling, it's AEC-Q100 qualified processes and vast manufacturing expertise provides Ranix with the optimal development and manufacturing platform," said Michael Song, President TowerJazz Korea and Vice President of Sales Korea.

Analog Devices' Katsu Nakamura Named IEEE Fellow

Analog Devices, Inc., (ADI) Technology Fellow Dr. Katsu Nakamura has been named an IEEE Fellow. He is being recognized as a leader in the development of integrated circuits for digital imaging. IEEE Fellow is the highest grade of IEEE membership and is recognized by the technical

community as a prestigious honor and an important career achievement. The total number selected in any one year cannot exceed one-tenth of one-percent of the total voting membership.

Dr. Nakamura's career at Analog Devices spans nearly 25 years. In 1994, he joined Analog Devices as a senior staff design engineer in the High-Speed Converter Group developing ADI's early technologies in CMOS data converters for embedded applications. Dr. Nakamura subsequently led ADI's technology development for digital imaging until 2011



when he assumed the role of product line director for ADI's Consumer Product Group. Since 2018, Dr. Nakamura has been leading the technology strategy for ADI's Healthcare and Consumer Business Unit. In 2005, he was named an ADI Fellow for his contributions that drove ADI's technical

and commercial breakthroughs in the consumer imaging market.

Dr. Nakamura was a co-recipient of the SRC Inventor's Recognition Award in 1992 and holds more than 20 US patents with several patents pending. He was selected as a finalist of the 2006 EE Times ACE Innovator of the Year Award. Dr. Nakamura holds a B.S. degree in electrical engineering and M.S. and Ph.D. degrees in Electrical and Computer Engineering from Carnegie Mellon University.

NXP and Kalray Enter Partnership to Develop Platform for Safe, Reliable Autonomous Driving

NXP Semiconductors N.V., a technology and market leader in next-generation automotive technologies, announced a new strategic partnership with Kalray (Euronext Growth Paris – ALKAL), a pioneer in processors for new intelligent systems. The partnership will combine NXP's scalable portfolio of functional safety products for ADAS and Central Compute with Kalray's high-performance intelligent MPPA® (Massively Parallel Processor Array) processors. The new platform is significant because it addresses the performance, safety and near-term commercial needs of levels 2 and 3 driving with an eye to longer-term release in level 4 and 5 autonomous vehicles. The collaboration also aims to take on the safety shortcomings of today's pilots and experimental offerings in the autonomous development space.

The autonomous driving ecosystem faces technology challenges and concerns related to the safety of self-driving vehicles. Recent research indicates that while consumers are enthusiastic about an autonomous future, many hold deep reservations about whether self-driving vehicles will ever be safe. This perception has been reinforced by high-profile accidents involving prototypes and experimental vehicles. To overcome these technology and consumer confidence gaps, the autonomous ecosystem needs fail-safe automotive systems that enable a vehicle's central processing unit to protect drivers through a complex and heavily tested safety approach. NXP provides more than 25 years of expertise in the types of functional safety systems required to tackle autonomous driving.

NXP and Kalray have joined forces in a partnership to co-develop a central computing platform with safety as a foundation. NXP will offer the host processor of the platform, its high-performance S32 processor, with its safety critical ASIL D and ASIL B capabilities. This will help the platform tackle the requirements of automotive central computing and will target path planning functions. Kalray will deliver the world-class performance of its MPPA® processors to safely handle the machine learning aspects of perception. The first example of this partnership will be the integration of Kalray's MPPA® processors into the NXP BlueBox®, an

embedded autonomous driving platform. This iteration will address autonomous challenges in power and safety with Arm®-based technology and will be designed to support open standards.

"We are happy to partner with Kalray to take on the safe performance challenges of increasingly autonomous driving," said Kamal Khouri, vice president & general manager, Advanced Driver Assistance, NXP. "Our platform offers the performance and functional safety needed for reliable autonomous driving as opposed to the risky and power-hungry consumer grade solutions that are currently being tested in vehicles."

The strategic partnership between NXP and Kalray will bring multiple benefits to the development and industrialization of autonomous vehicles in areas such as safety, software, open standards support, performance per watt, architecture flexibility, and scalability. The new solution will offer sophisticated safety technologies in a "Safety Co-Pilot" configuration that leverages the strengths of each company. In addition, the modularity and scalability of the combined architecture will offer the partners a roadmap with flexible opportunities for rapidly scaling performance.

"We are pleased to announce this strategic partnership with NXP, the leading supplier of semiconductors to the automotive industry," said Eric Baissus, CEO, Kalray. "Safety is unquestionably the single most pressing issue holding back the momentum of the autonomous vehicle movement globally, and we are confident that by leveraging the strengths of both companies we can overcome this critical industry challenge and provide a leading solution to the market."

At CES 2019, the partners will demonstrate the platform running a prototype of Baidu's Apollo open automotive software solution. Attendees can witness the platform demonstration at NXP's CES booth, LVCC, Central Plaza – CP 18.

LiNaMan Project Working on Next Generation EV Batteries

The Centre for Process Innovation (CPI) is part of a collaboration aiming to accelerate the introduction of next generation automotive batteries.

Working alongside LiNa Energy and Lancaster University, CPI is supporting the development of a robust, low-cost and high performance energy storage battery to replace existing lithium-ion (Li-ion) batteries.

The project, known as LiNaMan, will demonstrate the technical and commercial viability of sodium nickel chloride (Na-Ni-Cl) batteries as a new disruptive technology in the UK and European electric vehicle sector.

The collaboration will also highlight the benefits of Na-Ni-Cl batteries against Li-ion alternatives, in particular their highly recyclable and relatively cheap components of steel, nickel, iron, salt and ceramic, and display their capacity to operate across a much wider operating temperature range.

LiNa Energy is founded upon a patented novel sodium metal chloride planar cell, which unlocks the high power and energy density potential of established sodium battery chemistry while offering vastly improved safety and reduced product complexity.

The collaboration will take LiNa's concept and apply the latest material engineering to design, develop, manufacture and test the first-ever LiNa cell.

Process development and process economics of LiNa's single cell will take place at CPI's state-of-the-art formulation facility, which is based in NETPark, Sedgefield, County Durham.

CPI will work alongside Lancaster University and LiNa Energy, providing cutting-edge equipment and its wide range of industrial experience to the project, which will include utilising its long-held expertise in fuel cell technology and its roll-to-roll printable electronics capability.

Process development and process economics of LiNa's single cell will take place at CPI's state-of-the-art formulation facility, pictured above

Process development and process economics of LiNa's single cell will take place at CPI's state-of-the-art formulation facility, pictured above

Dr Graeme Cruickshank, Director of Formulation at CPI, said: "By using our state-of-the-art formulation capabilities, we are



able to apply our expertise from other advanced coatings and re-apply into this exciting area to create products for our greener tomorrow.

"It is very much an interesting and exciting time to be part of this industrial revolution."

Dr Gene Lewis, LiNa Energy Managing Director, said: "Project LiNaMan will advance our sodium

battery technology and demonstrate the enormous potential of sodium batteries to decarbonise automotive transport and provide efficient and effective energy storage solutions.

"LiNa believes this is the ideal consortium to deliver the project's ambitious technical objectives and to demonstrate the tremendous advantages of sodium battery solutions over current industry-standard technologies."

The collaboration will highlight the benefits of sodium nickel chloride batteries against Li-ion alternatives, in particular their highly recyclable and relatively cheap components of steel, nickel, iron, salt and ceramic, and display their capacity to operate across a much wider operating temperature range

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Dr Richard Dawson, Senior Engineering Lecturer at Lancaster University, said: "We are proud to have been part of LiNa's development programme from its inception.

"A new sodium battery has the potential to be a truly disruptive technology that plays a significant role in decarbonising road transport in Europe and abroad, and an important driver of jobs growth and wealth creation in the North-West."

The project will complement existing Faraday Challenge projects by adding a strand currently missing from the portfolio and supporting the UK in a fresh sodium technology ideally suited to automotive applications.

The Faraday Challenge is an integral aspect of the Industrial Strategy Challenge Fund.

Seeking to lower carbon emissions and tackle air pollution, the fund supports research and innovation around the development of new battery technologies for future vehicles to create a stronger UK materials supply chain.



AI systems will become our workmates. Workmates we understand and trust.

> Pieter Ballon, Imec

Artificial intelligence, or AI is all the rage again. Some people – most of them technologists – are looking at AI as a way to resolve some of the problems we face. But others are afraid of it. How can we make sure that AI systems – such as robots – will really help us and not take over the world and snatch our jobs away from us? Pieter Ballon, director of SMIT (an imec research group at VUB), emphasizes that engineers and social scientists need to work together on AI, because artificial intelligence is a technological innovation that will undoubtedly cause significant economic disruption and social changes.

AI is an evolution, not a revolution

Science fiction films featuring robots or intelligent machines in the leading roles (such as Blade Runner, Real Humans, Westworld, etc.) have caused us to look at a future with AI with some trepidation. But it won't happen overnight and we will also have time to adjust ourselves to the idea and to control AI systems where necessary so that it becomes a gradual evolution, not a sudden revolution. But it is definitely an evolution that is already underway. Harvard professor, Michael Porter, sets out four stages that mark the way toward smart objects and systems. Stage one is 'Monitoring': by using sensors, a smart product will be aware of its own situation and the world around it. An example of this is the Medtronic glucose

meter, which uses a subcutaneous sensor to measure a patient's blood-sugar level, alerting the patient 30 minutes before that level reaches an alarming status.

Stage two is 'Control': thanks to its in-built algorithms, the product will then carry out an action based on the readings or measurements it has taken. For example, if a smart camera detects a car with a specific number plate, the gate will open.

Systems then evolve towards the stage of 'Optimization'. Basing itself on all the data that the system collects while it is operating, in-built algorithms can carry out analyses to determine the best way of working. It's as though the system 'learns' to work more efficiently. An example of this are wind turbines that are able to adjust the position of their vanes each time the wind changes direction so that they can cap-

ture a maximum amount of wind energy and also 'disturb' the flow of the wind to any neighboring wind turbines as little as possible.

Finally, smart systems evolve towards 'Autonomy'. When a product is capable of monitoring itself or carrying out an action – and making that action as optimal as possible – it can work autonomously. For instance, there is the iRobot vacuum cleaner robot, which is capable of cleaning all sorts of surfaces in the home, as well as detecting dirt, finding its way round furniture and avoiding tumbling down stairs. It also 'stores' details of the layout of a room in its memory for the next time and makes its own way back to its recharging station, where it announces its safe arrival with a triumphant sound signal!

Smart systems can also be connected with each other so that they can carry out actions in tandem, learn from each other – and so on. An example of this is the idea of driverless cars and the road infrastructure working together so that if there is an accident somewhere, cars further away from the incident can be notified and the appropriate action taken.

As we can see from these examples, we will gradually evolve towards systems that are capable of learning and taking decisions by themselves. And equally gradually, we – humans – will hand over the monitoring, control and optimization, partly or in full, to machines. This will happen faster in some sectors than in others – and there are various reasons for that. In the mining industry, for instance, Joy Global's Longwall Mining System is used to dig underground virtually automatically, without any human input. Staff sitting in the control room above the ground keep a close eye on everything going on and

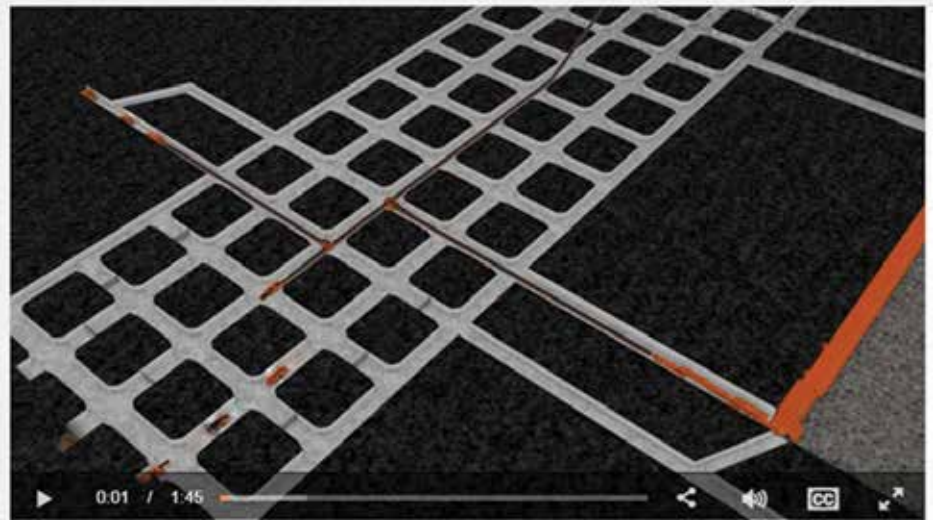


Fig 1: In mining, for example, fully autonomous robots are used to work under the ground, while everything is monitored closely from a control room above the ground so that humans can inter-vene when necessary, for example if repairs are needed. (Video from Joy Global / Komatsu Mining via <https://hbr.org/video/3819456791001/smart-connected-mining>)

only send engineers below ground if it becomes necessary. So, for the sake of people's safety, mining has evolved to the most advanced stage of autonomy – although people are still very much a crucial factor of operations.

People and AI systems will become workmates

Human-like AI, human-centric AI, human-in-the-loop AI – these are all terms to indicate that human beings are still very much central to the story. Robots and machines need to be made in such a way that people can understand them, are able to communicate with them and can work efficiently with them. That way, machines can carry out tasks on behalf of and for the benefit of humans.

A good example of this is the 'cobot', or collaborative robot, developed to assist Audi production line workers in assembling cars. Whereas previously these types of machines used to be placed in safety cages,

the cobot is able to carry out certain actions safely close to and with the help of its human workmates. This means that tasks such as applying adhesive can be carried out much more precisely, consistently and always in the same way. Meanwhile, the cobot's human workmate is able to control and direct it using hand gestures.

There are still many challenges to overcome in the area of communication between robots and humans. For example, will a robot ever be capable of identifying our intentions? Can a robot detect if we say something in a fearful or more self-assured way? In which case, this can be important in certain situations. Or when we carry out an action, what does this say about our actual intentions? For instance, it is no easy task to get a driverless car to recognize whether a pedestrian intends to cross the road, or is simply standing at the side of the road. Typically, as a pedestrian, we will try to make eye contact with the driver to indicate that we



Fig 2: The cobot developed for Audi can be operated using hand gestures and has a screen in the form of a face to communicate with the worker.

would like to cross. But this type of 'unwritten rules' in human-to-human communication is not easy to transfer to AI systems.

The way humans and cobots work together on the workfloor can take the form of the human demonstrating how something is done and the cobot learning from it so that it can then perform a particular action perfectly. In a single, repetitive process it may be that the human worker will only have to show the robot how to do something a few times and the robot will then take

it from there. But in more complex situations, the cobot may always need a human workmate on hand to give it instructions and to instruct it how to do things. One example of this would be collecting waste in a city. It can be a complex business distinguishing what is waste and what isn't. It's also hard to know how to react if someone waves to the waste truck driver and then runs up behind with a bag of waste to be picked up. A robot would not know how to respond, whereas a human knows that the friendliest thing to



Fig 3: This is Norman, the 'psychopathic' AI algorithm that MIT scientists trained to demonstrate the danger of AI when 'false' data is used as input. (copyright "Thunderbrush on Fiverr", <https://www.fiverr.com/thunderbrush>). At right is one of the Rorschach inkblot tests that Norman was given to look at. In it, he saw a man knocked down and killed by a speeding car, whereas standard AI systems see it as a close-up of a wedding cake on a table.

do is wait. This means that in some situations, humans and robots will always have to work together, with the robot taking on the heavier work and its human workmate having more time for interaction with other people and knowing how to respond to unexpected situations.

AI systems need to be tested regularly

As we have already said, the human always needs to understand how a robot arrives at a certain conclusion or action – and must always be able to make adjustments where necessary. Recent examples of problems with artificial systems have demonstrated exactly that.

For example, there is the instance of the chatbot, Tay, which began posting racist messages on Twitter after certain other Twitter users left politically incorrect posts. The chatbot had not been given any instructions to recognize these types of statements as being inappropriate.

'Norman' also made the news in 2018. Norman is an AI system that displayed psychopathic characteristics when doing a well-known test with Rorschach inkblots. It happened because Norman had previously been shown mainly sensational and violent images from Reddit and he had built up a picture of the world based on those images. MIT researchers wanted to use the experiment to demonstrate the danger of 'false data' being used as input for AI systems.

And finally, there is also the example of the COMPAS algorithm that was used by the judicial system in America to make predictions about the recidivism of convicts. What happened? Based on the historical data used as input for the algorithm, it reached the conclusion that blacks

were more likely to re-offend than whites.

All this has taught us that we need to look very carefully at the data used as input for AI systems. It also shows us that it is important for us to understand at all times how an algorithm arrives at a certain conclusion – and that we can make adjustments to it. The AI system cannot be a 'black box'. New procedures and checks are required to ensure data and algorithmic transparency.

Yet it will probably not be possible to make all data input and algorithms transparent – which means there will be times when we do not know why an AI system may have come to certain conclusions. So it is important to introduce regular tests for AI systems, which include paying a great deal of attention to ethical issues, so that any problems can be identified quickly.

How can we trust 'them'?

So, how can we ensure that everyone is able to trust the AI system they come across on the workflow, at the doctor's surgery or on the road? First and foremost by allocating some sort of approval certificate, based on a regular audit of the system. One example of this are the elevators that we use every day. We have no idea about how their technology works, but we trust them to be safe and work properly (and we can do this because they are checked regularly by people who know what they are doing).

The way humans and AI systems communicate and their predictability can also help to build a relationship of trust. For instance, take the traffic lights that we use to cross the road as pedestrians: they have a pushbutton that enables us to provide our own input (while a



Fig 4: We need to try and achieve the same level of trust in AI systems that we already have in smart traffic lights.

camera should also be able to detect the pedestrian anyway); we then receive a signal that our input has been registered; next, we wait patiently because we know that we are using a predictable system that will turn green within a maximum of 2 minutes; and in some cases, the system even tells us how long we will have to wait before crossing.

Will we still have a job in 2035?

There is a good chance that many routine jobs will be taken over by AI systems and robots. That may range from working on a conveyor belt in a factory, to making certain medical diagnoses or working as an accountant or in legal jobs. Even tasks where a bit more creativity is

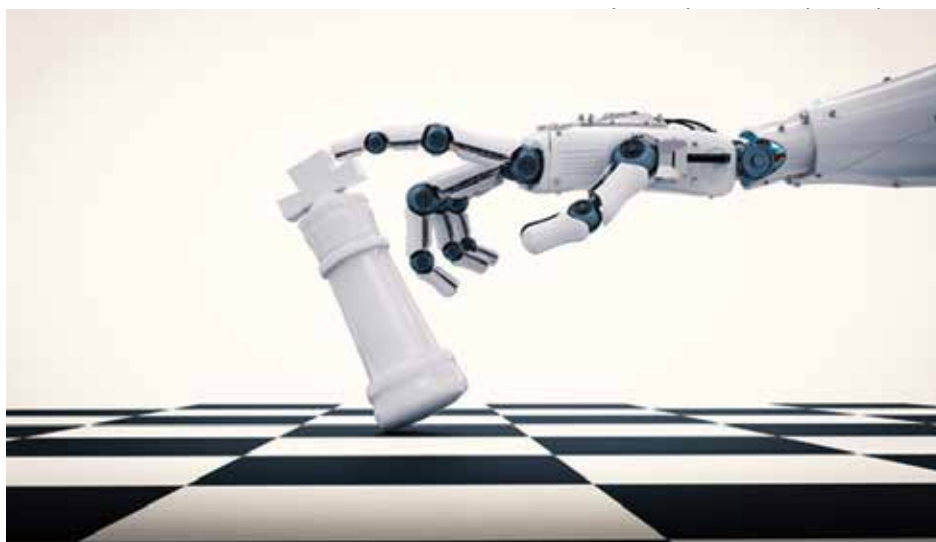


Fig 5: Chess computers are a great example of what is possible with AI. They have gone so far that players can be suspected of using chess computers if the moves they make are strikingly original and creative.

systems. The well-known historian, Yu-val Harari, quotes the example of Google's AlphaZero, which took less than 4 hours to learn how to play chess, after which it was able to beat the best human-trained chess computer. Not by learning from historical data, but by using machine learning to teach itself to play the game. This has gone so far now that when players in chess tournaments make a move that is strikingly creative and original, the judges may suspect that player is using a chess computer to come up with the moves. So, both routine jobs and jobs in which new possibilities have to be explored can be carried out by AI systems. But will they ever be as creative as we, humans? That remains to be seen.

Whatever happens, the content of many jobs will be changed by the arrival of AI. We will work with these AI systems and have to keep adjusting to new capabilities. Lifelong learning will be very important, both for low-skilled and highly qualified jobs. New types of job will also be created that we can't predict at the moment. Typically, jobs where human contact is very important – such as nursing – will still be done by humans, even though robots may be brought in to provide assistance and support.

But the impact goes further than just our job content and we will also find other economic models becoming involved in which we will work less and in which job, income and consumption will be separated out from one another. So perhaps you won't have to work (fulltime) to receive a full income – and maybe you won't need a full income to provide for your basic needs. Just look at the current digital economy of apps and digital services. You can use many services free of charge and sometimes (with or without you

realizing it) in exchange for access to your data. With this system, data will become a new tradeable commodity and so we will be able to ensure better that our data is our own property and that we can use it transparently when and where we want.

How is imec working on this future? Imec is working on neuromorphic chips that are able to support complex algorithms efficiently and without consuming too much energy. Being economical is important when it comes to building AI into sensors. Imec is also involved in the ExaScience Life Lab to build super-computers for major medical problems (developing new medication, understanding diseases better, etc.).

The imec research group SMIT set up the internal DANDA project to make AI more transparent in order to make the algorithms understandable for different parties involved. Methods such as post-it data flow mapping and a description of the data preparation process were developed for imec's AI developers. Also, the DELICIOS project was launched in 2018. This four-year project will see researchers examining which complex tasks humans will be willing to transfer to autonomous systems and on what terms – as well as how comfortable they feel about it. Trusting these systems will be one of the central points in the study.

A technology such as AI cannot be developed without taking account of the social and economic implications from the outset. For this reason, imec will be intensifying this multidisciplinary research in 2019.

This article is part of a special edition of imec magazine. To mark imec's 35th anniversary, we are creating a vision of how technology will shape our society in 2035.

Biography Pieter Ballon

Professor Pieter Ballon gained his master's degree in Modern History from KU Leuven and his PhD in Communication Sciences at VUB. He has taught Communication Sciences at VUB since 2009. Since 2016, he has been director of SMIT, an imec research group at VUB focusing on 'Studies in Media, Innovation and Technology'. Pieter Ballon was appointed the first Brussels Smart City Ambassador and is also the International Secretary for the European Network of Living Labs. His publications include the book "Smart Cities: how technology keeps our cities livable and makes them smarter".

Illustrations for article pieter ballon: in attach a picture that is ours. The other are from istock and one from MIT (request picture usage from norman project with Pinar Yanardag Delul pinary@mit.edu)





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Adaptive Acceleration Holds the Key to Bringing AI from the Cloud to the Edge

> Dale K Hitt, Director Strategic Market Development, Xilinx Inc.

Emerging applications for AI will depend on System-on-Chip devices with configurable acceleration to satisfy increasingly tough performance and efficiency demands

As applications such as smart security, robotics, or autonomous driving rely increasingly on embedded Artificial Intelligence (AI) to improve performance and deliver new user experiences, inference engines hosted on traditional compute platforms can struggle to meet real-world demands within tightening constraints on power, latency, and physical size. They suffer from rigidly defined inferencing precision, bus widths, and memory that cannot be easily adapted to optimize for best speed, efficiency, and silicon area. An adaptable compute platform is needed to meet the demands placed on embedded AI running state-of-the-art convolutional neural networks (CNN).

Looking further ahead, the flexibility to adapt to more advanced neural networks is a prime concern. CNNs that are popular

today are being superseded by new state-of-the-art architectures at an accelerating pace. However, traditional SoCs must be designed using knowledge of current neural network architectures, targeting deployment typically about three years in the future, from the time development starts. New types of neural networks such as RNNs or Capsule Networks are likely to render traditional SoCs inefficient and incapable of delivering the performance required to remain competitive.

If embedded AI is to satisfy end-user expectations, and – perhaps more importantly – keep pace as demands continue to evolve in the foreseeable future, a more flexible and adaptive compute platform is needed. This could be achieved by taking advantage of user-configurable multi-core System on Chip (MPSoC) devices that integrate the main application processor with a scalable programmable logic fabric containing configurable memory architecture and signal processing suitable for variable-precision inferencing.

Inferencing precision

In conventional SoCs, performance-defining features such as the memory structure and compute precision are fixed. The minimum is often eight bits, defined by the core CPU, although the optimum precision for any given algorithm may be lower. An MPSoC allows programmable logic to be optimized right down to transistor level, giving freedom to vary the inferencing precision down to as little as 1-bit if necessary. These devices also contain many thousands of configurable DSP slices to handle multiply-accumulate (MAC) computations efficiently.

The freedom to optimize the inferencing precision so exactly yields compute efficiency in accordance with a square-law: a single-bit operation executed in a 1-bit core ultimately imposes only 1/64 of the logic needed to complete the same operation in an 8-bit core. Moreover, the MPSoC allows the inferencing precision to be optimized

differently for each layer of the neural network to deliver the required performance with the maximum possible efficiency.

Memory Architecture

As well as improving compute efficiency by varying inferencing precision, configuring both the bandwidth and structure of programmable on-chip memories can further enhance the performance and efficiency of embedded AIs. A customized MPSoC can have more than four times the on-chip memory, and six times the memory-interface bandwidth of a conventional compute platform running the same inference engine. The configurability of the memory allows users to reduce bottlenecks and optimize utilization of the chip's resources. In addition, a typical subsystem has only limited cache integrated on-chip and must interact frequently with off-chip storage, which adds to latency and power consumption. In an MPSoC, most memory exchanges can occur on-chip, which is not only faster but also saves over 99% of the power consumed by off-chip memory interactions.

Silicon Area

Solution size is also becoming an increasingly important consideration, especially for mobile AI on-board drones, robots, or autonomous/self-driving vehicles. The inference engine implemented in the FPGA fabric of an MPSoC can occupy as little as one-eighth of the silicon area of a conventional SoC, allowing developers to build more powerful engines within smaller devices. Moreover, MPSoC device families can offer designers a variety of choices to implement the inference engine in the most power-, cost-, and size-efficient option capable of meeting system performance requirements. There are also automotive-qualified parts with hardware functional-safety features certified according to industry-standard ISO 26262 ASIL-C safety specifications, which is very important



for autonomous-driving applications. An example is Xilinx's Automotive XA Zynq® UltraScale+™ family, which contains a 64-bit quad-core ARM® Cortex™-A53 and dual-core ARM Cortex-R5 based processing system alongside the scalable programmable logic fabric, giving the opportunity to consolidate control processing, machine-learning algorithms, and safety circuits with fault tolerance in a single chip.

Today, an embedded inference engine can be implemented in a single MPSoC device, and consume as little as 2 Watts, which is a suitable power budget for applications such as mobile robotics or autonomous driving. Conventional compute platforms cannot run real-time CNN applications at these power levels even now, and are unlikely to be able to satisfy the increasingly stringent demands for faster response and more sophisticated functionality within more challenging power constraints in the future. Platforms based on programmable MPSoCs can provide greater compute performance, increased efficiency, and size/weight advantages at power levels above 15W, too.

The advantages of such a configurable, multi-parallel compute architecture would be of academic interest only, were developers unable to apply them easily in their own projects. Success depends on suitable tools to help developers

optimize the implementation of their target inference engine. To meet this need, Xilinx continues to extend its ecosystem of development tools and machine-learning software stacks, and working with specialist partners to simplify and accelerate implementation of applications such as computer vision and video surveillance.

Flexibility for the Future

Leveraging the SoC's configurability to create an optimal platform for an application at hand also gives AI developers flexibility to keep pace with the rapid evolution of neural network architectures. The potential for the industry to migrate to new types of neural networks represents a significant risk for platform developers. The reconfigurable MPSoC gives developers flexibility to respond to changes in the way neural networks are architected, by reconfiguring to build the most efficient processing engine using any contemporary state-of-the-art strategy. More and more, AI is being embedded in equipment such as industrial controls, medical devices, security systems, robotics and autonomous vehicles. Adaptive acceleration leveraging programmable logic fabric MPSoC devices holds the key to delivering the responsive and advanced functionality required to remain competitive.



From Development Board to Production Solution in Zero Time

› Amir Sherman, Director of Engineering Solutions & Embedded Technology, EMEA, at Arrow Electronics

Today, with social media getting out information so quickly, customers need to have their products ready in zero time, and Arrow, as a technology provider, must be able to support this need. To do that, Arrow is moving toward solution-selling while continuing to support the needs of legacy customers, thereby supporting customers no matter what step they are at with their projects and no matter what the request.

One example is for the IoT gateway market, wherein many customers need fast solutions but the options are endless. The customer needs to adopt a popular solution and change it to fit their end application. Let's use a success story that we had with a customer that got a very popular community board from Arrow called DragonBoard 410c. The DragonBoard 410c is the first development board based on a Qualcomm Snapdragon

400 series processor. It features advanced processing power, Wi-Fi, Bluetooth connectivity, and GPS, all packed into a board the size of a credit card. Based on the 64-bit-capable Snapdragon 410E processor, the DragonBoard 410c is designed to support rapid software development, education, and prototyping and is compliant with the 96Boards Consumer Edition specification from www.96boards.org.

After only two months, the customer realizes that they will NOT be able to develop a full IoT gateway—even though he had all of the documentation, software, and firmware—because of his request for time to market, so they have to ask for an industrial version of this board. Normally, this is not a popular solution because many suppliers are developing reference boards and development boards only, but Arrow

also has ready-to-use industrial boards that are similar. In this case, the DB4 from Geniatech is the industrial version of the DragonBoard 410c that also includes Ethernet, different and more popular power connectors, and other features not included on the community board.

With this board, the customer was able to add only a case and, in two months, release the first working prototype to their end customers.

But the story doesn't end there. Because of this fast time to market, Arrow was requested to support the same solution but add another Ethernet port for Power over Ethernet (PoE). This needed to also come in a "box/case" form factor but could quickly increase to large quantities.

Typically, when doing business, a distributor will tell the customer that they need to do this by themselves, but as a technology provider, Arrow

also has the ability to support this request because it was part of the strategy. So Arrow introduced the customer to a partner, Inforce Computing. This partner already had this exact request from the customer named Inforce 6320.

The Inforce 6320 enables simple integration of IoE devices and has been specifically designed to provide network solutions with advanced security and cater to use cases that necessitate intense edge computing. Its feature set includes dual Ethernet connectors that enable PoE with support for PD and PSE configuration compliant to 802.3at, wherein the board gets power from PoE-enabled switches. With the well-proven and powerful 64-bit Snapdragon 410 at its core, the Inforce 6320 platform provides excellent connectivity as an IoT edge gate-way with an option for routing capabilities, and with its guaranteed long-life support, it is an ideal application-ready platform for your networking device!

Inforce 6320 Features:

- Dual Ethernet ports that enable Power over Ethernet supporting 803. at-compliant PD/PSE configuration
- 1080p HDMI out stream with H.264 decode
- Camera support via USB UVC ports
- Excellent connectivity with Wi-Fi/Bluetooth/Gigabit Ethernet
- Official BSP support for Debian Linux and Ubuntu Core OS (Snappy)



Dragonboard410c

- High-quality custom enclosure made of aluminum for excellent emission control and heat dissipation

The customer was very impressed with this solution, tested it in a very short time, and was able to place the order for the large quantities that they requested because the main efforts are now only in software and not in hardware.

Another example was a customer request for an edge-node IoT solution after a seminar on wireless technologies like LoRa, Sigfox, NB-IoT, and SmartMeshIP. For this, we used the ASME Board, or Arrow Smart Everything Board.

The first board was the ASME-FOX. The ASME Fox features the Atmel

D21 ultra-low-power microcontroller using the 32-bit Arm Cortex M0+ processor also supported by the Arduino IDE for a fast and easy software development cycle. The ASME Fox provides the following peripherals/modules:

- Crypto Authentication chipset
 - Sigfox module
 - GPS module with embedded antenna
 - Bluetooth Low Energy (BLE) interface
- The LE51-868 S module is a complete solution from serial interface to RF interface. It has a digital part and an RF part in which the radio link on the Sigfox network is a half-duplex bidirectional link.

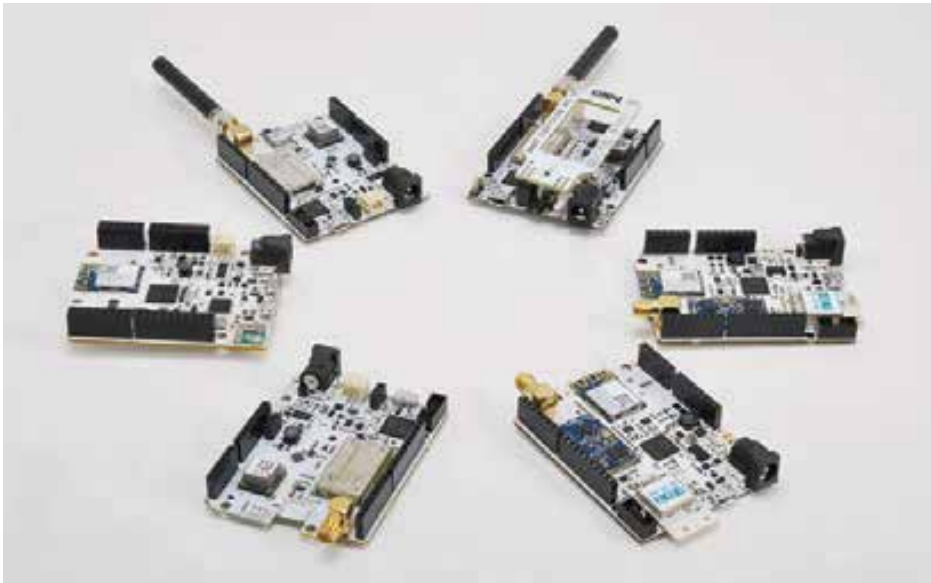
The second board was the ASME-LION. The ASME Lion SoM features the Atmel D21 ultra-low-power



DB4



DB4 Inforce 6320 IoT



ASME — Arrow SmartEveryThing Boards: Tiger, Lion, Fox, Dragonfly

microcontroller using the 32-bit Arm Cortex M0 processor that is supported by the Arduino IDE for a fast and easy software development cycle.

The Lion Board provides the following peripherals/modules:

- Crypto Authentication Chipset
- LoRa module
- GPS module with embedded antenna
- Bluetooth Low Energy (BLE) interface

The third board was the ASME-DRAGONFLY. The Dragonfly is ready-to-use IoT hardware that is a part of Arrow's board family called SmartEverything. It is Arduino-IDE-compatible, which allows fast and easy software development.

The main highlight of this board is that it is an ideal triple-play gateway solution with its main modules:

- Microchip MCU for Arduino compatibility
- Dusty module from IOTeam, performing SmartMesh IP operations
- A Sigfox module from IOTeam for low-power, long-range wireless communication
- A Wi-Fi module from Microchip

A couple of weeks after the seminar, the customer knew that they wanted and needed to use all of the wireless communication on their product and that it would be very difficult to develop in a short time, mainly because of the complexity of the RF. The customer wanted to know if Arrow had an industrial solution that supports all RF technologies in one rugged product with built-in sensors.

Arrow has a supplier, Vicotee, a leading IoT company delivering smart sensors for scalable IoT solutions to the professional market around the world. Vicotee can be used wherever sensors are needed for monitoring purposes. Whether it is building automation, environmental monitoring, offshore, green energy, smart cities, health care, hospitals, or homes, the Vicotee network solution

offers more than 99.99999% network reliability in even the most challenging RF environments - equivalent to cable network reliability! The Vicotee system can easily, effectively, and wirelessly connect entire cities using inexpensive existing technology-in this case, the AURORA XDLSN3.

This unit consists of one radio mainboard unit with SMARTMESH IP, LoRa, Sigfox, or NB-IoT radio and one sensor board that can easily be configured to use all kind of sensors. This module is meant for rapid development of new functionalities. Both boards have an MCU. This way, we can handle and analyze high-speed data on the module. The radio module has a temperature and humidity sensor, so it can work as a standalone module. Both the radio mainboard and sensor

board are equipped with one battery each. When the two boards are connected together, the batteries will be connected in parallel (long life). They are connected by open-ended card edge - no soldering.

Arrow was able to support both IoT gateway and IoT edge-node applications with fast time to market after the customers evaluated the technologies and their needs with Arrow development tools/reference designs and moved to production units in a short time.

To find out more, visit Arrow at Arrow.com for the aforementioned boards and solutions.



Vicotee AURORA

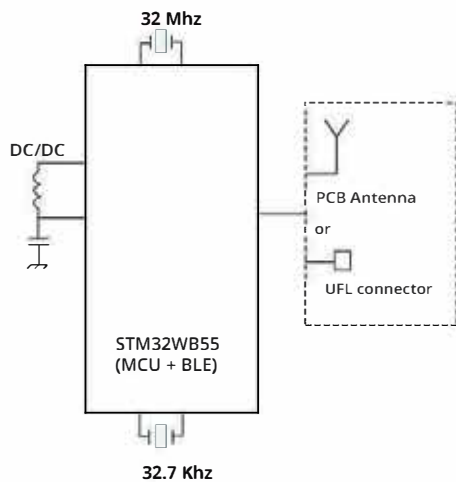


Amir Sherman, Director of Engineering Solutions & Embedded Technology, EMEA, at Arrow Electronics

STM32WVB Family
Sharky Module

The Sharky module is an IoT module with onboard PCB antenna or UFL connector based on the ST Microelectronics STM32WVB Family system onchip, a highly integrated low power radio design with two cores in a single SoC. There are an ARM Cortex-M4 32-bit microprocessor to run your application and one ARM Cortex-M0+ 32-bit microprocessor running the radio networking Stack.

The Sharky module supports BLE, Thread, Zig Bee and generic IEEE 802.15.4 protocol stacks.


SPECIFICATION

Supply Voltage	3,3V
Receiver Sensitivity	-96 dBm
Output Power	0 to 6 dBm
Working Temperature	-40°C to 85°C
Consumption	
Standby	600 nA
Shutdown mode	13 nA
Transmitting	9.5 mA @ 0dBm
Receiving	4.5 mA

MAIN FEATURES

1. Module with onboard PCB antenna or UFL connector.
2. 2.4 GHz – RF transceiver supporting Bluetooth® specification v5.0 and IEEE 802.15.4-2011 PHY and MAC
3. Consume 13 nA in shutdown mode
4. Consume 600 nA in Standby mode + RTC + 32 KB RAM
5. Secure & ID



For more information please visit

[http://midatronics.com/
Encapsulated_products/Sharky](http://midatronics.com/Encapsulated_products/Sharky)

QUICK SPECIFICATION

Supply Voltage :	3.3V	.1
Interface :	USART / ADC / SPI / I2C / QSPI	.2
Dimensions :	16 x 27.25 mm	.3
Working temperature	-40 °C to 85 °C	.4
RX Sensitivity	-96 dBm	.5



When Robots Can Communicate with Each Other What Industry 5.0 and Machine-Vision Systems Mean for Industrial Automation

› [Jeff DeAngelis, Managing Director, Industrial Communications, Maxim Integrated](#)

Picture the fulfillment warehouse of the near future. Much like what is already happening today, robots will traverse the aisles, picking and packing goods for shipment. What's different in this world is, when one of the robots detects that it has a deficiency, it will be able to ask its mechanical colleague to take over its tasks while it either troubleshoots and repairs itself or flags a human co-worker for service.

This futuristic scenario is quite similar to what is envisioned for self-driving cars. In the automotive world, technologies for vehicle-to-everything (V2X) communications could enable cars to communicate with each other, with traffic signals, and with other elements in the world around them. In the industrial environment,

underlying technologies such as sensors, processors, power ICs, and advanced algorithms are paving the way for factory automation equipment to do the same.

Industry 4.0 heralded the convergence of connectivity and intelligence with manufacturing equipment. On the one hand, factory automation has shifted the balance between human workers and machines. On the other hand, the resulting boost in factory uptime and productivity is also giving manufacturers the choice to re-shore production facilities closer to their customers rather than being forced to place facilities in traditional low-cost manufacturing environments. In other words, countries that gave up on manufacturing now are afforded the opportunity to re-level the playing

field. Will Industry 5.0 continue these trends?

A Fresh Perspective on Industry 5.0

A prevailing perspective of Industry 5.0 paints a picture of environments where robots and humans are working together side by side, each contributing the best of their abilities. We see some of this now in our fulfillment warehouse example. Amazon, for instance, uses more than 100,000 robots in its warehouses worldwide to move stock and build orders. The retail giant has noted that the robots are there to enhance efficiency in fulfilling tens of thousands of simultaneous orders. The machines have the stamina, but they lack the common sense,



Image 1: Robots are already being used to facilitate fulfillment processes in warehouses. In the future, they may become even more self-sufficient. Photo courtesy of Chesky/Shutterstock

dexterity, and adaptiveness that humans have. A similar phenomenon is happening in manufacturing. Tesla, for example, has been using robots alongside humans to produce its electric vehicles. Company CEO Elon Musk has famously talked about the “machine that builds the machine,” and this approach is evident in the more than 1,000 robots that take part in the production of Tesla’s Model 3 sedans at the company’s Fremont, California, plant. While facing Model 3 production delays, however, Musk pointed to overuse of automation and moved to re-balance the machine-to-human mix. Robots, after all, haven’t demonstrated the ability to perform certain tasks well, such as those requiring dexterity or finesse. Meanwhile, some industry pundits have pointed to even closer collaboration between humans and increasingly more intelligent machines as a hallmark of Industry 5.0. But if



Image 2: An engineer monitors factory robotics via real-time monitoring system software. Is this what Industry 5.0 will look like? Photo courtesy of Zapp2Photo/Shutterstock.

Delivering Intelligence at the Edge for Industry 4.0

Go-IO: compact industrial IoT reference design

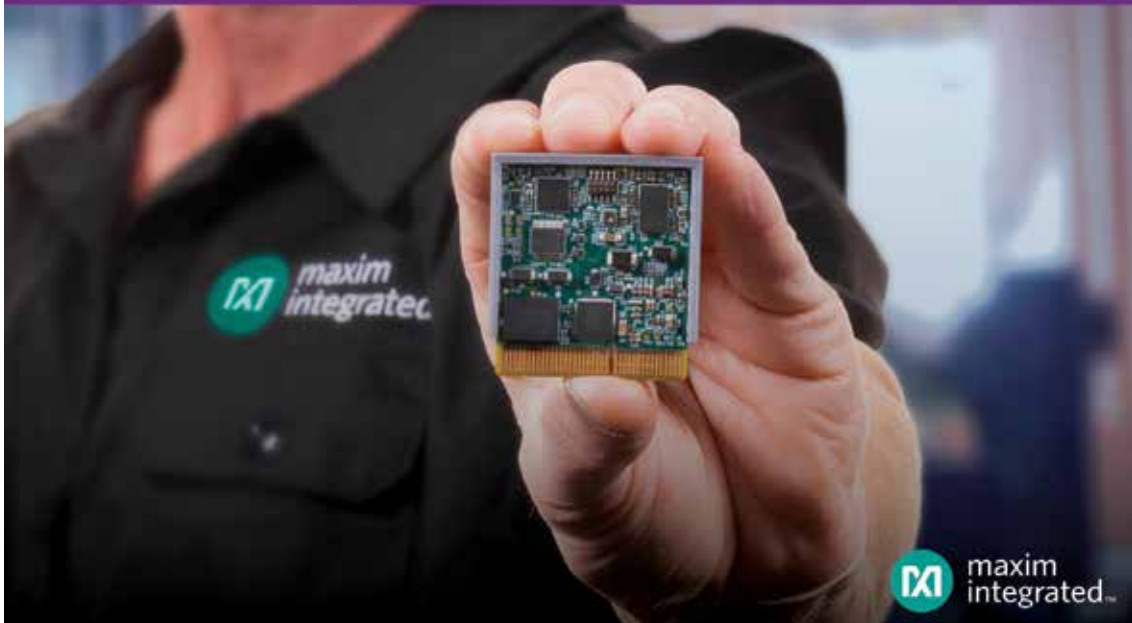


Image 3: The Go-IO industrial IoT reference design drives intelligence to the edge.

this is the case, wouldn't this be a step backward instead of the next phase of a technological evolution?

There's room in the discussion for another perspective of Industry 5.0. In this view, as increasingly sophisticated artificial intelligence (AI) algorithms become commonplace, there is a potential to enhance machine-to-machine communications. For instance, if a machine in a factory cell becomes limited in its function, another machine in the cell can automatically take over to perform the stalled machine's task while still supporting its own main task. This capability, or nimbleness, of the manufacturing line to keep it up and running will foster a new breed of underlying ICs that provide a higher level of flexibility to adapt its functionality to the requested task at hand. At Tesla's Fremont production plant, human workers are currently alerted by flashing red and yellow

lights when a particular robot needs maintenance. But in the future, we may see more automated factories where the robots require much less human intervention when one unit goes down for repairs. This self-aware digital factory approach does have implications on the human workforce, but, again, it's a shift that began as Industry 4.0 matured.

Smaller and Smarter

While machines handle repetitive and physically taxing tasks, people would service or repair the machines... and design them. As AI algorithms evolve to become more accurate and reliable, this will influence the need for compact programmable logic controller (PLC) modules that provide universal IO capabilities to drive the industrial internet of things (IIoT) to the next level of dynamic control. One technology that provides facets of this universal IO capability is IO-Link.

This powerful point-to-point serial communications technology provides flexibility to interchange sensors via a common physical interface, creating a number of software-defined sensors based on the IO Device Description file. The IO-Link port then serves as a universal IO that can turn into any type of sensor, so a factory worker can remotely reprogram these intelligent sensors to handle changed or new manufacturing requirements.

Sensors provide input stimuli (as analog voltages and currents as well as digital IO) while the PLC interprets these inputs to establish the operational conditions of the factory in its environment. Based on these conditions, the PLC must accurately make decisions to instruct the array of actuators to enable adaptive manufacturing, maintain throughput to keep the factory up and running, and provide the ability to improve the operational production efficiency of



Beyond Distribution - ready-to-use products

> Kristóf Féja, Arrow Electronics

There is a natural trend how electronic components are getting more complex and integrated pretty much week by week. We moved from chip-down radio designs towards module solutions because modules are easier to design in, program and use, they oftentimes come with integrated antennas and are pre-certified. All of these enable quicker and simpler design phases both on hardware and software side and reduce go-to-market time.

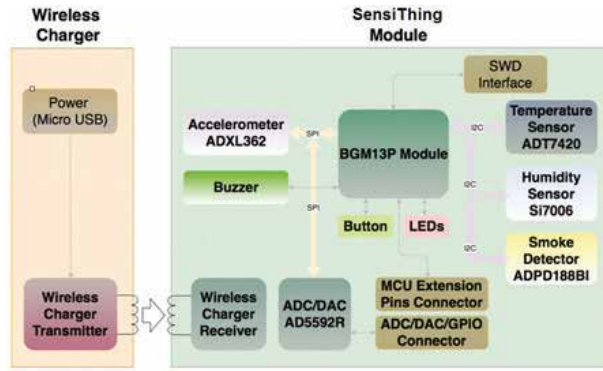
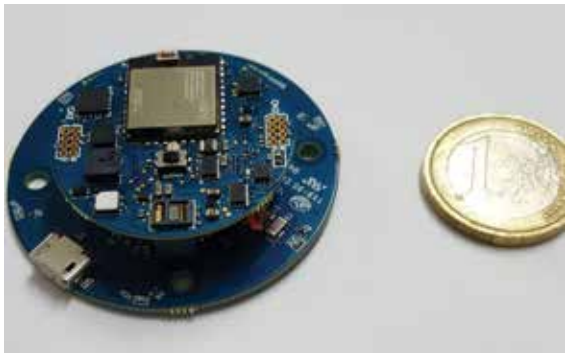
At Arrow we don't see this process stopping here. The market is entering into the next chapter of integration and as a market leader and technology platform provider it is our responsibility to bring these innovations to our customers.

We call this solution selling, it is not just a single component or module any longer. Solution selling is providing simple, Plug&Play yet flexible platforms

that are ready to use in finished products. Arrow is not only enabling its customers with solutions but is a major driving force in developing them. Leveraging our extensive network of experienced developers and partners we are bringing these products to life and to the market. As a leading electronic components manufacturer Analog Devices joined us in this adventure and is cosponsoring our solution developments.

Take our SensiThing solution developed by SensiEDGE. A highly integrated sensor product with Bluetooth connectivity and wireless charging. By simply turning it on and pairing to a smartphone data starts streaming immediately. This opens the door to many new customers that don't have the internal knowledge, engineering resources/tools, time or financial strength to create a custom design.

Another great example is an RFID reader device developed by our partner, IoTechnics that is equipped with an additional RF interface called SmartMeshIP. It is a wireless mesh technology developed by Analog Devices and it was created to enable extremely reliable communication between devices in the harshest RF environments. With a reading distance of several meters, our RFID solution can be used in various applications. Customers in the retail industry can use it for real-time inventory, giving immediate feedback when a product is taken off or put back on the shelf. Any customer that is looking for a solution to track assets indoor or on-premise can use cheap RFID tags and our RFID reader product. Once an RFID tag is read by the device its information is sent to a central device – also equipped with SmartMeshIP interface – over SmartMeshIP.



- Features:**
- BLE 5.0 BGM13P
 - Smoke Detector ADPD188BI
 - Accelerometer ADXL362
 - Temperature ADT7420
 - Humidity SI7006
 - Pin Expansion AD5592R
 - Buzzer TE044003-1
 - User Button
 - Rechargeable battery
 - Wireless receiver LTC4124
 - Wireless transmitter LTC6990
 - SWD debug interface
 - Demo Application
 - Customization Service
 - Diameter 48mm

Image 1: SensiThing solution

Our customers can use it either as a development platform/reference design or as an off-the-shelf product – plastic enclosure is optional.

And finally, let me introduce the latest addition to the 96boards Mezzanines. As the name suggest the VoiceUI Mezzanine enables developers to evaluate voice user interface technology with various processors. Those not familiar with 96boards platform, it is a collection of well-maintained and well-supported, mainly processor based base boards. The form factor enables of creating shields (aka Mezzanines) that can extend the functionalities of the base boards.

Our VoiceUI Mezzanine gives great flexibility to developers. Either You are looking to develop a cloud-based application where processing



Image 2: RFID reader solution

is performed on a 3rd party cloud platform (i.e.: home assistant application) or enabling your product with voice control capabilities where because of the limited amount of commands on-edge processing becomes possible (i.e.: voice controlled coffee machine), our

VoiceUI Mezzanine is your best tool!
It is a LIMITED EDITION platform!
Come to our booth to learn how You can secure one for yourself!

**Visit the Arrow booth in hall 4A!
I look forward to seeing You!**

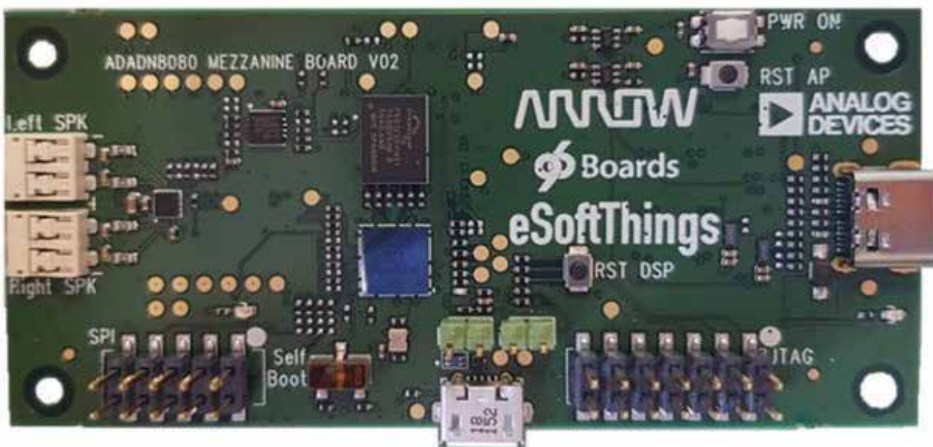


Image 3: VoiceUI Mezzanine



**Kristóf Féja, ESC Program Manager –
Boards & Solutions, Arrow Electronics**



Security is changing in the IoT era

› Rich Hoefle, Marketing Director, 32-Bit Microcontroller Business Unit, Microchip Technology Inc.

As the connectivity and embedded intelligence of smart devices becomes commonplace across many industrial, commercial and domestic applications, the Internet of Things is starting to become engrained in our everyday lives. From the ubiquitous smartphone and fitness wearables to smart speakers, virtual assistants and home/building automation devices/systems, smart energy networks to industry 4.0-enabled machines and factories, even the development of autonomous vehicles — all of these are being enabled by the IoT, and soon it will be hard to imagine life before the IoT era. Gartner has predicted that there will be 20 billion IoT-connected devices by 2020 — and that IoT product and service suppliers will generate revenues of \$300 billion.

This explosion of billions of wirelessly connected devices

demands technology infrastructure that can handle massive increases in computing power, storage and bandwidth, delivered by low cost, compact and ultra-low power hardware. But as these IoT devices collect more and more data, how we treat and protect that data also becomes more important — and a quick review of 2018 lists of the top IoT trends according to Forbes, IBM and IDG ComputerWorld reveals that security is a common thread. Nicole Eagan, CEO of cybersecurity firm, Darktrace, told 2018's Wall Street Journal CEO Council Conference how a casino's high-roller database was hacked via a smart thermometer in an aquarium in the lobby.

With the rapidly accelerating growth of IoT endpoints and increased concerns around security breaches, design engineers are looking for solutions that help reduce

power consumption while adding robust security. Enter Microchip, manufacturer of microcontroller, memory and semiconductor devices, with its new SAM L10 and L11 MCU families. These 32-bit MCUs attempt to solve these twin challenges by integrating a wide variety of peripherals into the industry's lowest power MCU in its class, as well as incorporating a broad array of hardware and software security features, protecting against the dual risks of exposing intellectual property (IP) and sensitive information.

This allows designers to develop secured applications without the battery constraints of less power-efficient MCUs. The new MCU families are based on the Arm Cortex-M23 core and run at 32 MHz, with memory configuration of up to 64 KB Flash and 16 KB SRAM. They boast ultra-low power consumption,

as well as an enhanced Peripheral Touch Controller and advanced analogue features, with the SAM L11 variant adding integrated hardware security. They both come in 24- and 32-pin package options and are targeted for use across IoT and security, low power, capacitive touch and general purpose embedded control applications.

The SAM L11 features Arm TrustZone technology, a programmable environment that simplifies the implementation of security and provides hardware isolation between certified libraries, IP and application code. Microchip further enhances robust security by including chip-level tamper resistance, secure boot and secure key storage which, when combined with TrustZone technology, provides a comprehensive security framework that protects customer applications from both physical and remote attacks. IoT nodes driven by a SAM L11 provide strong resistance

to remote software attacks, thereby increasing reliability and avoiding downtime of the critical functions of the nodes. The chip-level tamper resistance helps protect nodes from cloning and IP theft.

Both MCU families offer the industry's lowest power consumption, allowing developers to create extremely power-efficient designs. When benchmarked for power consumption, the SAM L10 received a ULPMark score of 405, 200% better than its nearest EEMBC-certified competitor. Built with proprietary picoPower technology to provide flexible power saving modes across all active and sleep modes, the MCUs are supported with power debugging and data visualiser tools to monitor and analyse power consumption in real time. This helps developers to rapidly optimise their system design for lower power consumption, with significant improvements in battery life.

They also feature Microchip's latest-generation Peripheral Touch Controller (PTC), allowing designers to incorporate capacitive touch interfaces into their applications that offer best-in-class water tolerance and high noise immunity. Four times faster than the previous generation of PTC, it provides highly-responsive and accurate touch sensing and is supported by the QTouch Configurator and Modular Library, making it simple for designers to add elegant touch interfaces to applications that provide an impressively smooth and efficient user experience, even in the presence of moisture and noise, while maintaining low power consumption. The touch interface makes the devices ideal for a myriad of automotive, appliance, medical and consumer Human Machine Interface (HMI) applications.





Improving Embedded Security with the Armv8-M Architecture and TrustZone

› Rich Miron, Digi-Key Electronics

Securing a microcontroller-based application for the IoT can be tricky. Security starts at the hardware level and then scales into the embedded software. To successfully secure the software, developers require that the underlying hardware support critical features such as:

- Secure boot
- Memory protection
- Cryptographic engine accelerators
- True random number generator (TRNG)
- Secure pin multiplexing
- Software isolation

While some of these features are supported in the Arm® Cortex®-M processors such as the M0+, M3/4/7 series, it can be difficult and time consuming to create a successful solution.

A new solution that developers can leverage at the hardware level is to use the new Cortex-M23/33

series of microcontrollers which are based on the Armv8-M architecture. These processors are designed with security in mind and contain many security features like those listed earlier, including Arm TrustZone® for microcontrollers. In this article we will become more familiar with the Armv8-M architecture and explore how we can improve embedded security using TrustZone.

Introduction to the Armv8-M architecture

The first thing to realize about the Armv8-M architecture is that it is the latest microcontroller architecture from Arm that targets low cost, deeply embedded real-time embedded systems. There are three new processor types that are joining the family. The M23, which is a low-power variant, the M33, which is a

high-performance variant, and the recently announced M35P which is a high-performance, physical security (think tamper-resistance) processor (Figure 1).

While the Armv8-M architecture does improve performance from previous architecture generations, several critical improvements to note include:

- Instruction set enhancements
- Flexible breakpoint configuration
- Dynamic reprioritization of interrupts
- Enhanced trace support
- Simpler Memory Protection Unit (MPU) setup

The biggest and most interesting improvement to the architecture is the ability to use Arm TrustZone. TrustZone is a security extension to the architecture that allows a developer to physically isolate executing code and memory regions such as RAM, code space, and

peripherals in hardware. TrustZone allows the software to be broken up into secure and unsecure regions which then execute in either a secure or non-secure processor state. The secure state allows full access to the processor's memory and peripherals, while the non-secure state can only access non-secure regions and secure functions that are purposely exposed to the non-secure code (Figure 2).

Developers can choose which flash and RAM locations belong to the secure state and which belong to the non-secure state. When non-secure code calls a secure function, the switch between non-secure and secure states is handled completely in hardware in a deterministic manner that has a worst-case switch time overhead of three clock cycles. There are several registers within the CPU that are shared between the secure and non-secure states, but each state also has their own stack pointer, fault, and control registers. The M33 even has a stack limit register that can be used to detect a stack overflow.

It's important to note that TrustZone is a processor extension, which means that it is up to the processor manufacturer as to whether they will include TrustZone support or not on the part. Since TrustZone is optional, let's examine a few Armv8-M processors that are currently available and how they handle TrustZone.

Selecting an Armv8-M processor with TrustZone support

There are currently several processors that are available that support the Armv8-M processor. What's interesting is that these parts are so new, that as of late summer 2018, the only manufacturer that

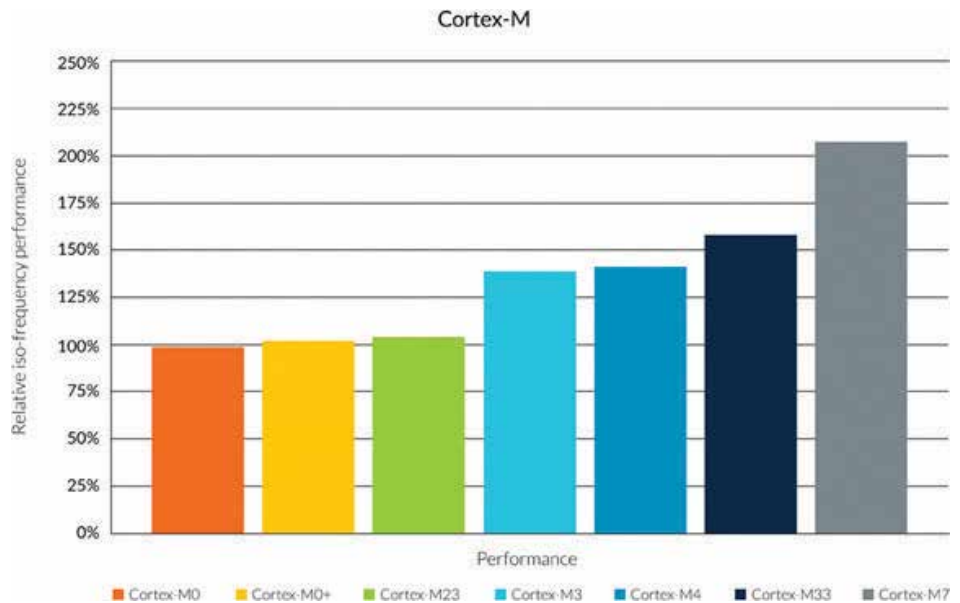


Figure 1: From a performance standpoint, the new Cortex-M23/33 processors fit into the family as improved Cortex-M0+ and Cortex-M4 processors. (Image source: Arm)

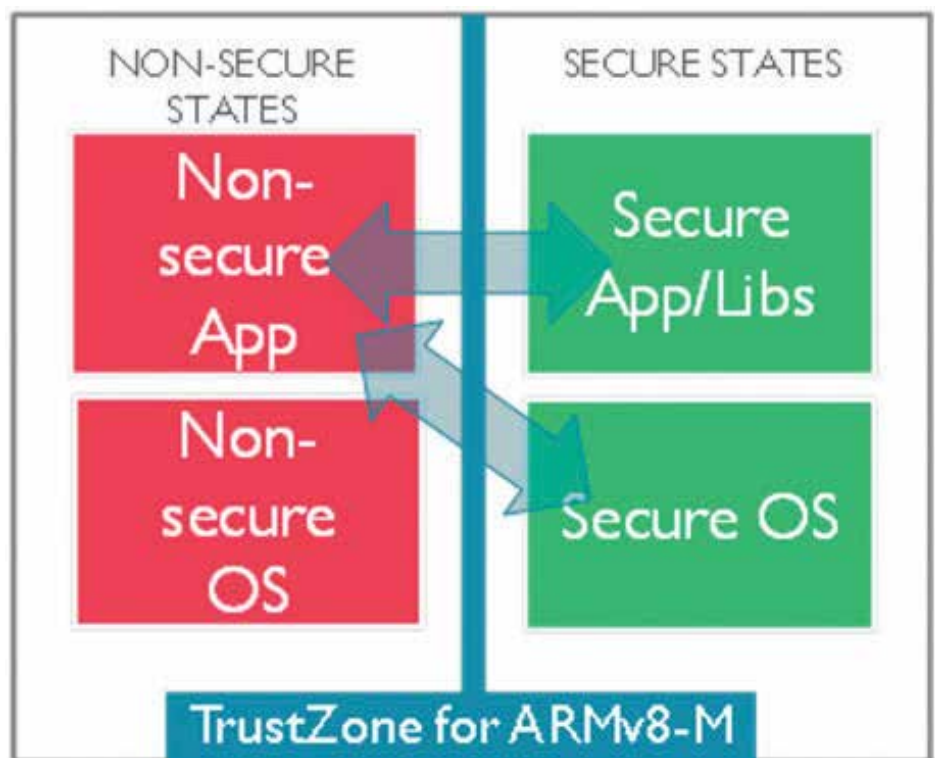


Figure 2: TrustZone uses hardware isolation to separate the processor and application into non-secure and secure states. Code executing in the non-secure state cannot access or manipulate secure memory or code. Secure memory and code can only be accessed while running in a secure state. (Image source: Arm)

Configuration Summary

Table 1-1. SAM L10/L11 Device-specific Features

Device	Flash + Data Flash Memory (KB)	SRAM (KB)	Pins	SERCOM	ADC Channels	Analog Comparators Inputs	PTC Self-capacitance/ Mutual-capacitance Channels	I/O Pins	Tamper Pins	Packages
SAML10D14	16+2	4	24	2	5	2	16/64	17	3	VQFN, SSOP
SAML10D15	32+2	8								
SAML10D16	64+2	16								
SAML10E14	16+2	4	32	3	10	4	20/100	25	4	VQFN, TQFP, WLCSP
SAML10E15	32+2	8								
SAML10E16	64+2	16								
SAML11D14	16+2	8	24	2	5	2	16/64	17	3	VQFN, SSOP
SAML11D15	32+2	8								
SAML11D16	64+2	16								
SAML11E14	16+2	8	32	3	10	4	20/100	25	4	VQFN, TQFP, WLCSP
SAML11E15	32+2	8								
SAML11E16	64+2	16								

Figure 3: The Microchip SAML10 and SAML11 microcontroller variants. Only the SAML11 parts include Arm TrustZone. (Image source: Microchip Technology)

has parts in production is Microchip Technology.

There have been announcements from other processor manufacturers such as Nuvoton that parts are coming. We can expect over the next 12 months to see a dramatic increase in the number of Armv8-M parts, including those that support TrustZone.

Microchip has produced two main versions of the Armv8-M architecture in their SAML10 and SAML11 family of parts. The SAML10 version does NOT include TrustZone, while the SAML11 parts do. Figure 3 shows all the variants for the SAML10 and SAML11 parts that are currently in production and available. The main differences between the variants is

the availability of RAM, flash, pins and peripherals, which is what we expect when selecting a microcontroller.

For developers that are looking to get started with Armv8-M, there are two development kits to choose from. The Microchip SAML10 Xplained evaluation board includes the SAM L10E14A microcontroller which includes 16 Kbytes of flash, 2 Kbytes of data flash memory, 4 Kbytes SRAM, and comes in a 32-pin package. The Microchip SAML11 Xplained Evaluation Board includes the SAM L11E16A microcontroller which includes 64 Kbytes of flash, 2 Kbytes of data flash memory, 16 Kbytes SRAM and also comes in a 32-pin package. The development boards are identical minus the fact that the processors are different. The Xplained board can be seen in Figure 4.

How TrustZone applications work

Developers working with TrustZone will discover that the way in which an embedded application is developed is going to dramatically change. First, developers need to separate out their applications spaces to determine what code and libraries belong in the secure state and which belong in the non-secure state.

Once this is determined, a developer creates two different software applications; one for the secure code and one for the non-secure code. This can be done very easily using a compiler/IDE like Keil MDK. What a developer essentially ends up with is a multi-project workspace where one project is the secure code and the other is the non-secure code (Figure 5).

When a TrustZone application starts, the code begins executing in the secure state. This allows a developer to immediately establish a root of trust from which the rest of the application can execute. Once

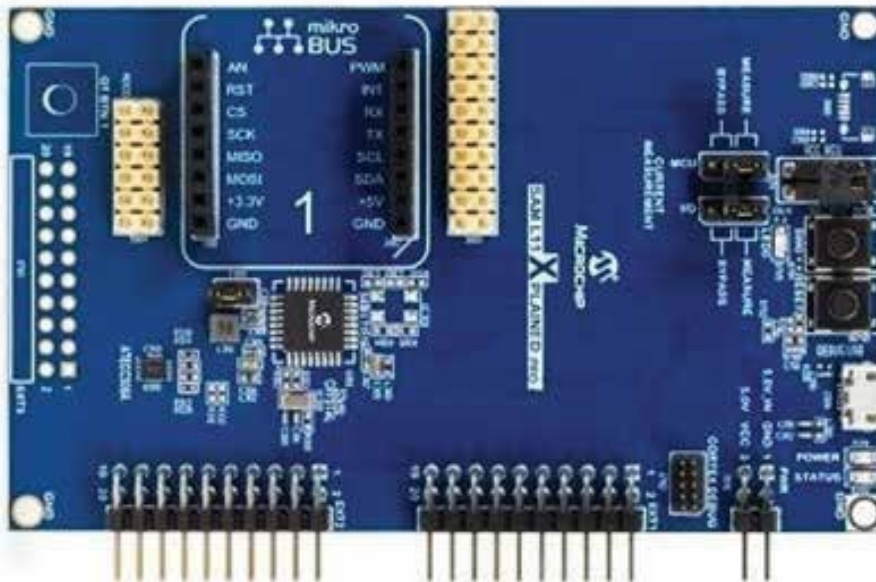


Figure 4: The Microchip SAML10/L11 development board is based on the Armv8 architecture. The SAML11 version supports TrustZone (Image source: Keil)

the system boots, the application will switch from the secure state to the non-secure and execute what is known as the user code. At this point, the application executes just like any other embedded application. The main difference is that the non-secure code can only access secure functions and callbacks through a secure gateway (Figure 6). If the user application attempts to access secure code, memory or peripherals without going through the secure gateway, an exception will be generated. Undoubtedly this means that either there is a bug in the software, or in a production environment, a hacker is attempting to access the system. At this point, the code can then decide how it should thwart the attack, such as restarting the system to remove any injected code that may be running in the non-secure SRAM.

Tips and tricks for securing an embedded application with TrustZone

There are many techniques that can help improve embedded security. Below are several tips and tricks that will help developers interested in using the Armv8-M architecture with TrustZone:

- Use the secure zone during reset to establish a root of trust and a trusted execution environment.
- Put security critical tasks, libraries, and keys into the secure zone.
- Let the user code be placed in the non-secure zone.
- To keep things simple, put the RTOS kernel in one place, either the secure or the non-secure zone.
- Use the MPU in the secure and non-secure zones to improve process isolation.
- Minimizing the code in the secure zone can help to minimize the secure codes attack surface.

■ Make sure that secure code clears any secret information from unbanked registers before initiating a transition from the secure to non-secure state.

Conclusion

Securing a microcontroller-based application for the IoT is important but tricky. Security starts at the hardware level, but many traditional microcontroller families running Cortex-M0+, Cortex-M3/4/7 cores may lack the features necessary to successfully secure the device. Developers can now leverage the new Armv8-M architecture on the Cortex-M23 and Cortex-M33 cores to secure their embedded applications using a rising number of processors using the architecture.

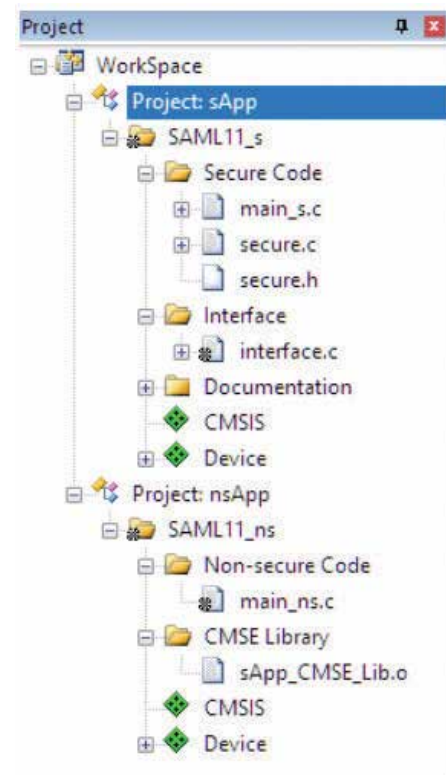


Figure 5: When using TrustZone, developers end up with a multi-project workspace where one project is specifically for the secure code and the other is for the user code. (Image source: Keil)

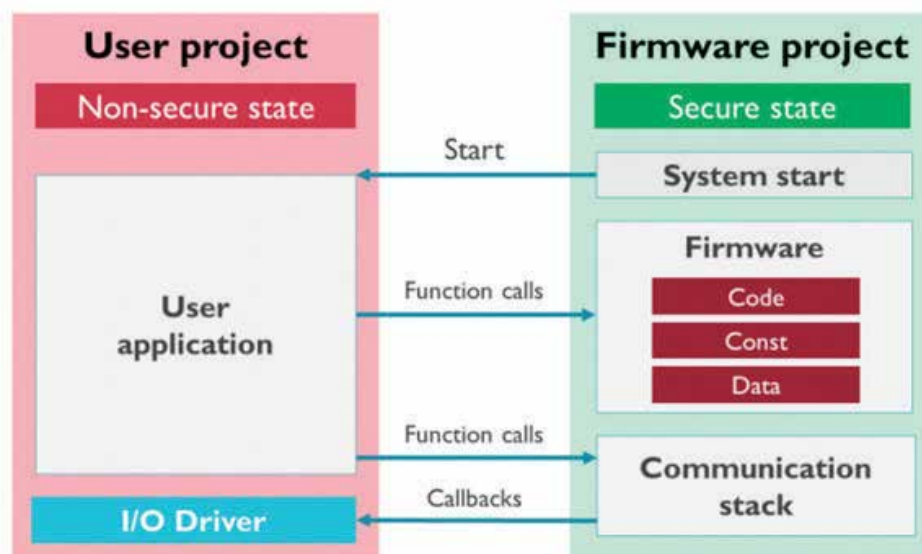


Figure 6: A TrustZone application starts execution from the secure state and enters the non-secure state once the root of trust has been established. The non-secure state can only make function calls to exposed functions within the secure code, otherwise an exception is thrown. (Image source: Keil)



Artificial Intelligence: It's all about the Cloud or it's on the Edge ?

> Łukasz Grzymkowski, Arrow Electronics

Buzzwords like Artificial Intelligence, Machine Learning, Deep-learning have all in recent years gained a lot of attention. This is in many parts thanks to the large, internet-based corporations that utilize them for extremely interesting tasks like image or speech recognition, natural language processing and more while Most of us use such systems on a daily basis.

When thinking about Machine Learning, the first thing that comes to our mind is the cloud hosted on enormous data centers with thousands of servers. For many applications this is the standard and has been for many years. However, with recent increase in hardware availability and performance, thanks to the advent of the Internet of Things, and decrease in cost, a vast range of use cases are moving from the cloud directly to the

edge. In this paradigm shift, the node devices are becoming more autonomous as the intelligence shifts closer to the field and away from the cloud, where the events take place. This has already enabled very interesting applications, like autonomous drones, ADAS systems in automotive, smart mobile robots and this is certainly just the beginning. In the following article, we will provide an overview of what a system designer must consider when working on an artificial intelligence in the edge solution. The typical flow comes down to understanding the task to be solved, choosing the algorithm, training and deploying a model for inference.

The Goal: defining the problem

When working on any solution,

probably the most important, and surprisingly often neglected, step is to identify the problem that we are trying to solve. Truly understanding the issue is crucial to choosing the right angle and technology to tackle it. Is what you are trying to address a complex classification task that requires a deep neural network with many hidden layers?

Machine learning is not limited to deep learning and neural networks only. There are plenty of so-called "classical" machine learning algorithms, for example k-means, support vector machines, statistical models, that are often less resource-intensive and may in fact be an optimal solution. It is there important to experiment and be able to fail-quickly in order to move forward with a more appropriate approach. That said, the deep learning is what has been

as of recent the main driving force in popularizing artificial intelligence.

Architecture: Choosing the correct tools

The application requirements and constraints are what drives the specification of the final product that incorporates an Artificial Intelligence-related algorithm. These are related to robustness, inference time, hardware resources and quality of service. This is especially when considering edge deployment and choosing appropriate the embedded platform. Robustness is the accuracy of the model's output and the ability to generalize, e.g. the likelihood of computing a correct output and avoiding overfitting. Typically, the more complex the model (or deeper, more layered) and the richer the dataset, the more robust the model tends to be.

Defining a desired inference time is entirely dependant on the application. In some cases, for example in automotive, it is crucial for safety reasons to get a response from a machine vision system under a millisecond. This not the case for a sensor fusion system with slow-changing measurements where one could infer only every a minute or so. Inference speed depends on the model complexity - more layers correspond to more computations and that results in longer inference time. This can be offset by selecting and using more powerful compute resources, e.g. embedded GPUs, DSPs, Neural accelerators with OpenCL kernels to fully utilize the available resources.

In addition, the model memory footprint grows with the number of neurons and weights. Each weight is a number that must be stored in memory. To reduce the size of the model, and often to address



Picture Nu1: NVIDIA Jetson Xavier System On Module and Development Kit

hardware specifics, one can convert the weights from floats or doubles and use integers instead.

Quality of service and reliability of the system depends on the deployment model. In a cloud-based approach, the fact that a connection is needed, can result in the system is unreliability. What happens if the server is unreachable? Still, a decision must be made. In such cases, the edge may be the only viable solution, e.g. in autonomous cars, isolated environments. It is also essential to understand that the Machine Learning-based algorithms are inherently probabilistic systems and the output is the likelihood with a certain dose of uncertainty. However, for many use cases, the accuracy or reliability of predictions made by AI systems already exceeds those made by humans. Whether the system designer should consider a 90% or 99% probability to be high enough depends on the application and its requirements.

Finally, when considering an appropriate hardware and software, a designer should realize that the difficulty of development and scalability of certain solutions may differ.

AI is not new to Arrow Electronics but now we believe that this is the time to drive this technology bottom-up meaning that we need to address all options available and to fit it to the customer demand and requirements.

In September 2018, Arrow Electronics and NVIDIA have signed a global agreement to bring the NVIDIA® Jetson™ Xavier™, a first-of-its-kind computer designed for AI, robotics and edge computing, to companies worldwide to create next-generation autonomous machines.

Jetson Xavier — available as a developer kit that customers can use to prototype designs — is supported by comprehensive software for building AI applications.

This includes the NVIDIA JetPack™ and DeepStream SDKs, as well as CUDA®, cuDNN and TensorRT™ software libraries. At its heart is the new NVIDIA Xavier processor, which provides more computing capability than a powerful workstation and comes in three energy-efficient operating modes.

The Tech Specs for Jetson AGX Xavier is GPU 512-core Volta GPU with Tensor Cores, CPU 8-core ARM

v8.2 64-bit CPU, 8MB L2 + 4MB L3, Memory 16GB 256-Bit LPDDR4x | 137GB/s , Storage 32GB eMMC 5.1, DL Accelerator (2x) NVDLA Engines, Vision Accelerator 7-way VLIW Vision Processor ,Encoder/Decoder (2x) 4Kp60 | HEVC/(2x) 4Kp60 | 12-Bit Support ,Size 105 mm x 105 mm as Deployment Module (Jetson AGX Xavier).

Data & Training: get the right answer

Data is the true currency of Artificial Intelligence. By collecting, processing and analyzing data companies can get important and meaningful insights into business processes, human behavior or recognize patterns. No wonder many internet-based companies like Google or Amazon invest so heavily into storing and processing the data they have access to. In deep learning, the datasets are used to train neural networks. In general, the larger the dataset, the better the accuracy and more robust the model. To make it even less susceptible to environmental factors (sunlight, dirt on lenses, noise, vibration, etc), the data is typically augmented, for instance by rotating images, cropping, adding artificial noise.

There are different approaches to training a model and these are briefly the supervised, unsupervised and reinforced learning. In the first, the dataset is labeled and, for image classification, constitutes of pairs of images and labels. The image is forward propagated through the model's layers, each layer adding a bit more abstraction to finally get the classification value. The output is compared to the label, and the error is then backpropagated from the end to the start to update the weights. In unsupervised learning, the dataset is unlabeled and the

model finds patterns on its own. Reinforced learning is best explained by taking an example of a video game. The goal is to maximize the score by taking a set of subsequent actions and responding to feedback from environment, for instance performing a series of consecutive control decisions to move from one place to another.

Deployment and Inference: the unsolved challenge

Most of the training of deep neural networks typically takes place on large GPUs. When it comes to inference, i.e. forward propagation of the neural network to obtain a prediction or classification on a single sample, there are various platforms that can be used. Depending on the requirements, it is possible to deploy and run models on devices like Cortex-M, Cortex-A with GPUs or Neural accelerators, FPGAs or specialized ASICs. These obviously vary by processing power, energy consumption and cost. The tricky part is how to efficiently and easily deploy a model. The models are typically trained using deep learning frameworks like Tensorflow or Caffe. These models must be converted to a format that can be run by the inference engine on the edge device, for example using Open Neural Network Exchange format (ONNX) or to a plain file with weights for ARM CMSIS-NN on Cortex-M. To further optimize, weights may be optimized by pruning (removing close to zero values), quantization (moving from float32 to integer) or compression. Finally, the heavy-lifting on the device is done by an inference engine. It is mainly up to vendors to provide support the target processors and components for frameworks like OpenCL or OpenCV.

Unfortunately, the market at the moment is very fragmented and we can see various proprietary SDKs or tools, and no single standard how to deploy and infer on the edge. What is promising is that with standards like ONNX there is an increasing interest in the industry for standardization.

Conclusion: the Edge is getting smarter

The Artificial Intelligence has been the biggest trend in recent years. For the edge devices, the key obstacles to adoption are the lack of understanding and difficulty in deploying and running. As suppliers compete to attract customers and establish their solution as the go-to standard, Arrow has the unique possibility to understand the different approaches from our partners and recognize where different platforms may be the most useful for our customers. We are using our expertise in Artificial Intelligence to aid the customers and demystify the edge computing.

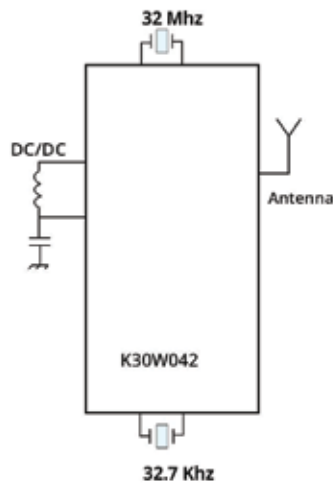


Łukasz Grzymkowski, AI/ML Software Engineer, Arrow Electronics

Stormy Module

The Stormy module is an IoT module with onboard PCB antenna based on a NXP Semiconductor K32W042 system on chip, a highly integrated low power radio design with two core in a single SoC. There are an ARM Cortex-M4 32-bit microprocessor to run your application and one ARM Cortex-M0+ 32-bit microprocessor running the radio networking Stack.

The Stormy module supports BLE, Thread, generic FSK and generic IEEE 802.15.4 protocol stacks.



SPECIFICATION

Supply Voltage :	3,3V
Receiver Sensitivity	-96 dBm
Output Power	-30 to 3,5 dBm
Working Temperature	-40°C to 85°C
Consumption	
Run Mode	6.33 mA LDO / 3.67 mA DC-DC
Transmitting	9.5 mA @ 0dBm
Receiving	4.5 mA

MAIN FEATURES

1. Module with onboard PCB antenna
2. 2.4 GHz – RF transceiver supporting Bluetooth® specification v5.0 and IEEE 802.15.4-2011 PHY and MAC
3. Consume 6.33 mA LDO / 3.67 mA DC-DC run mode
4. Embedded Cryptographic Acceleration Unit v. 3 (CAU3)

For more information please visit
<http://midatronics.com/stormy>

QUICK SPECIFICATION

1. Supply Voltage : 3.3V
2. Interface : LPUSART / USART / ADC / SPI / I2C /
3. Dimensions : 30.9 x 22 mm
4. Working temperature -40 °C to 85 °C
5. RX Sensitivity -96 dBm

ORDERING INFORMATION

Part Number:	Description:
MDX-NXPK32W-R01	Stormy Module





How Real-Time Control, Safety, and Security Are Driving Technological Innovation in the Factory of Tomorrow

› **Brendan O'Dowd, General Manager (Industrial Automation), Analog Devices, Inc.**

Widening prosperity is combining with the proliferation of sensors and extensive cloud connectivity to accelerate the pace of change in factory systems and equipment. The way in which factories operate is changing fast in the face of powerful economic and technological forces. The most agile factory equipment manufacturers will thrive in this fast-changing environment, as they develop increasingly connected and intelligent systems which help factories become more flexible and safer, while maintaining security as they extend connectivity. Increased use of automated and autonomous systems will reduce factories' dependence on labor for repetitive or intricate manual operations. Semiconductors will be at the heart of this new generation of industrial automation equipment, providing the processing, control,

and sensing functions required to operate effectively in connected environments.

Analog Devices (ADI), which has always thrived at the intersection of the analog and digital worlds, has a close-up view of the technological changes that new factory automation equipment calls for. Its expertise in the fields of sensing, signal conditioning, digital signal processing, wired and wireless connectivity, and software bring it close to the challenges that its industrial customers face, enabling it to develop application-oriented solutions that accelerate OEMs' time to market. ADI's goal is to help customers innovate through technology and be prepared for whatever the future brings, while continuing to support legacy systems by providing guaranteed long-term availability of industrial parts.

What the future brings is profound disruption, which has its roots in a welcome trend: the global spread of prosperity.

Widening Prosperity

This century has seen a notable rise in disposable incomes in parts of the world that have traditionally been regarded as developing countries. As a result, demand for manufactured goods is growing globally, putting pressure on manufacturers to expand production while supplying an increasingly diverse set of product configurations, in order to satisfy regional and national variations in demand.

At the same time, the global growth in prosperity is shrinking the availability of cheap, unskilled manual labor. The one-time boost that manufacturers have gained in the past 30 years from offshoring

production to low cost locations such as China is evaporating, as wages in these locations rise, and the workforce, now increasingly well-educated, loses its appetite for performing repetitive manual operations for low pay. In the future, manufacturers will be seeking to increase competitiveness by deploying automation technology rather than moving to a new low cost location.

The Smart and Connected Factory

New technological capabilities are also helping manufacturers gain additional value from expenditure on factory automation equipment. A proliferation of miniature, high performance semiconductor sensors alongside pervasive connectedness are creating a deluge of data on machine and process performance. There is now more potential than ever for rich, new applications of data analytics, such as machine health monitoring and preventive

maintenance. At the same time, the increasing use of programmable hardware and software-defined electronics functions enables rapid reconfigurations of factory processes and tools.

The factory of tomorrow, then, will be more agile and responsive to demand, more automated, and more reliable. It will require fewer human operators and will face less disruption due to unplanned maintenance.

So which technologies in the analog and digital semiconductor worlds are going to enable this new model of factory automation?

Sensors - The Key to Machine Health Monitoring

MEMS sensor technology is enabling the development of new sensor types that are small, robust, and able to precisely measure vibration and motion. For instance, low noise, wide-bandwidth accelerometers offer the high precision and accuracy required to identify subtle

changes in the vibration signature of a machine. Coupled with sensor analytics software, these devices enable equipment operators to pinpoint the source of a potential failure long before it occurs and apply preventive maintenance measures in good time.

Machine health monitoring is an application that is not confined to conventional factory settings. Mobile or remote industrial equipment may use a wireless connection to report diagnostic information and operating status to a central controller. Running on battery power or intermittent power sources such as solar energy, this kind of application requires a very low power sensing solution.

High Speed Connectivity on the Factory Floor

The proliferation of sensors throughout factories and process plants is generating vast flows of real-time data. Legacy communication protocols between



sensor nodes and PLCs, such as 4 mA to 20 mA control loops, are giving way to ultrafast industrial variants of the Ethernet protocol, enabling increasing integration of operational technology (OT) infrastructure in the factory with information technology (IT) in the enterprise.

In responding to this new demand for high speed data transfer in the factory, OEMs need to future-proof their system implementations, so that they support not only industrial Ethernet protocols in use today, but also the emerging time-sensitive networking (TSN) variant of Ethernet, which is likely to become the standard wired networking technology for real-time industrial communications. To support this transition, ADI provides an Ethernet platform which enables systems to swap from one Ethernet protocol to another without the need for hardware redesign.

Robust, wireless sensor network technologies are also required for connecting sensor nodes in locations that are hard to reach with physical wiring. Wireless network technologies such as SmartMesh® and WirelessHART, which are designed to operate in tough IoT applications, provide a proven and high performance method of connecting industrial automation equipment without wires.

Safety Systems for Autonomous Machines

Autonomous vehicles and cobots offer a huge scope for widening the application of automation in factories and warehouses. The challenge for industry is to guarantee safety, ensuring that autonomous

machines are fully environment-aware. Advanced radar and lidar technologies are raising the standard of accuracy and precision in object and proximity detection and 3D mapping applications.

Protecting the Factory from Online Attack

With the growth in connectivity comes a heightened risk of attack by hackers intent on extorting payment from factory operators, or by state-sponsored attackers tasked with causing disruption to high value industrial systems.

As factory operators connect more and more nodes to the cloud, they open up new entry points for hackers to exploit. Semiconductor-based connectivity systems need robust security optimized for embedded systems. Analog Devices is developing new solutions to meet emerging security threats to industrial systems, thus helping to future-proof customers' industrial infrastructure.

Configurable Production Processes

The factory of the future must be capable of quick adaptation to new demands and new workflows; the key is to build flexibility into industrial automation technology products at the architecture level. One approach which can support this need for flexibility is software-defined I/O, which can be configured as analog or digital, and input or output, without altering wiring.

Pushing the boundaries of today's technology, ADI already supplies a robust and flexible industrial output solution, which enables full software

configurability of the analog output to support a variety of industrial standards.

Integrating Analog, Digital, and Software

The development and production of industrial automation equipment is becoming an increasingly high tech undertaking, driven by the need to meet end user demand for higher throughput, more configurability, safer operation, and more cloud integration. At the same time, pressure to get to market quickly with new, more sophisticated designs continues to intensify.

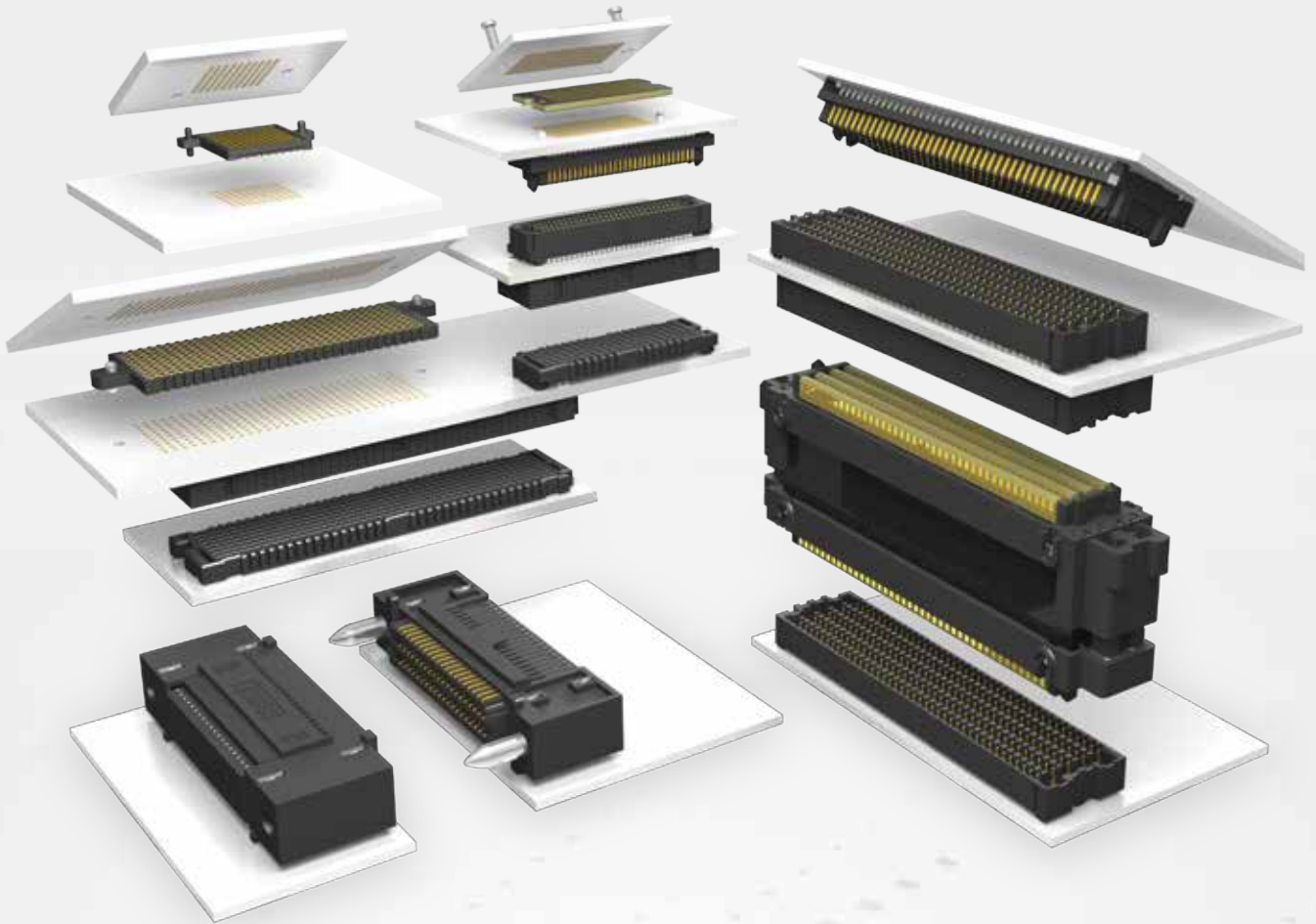
Analog Devices' response is to provide customers with an integrated offering, providing market-oriented solutions for applications including, among others, machine health monitoring, high speed connectivity, and safety and security systems. It will do so by combining analog, mixed-signal, and digital components with firmware and software to solve the most pressing development problems that its customers face, enabling them to respond rapidly and effectively to the intensifying technological and economic challenges of today and tomorrow.

About the Author

Brendan O'Dowd has over 30 years of experience in the industry working for companies like Tellabs, Apple, and Analog Devices. He is currently the general manager of Analog Devices industrial automation business. He can be reached at brendan.odowd@analog.com.

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Community Boards as Development Platforms

› Attila Ambrus, Arrow Electronics

At the beginning of a new project the first phase of the HW development is creating a design that can prove feasibility of our idea. It is called proof of concept (PoC). After defining the optimal SoC/FPGA/CPLD/MCU you need to find a ready to use board with the required interfaces and feature set. There are multiple factors that affecting which development platform is best fitting to a project. Let's see the available options:

Development kit from SoC manufacturer.

Usually the supplier devkits are the very first boards that are available to start working on an SoC after its release so if you are in a hurry to get a hand on the newest technology probably this is your choice. The Board Support Package (BSP) is usually containing the most up to date packages and most probably this is

the source of all the third party BSPs. The disadvantage of these boards that every socket is coming from the same semiconductor company as the SoC itself. It does not matter if there is a cheaper or better solution, they will promote their product anyway. Developers are usually doing a hard copy-paste of all the design section that are working as it is. So this can lead to a non-optimized BOM.

System on Module (SoM) development kit

If the project quantity is too low for custom board design it is required to choose a partially ready solution to save the designing cost. SoM is a good alternative. The development can be started on the SoM itself by attaching it on the manufacturer's evaluation carrier board. The BSP provided for the board is usually ported from the SoC supplier's BSP after smaller

customization and optimization for the kit. The provided support package possibly contains closed source binaries that are not editable by the developer. Support models can differ supplier to supplier offering different services and cost levels.

Community Boards

In case the core part is not finalized yet, and it is necessary to test multiple SoCs without major change in the ecosystem the best choice is Community Board. It has a massive supporting network with various available sample projects and applications. If a developer blocked by an issue it is most probably not the first occurrence and most probably there are already a fix for that. It also comes with an ecosystem that provides standard form factor, reusable, scalable, modular development environment. Opensource SW



Image 1: MCIMX8M-EVK NXP



Image 2: VAR-DVK-DT8M_LO NEW!

packages are a key too keep the cost down and the design customizable. Arrow electronics has recognized the possibilities in the maker community and decided to be a part of the most powerful community board organization, the 96Boards by Linaro: "96Boards is a range of hardware specifications created by Linaro to make the latest ARM-based processors available to developers at a reasonable cost. The specifications are open and define a standard board layout for SoC-agnostic (processor independent) development platforms that can be used by software application, hardware device, kernel and other system software developers. Boards produced to the 96Boards specifications are suitable for rapid prototyping, hobbyist projects or incorporation into new systems for a wide range of applications including desktop and laptop computing, the digital home, digital signage, point of sale (POS), high-end audio, robotics and drones, artificial intelligence, virtual reality, IoT and industrial control.

Standardized expansion buses for peripheral I/O have led to a wide range of compatible add-on mezzanine boards that will work across a variety of 96Boards products. Users have



Image 3: DragonBoard410C

access to a wide range of boards with different features at various price points. In addition, some SoC vendors have announced long term availability of the SoC to encourage their use in products with long life cycles."

Source: 96Boards.org

Just to show the strength of this ecosystem please see below the list of partners who already joined this community:

There are 4 different form factors that currently supported by the community:

- The Consumer Edition (CE)
- The Enterprise Edition (EE)
- The IoT Edition (IE)
- Mezzanine product line

The Consumer Edition (CE) targets the mobile, embedded and digital home segments. A key design objective is to encourage multiple



SoC vendors to build boards to this specification. This is an evolution from previous successful community boards where the external ecosystem is tied to a particular SoC. The 96Boards CE specification is designed to enable an ecosystem to evolve that will support multiple SoCs over a period of years.

There are two Form factors: Standard CE and Extended CE:

The Enterprise Edition (EE) targets the networking and server segments. The fundamentals of this specification are the same as in case of the CE spec. The additional interfaces and the more board place is coming from the target application differences. These boards are populated with high speed interfaces like SATA, Gigabit Ethernet, PCI-e, USB3 etc...

The 96Boards IoT Edition (IE) platform is designed to support development in the Internet of Things (IoT) space. The 96Boards IE hardware platform key features are low cost and small footprint suitable for edge device prototyping as well as other embedded products with size and cost constraints. Supplier independent hardware implementation supporting the ARM Cortex-A/R/M SoCs



Image 4: IMX8-HMI 96Board (CE Extended)



Image 5: Chameleon96, imx7 96 Boards (CE)

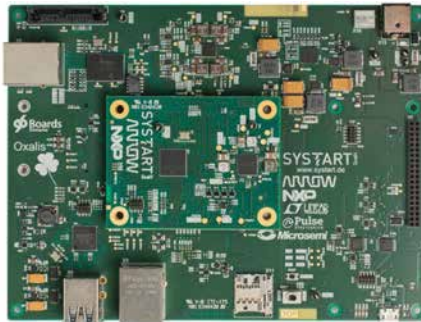


Image 6: IOT-LS1012A-OXALIS (EE)



Image 7: 4IoT – Geniatech (IE)

Mezzanine product line lets you expand your Consumer Edition or Enterprise Edition 96Boards with new interfaces for IoT, industrial control, and other embedded applications. Such as: Security, Camera, NB-IOT, Sensors, Fingerprint, Adapterboard, PoE and many more...



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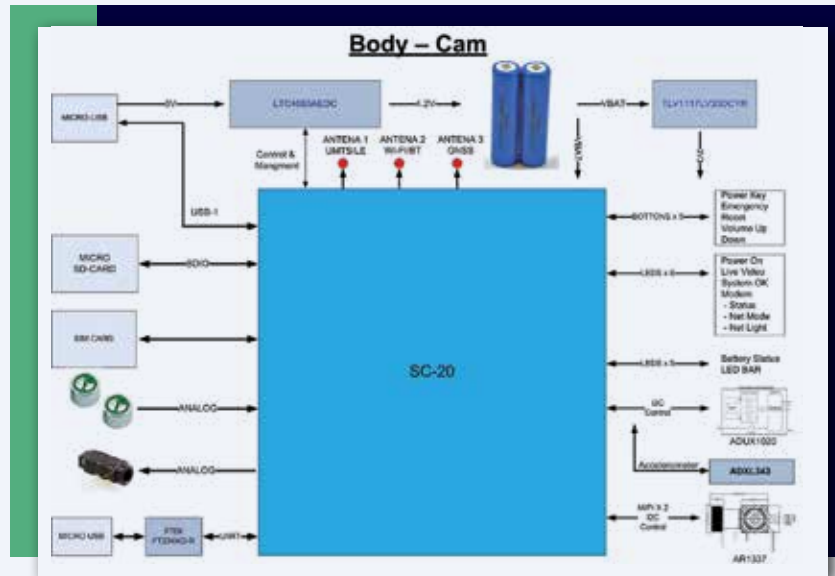
API for Customer algorithms to be implemented on the SC-20 Android 6 platform

Customer can use this in many applications like: Baby Monitor , Security , elderly camera and more



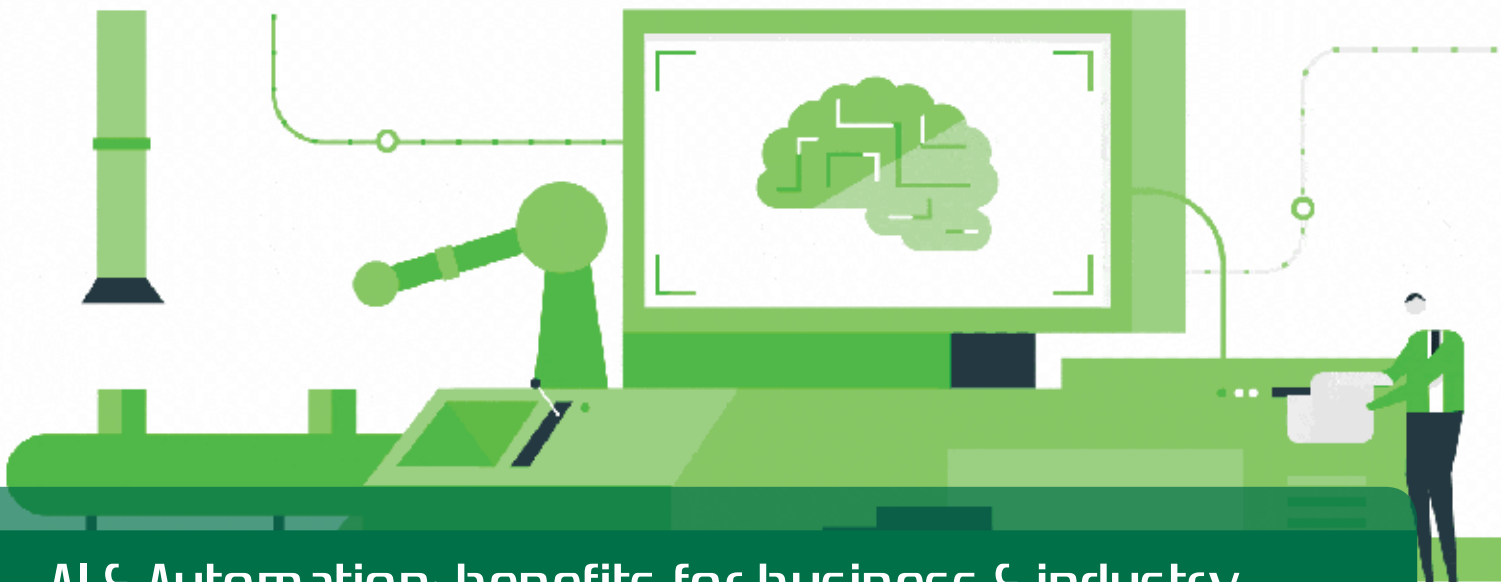
Quectel SC20 Based – Multi-mode Smart LTE Module with Wi-Fi & Bluetooth, Application Processor

- ARM Cortex-A7 microprocessor cores (quad-core) up to 1.1GHz 512KB L2 cache
- On Semi Camera Module – 13M pixel
- Interfaces
- MICRO SD Card
- MICRO SIM
- USB otg
- Build in Li-Ion battery + Battery charger (VIA USB OTG)
- ON Semi Camera Module - AR1337 ON Semi Based
- 2 x MIC
- 1 x Speaker
- 1 x Audio jack
- 1 x ADUX102 Motion Sensor
- 1 x Accelerometer



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AI & Automation: benefits for business & industry

> Stacey McIntosh, Sage

Are you worried that robots will take over the world? You're not alone. A world where robots are self-aware and can think for themselves is a favorite theme of filmmakers, writers and sci-fi fans. Characters like See-Threepio from Star Wars, Optimus Prime of Transformers and Skynet from the Terminator have been present on the big screen for decades. Always set far in the future, intelligent technology is finally here. Yet, many questions remain. What is the future of AI? Will robots be our friends and help us with missions in galaxies far away (or just at the office)? Or, are we likely to face a war against humanity? Are robots our friends or foes? Well, it depends on how you look at it...

History of AI

AI officially arrived on the scene in the early 20th century when Leonardo

Torres y Quevedo built the first chess playing automat. Ever since, developers have been fixated on creating a machine that can reason and think for itself.

AI timeline

We're entering a new industrial age, also known as Industry 4.0, where automation and AI technology can increase our productivity, analytical capabilities and much more. Harnessed correctly, this technology could allow employees to lead better lives and have more meaningful careers by reducing the amount of time spent on monotonous tasks while also cutting costs for businesses.

What is AI?

What is artificial intelligence? Founding fathers Minsky and McCarthy defined AI technology as a device that could use independent reasoning and

intelligence to complete a task. This is clearly a fairly broad definition which often leads to confusion over whether something can truly be classed as AI technology. However, it wasn't until the advances in machine learning were realized, that we had a breakthrough and the acceleration of AI powered products was made possible.

What is machine learning?

AI technology often depends on machine learning as this allows them to learn from their experiences and adapt their reactions accordingly. Machine learning can be defined as the science of teaching robots to learn and behave like humans. This process relies on a consistent input of data and information, which allows the robots to form observations and learn the appropriate reactions or responses to given situations.

The difference between AI and automation

It's often difficult to determine whether something is AI or automation, also known as robotic process automation or RPA, technology as the line between the two is often blurred. AI technology often underlines automation, so the difference is not always obvious. Here's a brief explanation, which should help.

Welcome to Industry 4.0

The advent of advanced technology like AI and automation, cyber-physical systems, and cloud computing and cognitive computing are radically transforming businesses. As these technologies become increasingly more mainstream, we are quickly approaching the next industrial revolution – Industry 4.0.

Industry 4.0 will transform how we work, produce products and even live. Harnessing this technology will allow us to increase our workload while working less hours, streamline manual and rather dull tasks and cut costs for businesses. We'll attain greater productivity and efficiency as well as cheaper production costs. AI apps and systems can even make everyday life easier.

Robots can complete certain tasks quicker, more accurately and better than their human counterparts. For example, AI can process data substantially faster than the human brain and can uncover insights far beyond our grasp and chatbots can be available to support customers 24/7 as they don't need to sleep or eat. By teaching machines to learn for themselves and complete mundane tasks, human employees can focus on more creative, social and fulfilling endeavors.

Will robots replace humans?

One of the biggest concerns about

A timeline of key moments in AI



1950

In *Computer Machinery and Intelligence*, Alan Turing defined the Turing Test: That an intelligent computer could convince a person they were talking to another human being.

1950

I Robot by Isaac Asimov. A collection of science fiction stories was published. Asimov's prescient work helped to inspire a generation of scientists.

1956

The term 'artificial intelligence' was first used for a conference at Dartmouth College. Organised by John McCarthy and attended by Marvin Minsky.

1966

Developed from around 1966 to 1972, Shakey the Robot was the first mobile robot able to make decisions and reason about its surroundings.

1968

2001: *A Space Odyssey*. Director Stanley Kubrick was advised by Minsky for the lead character in the film, HAL 9000 an intelligent computer.

1973

Professor Sir James Lighthill published a negative report on the state of the AI industry which resulted in funding being slashed. The 'AI Winter' began.

1981

The AI Winter ended, when commercial value began to be discovered. Digital Equipment Corporation operated the first successful commercial system.

1997

Deep Blue was an IBM machine that beat the world chess champion Garry Kasparov – for some it was considered the moment that AI came of age.

2002

Roomba, the first intelligent and autonomous vacuum cleaner was created – the beginning of autonomous robots focused on specific tasks.

2005

PackBot and other robots are developed by the US military as intelligent autonomous robots for deployment of bomb disposal.

2008

A Google app with speech recognition available on the iPhone was a breakthrough in language pattern recognition.

2010

Twenty NAO robots danced together in perfect harmony for eight minutes at the 2010 Shanghai World Expo.

2011

Watson from IBM won the game show Jeopardy by answering complex questions and riddles against the two all-time best competitors.

2014

Eugene Goostman, a chatbot, passed the Turing Test by fooling judges that it was human.



Source: <https://www.bbc.com/timelines/zq3REfr#zcpkj6f>

Image 1: AI timeline

welcoming robots into the workplace is the threat to human jobs. Will human employees be completely replaced by robots? If humans are replaced, how will this impact society and the workforce?

Research from McKinsey Global Institute shows that these concerns aren't unreasonable as they predict that approximately one-fifth of the global workforce will be impacted by the adoption of AI and automation. Developed countries like the US, United Kingdom and Germany are expected to see the biggest impact with estimates suggesting robots will replace between 400 and 800 million workers by 2030.

Within the next five years, we're likely to see some impact from AI and automation technology. According to the World Economic Forum, nearly 50% of companies believe that automation technology will lead to a reduction in their workforce by 2022.

While these studies may sound like robots will replace humans, many think that welcoming robots into our workforce will simply change how we work. For example, the same study conducted by the World Economic Forum also showed that 38% of businesses believe AI and automation technology will allow employees to redirect their attention to more productive tasks and 25% of companies think automation will result in the creation of new roles.

"Producers will only automate if doing so is profitable. For profit to occur, producers need a market to sell to in the first place. Keeping this in mind helps to highlight the critical flaw of the argument: if robots replaced all workers, thereby creating mass unemployment, to whom would the producers sell? Because demand is infinite whereas supply is scarce, the displaced workers always have the opportunity to find fresh employment to produce something that satisfies



What is Artificial Intelligence (AI)?

Artificial intelligence is a machine or system that can be programmed to seek patterns, display self-learning by adapting through experience and self-selecting a choice from presented options.

AI is about mimicking human ability to think and do.



What is automation?

Automation is software that follows pre-programmed rules to run processes and is usually applied to monotonous and repetitive tasks.

If X = this, then Y.

Automation is about following orders and rules.

Image 2: Welcome to Industry 4.0

demand elsewhere." – Kallum Pickering, senior economist with Berenberg.

Everyday Artificial Intelligence examples

Whether we realize it or not, automation and AI is already in our everyday lives. Businesses use automation for admin tasks like sending out invoices or creating personalized customer emails. Healthcare professionals use AI to detect cancer from radiographs quicker and more efficiently. Most of us even have AI devices in our kitchens and living rooms and use them to play our favorite songs, bake a cake or order our shopping. Devices like Google Maps use machine learning to calculate the fastest route home based on previous traffic flow, Amazon suggests products we might like based on previous purchases and Netflix helps us find binge-worthy TV

shows based on our viewing habits. The options for incorporating AI and automation into our lives are truly limitless.

Personal and home assistants

Assistants like Siri from Apple, Alexa from Amazon, Cortana from Microsoft and Home from Google are becoming increasingly present in American homes. At last estimate, around 39 million Americans currently own a smart speaker, a 128% increase from last year!

These personal assistants use a 'natural language interface' which means that users can talk to the device as they would a human assistant and ask it to complete certain tasks or provide specific information like the weather or directions.

Devices are getting better at understanding human speech and

What are the benefits of AI and automation to business?



Productivity

By implementing automated systems and processes, the rate of production can be increased and run more efficiently with less down time or human error. Less time is spent on mundane and repetitive tasks and more time can be spent on more productive areas such as business development and strategy.



Safety

One of the major contributors to workplace accidents is human error of either tired or overstretched operators. Machines are not infallible but they do create a safer environment by performing tasks which can be hazardous if carried out without full concentration.



Cost savings

The obvious benefit of investing in automated processes are the huge cost savings for businesses. A machine or system can complete repetitive tasks more efficiently and thus reduce production costs. Also, people can be redeployed into tasks that have a higher return and which are of more value.



Innovation

Machines and systems are ideal to complete mundane and repetitive tasks and AI excels at analysis and logical self-learning. AI can't compete with the human brain for creative thinking and this is where people excel – a business that can free up resources for more time spent on research and development will benefit from an increase in innovation.

Image 3: A few things to think about before hiring a robotic workforce

some can even identify different users based on their voice. Advancements in voice recognition technology has made it secure enough for some banks to use 'my voice is my password' for telephone banking.

They're also getting better at understanding their owner's behaviors and offering relevant options based on previous responses

or habits. Like any good assistant, they aim to please and the more you work together, the better they can understand what you like and then adapt their responses accordingly. From taking over mundane tasks like managing finances to making restaurant reservations and ordering groceries, personal assistants can help us better manage our lives.

Self-driving cars

"One of the top causes of death for people is car accidents still and if you can eliminate that with AI, that is going to be just a dramatic improvement." – Mark Zuckerberg, Facebook

Driverless cars are already being tested by companies such as Google Waymo, Uber and Drive.ai while Otto, the world's first driverless truck, is currently delivering commercial freight in the Northwest and Daimlers' Highway Pilot Connect, an AI driving aid, makes it possible for trucks to platoon and drift off each other – something that's too dangerous when done manually.

Improvements still need to be made to self-driving software before it can become mainstream or upend our current distribution systems. Yet, the potential is certainly there, and we may soon live in a world where we no longer need to actually drive our cars.

Delivery robots

We've all heard about the gig economy. But, now instead of hiring cyclists to deliver food companies may hire robots. Delivery robots may soon come to a city pavement near you, especially in large cities like San Francisco and London. While these autonomous robots mostly deliver fast food and small orders, they could soon be used to deliver mail and run errands.

Personalized online content

AI is already innovating online, digital content. In fact, you've probably already read copy that's been written by a robot. Companies are already starting to employ AI copywriters. For example, The Washington Post uses robots to write their sports columns and Alibaba has a robot copywriter that can produce

20,000 lines of copy a second. AI bot Persado can generate personalized language and emotion for each and every customer, and Phrasee can write better email subjects than humans.

Chatbots

Chatbots have been around since the 1960s, but 'conversational agents' as automated customer service reps have only become common within the last few years. Rather than having a human available at all times, companies are using chatbots to answer customer queries.

There are two types of chatbots: automated and AI. Automated chatbots are pre-programmed and can only operate within a limited framework so can only answer set questions while AI chatbots use natural language processing to understand customer's requests and provide "smart" answers. Natural language processing allows AI-driven chatbots to comprehend the nuances of human language and mimic human speech to encourage customer conversations.

In addition to serving as a live-chat representative, AI-powered chatbots can also order food, make restaurant reservations, book flights and get recommendations. Companies like Starbucks, Wholefoods, The Wall Street Journal and Pizza Hut are just a few that use chatbots.

Personalized products and news feeds

Large customer-focused companies like Amazon, Netflix and Google use an algorithm to analyze previous actions or behaviors and then make specific, personalized recommendations. For example, Netflix uses the shows you've previously watched to suggest TV shows or movies you might also enjoy while Facebook and Google

also use AI to deliver tailored news feeds or search results based on your browser history.

In fact, the practice of using machine learning to discover customer preferences are so common you could regard them well and over exploited. However, this isn't really a new concept if you consider the fact that supermarkets have been scanning our consumer habits and offering unique vouchers for years.

Applications of Artificial Intelligence in business

While AI and automation technologies are becoming more common within society, the technology also holds significant potential for companies. Implementing such devices can free up employees from repetitive and mundane tasks so that they can focus on more profitable and innovative pursuits. Rather than getting bogged down in admin tasks, business owners can use the additional time to focus on developing and growing their companies.

Artificial Intelligence in HR

A 2018 Global Trends report from LinkedIn reported that 76% of recruiters and hiring managers believe that automation and AI will significantly impact the recruitment industry. AI applications are already being used within HR to streamline certain aspects of the hiring process. Recruiters spend a lot of their time screening large amounts of job applications or scheduling interviews, which distracts from their main goal of matching the right candidate to the right role.

AI technology, like Ideal – an intelligent screening software, can help recruiters to quickly and efficiently screen applications and identify those most suitable for the role. This application uses data

about current company employees' skill sets and characteristics that contributed to employee success to find the perfect candidate. It can even gather data about candidates from alternative sources like social-media profiles. Other AI applications within the recruitment industry include chatbots which are used to answer candidates' questions or provide feedback and interview software which can analyze answers to determine if they're the ideal candidate.

AI and Marketing

Marketers are already harnessing the power of AI to gain insights into their customers' behaviors and streamline key tasks. More than 50% of marketers already use an AI-powered platform and this figure is expected to grow by another 27% by 2019.

AI's mass adoption in marketing is not surprising when you consider its wide range of benefits. Robot copywriters can increase companies' ROI, click-through-rates, and at a lower cost than human employees. On the other hand, computer generated content can fulfil the mundane tasks, but it's not quite developed enough to replace the subtle nuance of wit, intellect and individual style of the human writer.

Industrial & Manufacturing Automation

Manufacturing is probably one of the earliest industries to adopt AI technology as industrial robots, designed specifically for manufacturing plants, have existed since the mid-20th century. Over the last fifty years, AI and automation technology have reduced accident rates and made manufacturing plants much safer. Today, they're used for dangerous tasks like welding as well as picking and packing.

Robots are particularly well-suited for manufacturing as they excel at repetitive tasks. When asked to complete the same task again and again, humans can easily become bored and distracted leading to poor products or even worse accidents. As such, robots can often perform these tasks better than their human counterparts.

As technology develops, industrial robots are gaining more capabilities like increased dexterity and reasoning skills. So much so that CNN predicts that by 2025, 45% of manufacturing jobs will be undertaken by robots.

AI in healthcare

Many areas of healthcare are already benefiting from AI. Artificial intelligence in healthcare can use AI algorithms to scan radiology images for cancerous tumors and can produce far more efficient readings than even the best radiologist. This technology has allowed doctors to shorten diagnostic timeframes, which means that patients can receive treatment much faster and subsequently have a higher chance of survival.

Within the healthcare industry, AI is being used to examine large datasets to understand and make informed decisions about diseases and help doctors create optimized treatment plans. Chatbots, in the form of Virtual Health Assistants, are also being employed to schedule appointments and reduce admin tasks at doctor offices. AI can even be used for at home care services like reminding patients to take their medication, answer basic medical questions and call an ambulance in an emergency.

Artificial Intelligence in education

Schools and other learning environments are adopting AI to create personalized learning methods to assist students; especially those

with learning disabilities. AI devices, like Intelligent Tutoring Systems, can analyze how the student processes and learn information. By using this information teachers can create a tailored plan to meet students learning needs. AI can also be used to streamline admin tasks, like grading papers, so teachers have more time to focus on what they do best.

As AI becomes integrated into more classrooms, the traditional classroom structure could be radically transformed. More efficient learning environments, tailored to meet each students' unique needs, may soon be possible. Leading to a world, where every student gets the help they need to do their best.

Artificial Intelligence in banking & machine learning in finance

Machine learning algorithms can be used to detect and prevent credit card fraud. AI devices scan card transactions to identify an "abnormal" activity and flag anything out of the norm. This is why your card often gets declined if you try to use it overseas or to purchase a big-ticket item.

AI systems are far more capable than humans in their ability to accurately detect fraud as robots are experts at scanning large amounts of data. As this technology evolves, it should reduce the number of false

declines which currently affect card users and businesses.

Financial service professionals can also use AI algorithms to conduct credit reports, process mortgage applications, manage money and transactions, and trade on the stock market. For example, Automated Trading Systems quickly analysis large amounts of data to create more in-depth and accurate insights into the stock market so that traders can make quicker decisions. Customers and accountants can access apps like Pegg to manage and automate financial transactions from any location, at any time.

Benefits of Artificial Intelligence

Like any emerging technology, AI and automation have a few drawbacks. One of the biggest barriers for SMEs when it comes to integrating this technology into their work processes is the initial cost. Some AI applications can be very expensive. However, as AI technology becomes more mainstream, costs should decrease, and specialist equipment should come with payment plan options.

Currently, AI and automation technology is also rather limited in capabilities. Robots are unable to handle complex human emotions, react appropriately to unexpected events or come up with creative solutions. As such, they're not suitable for all

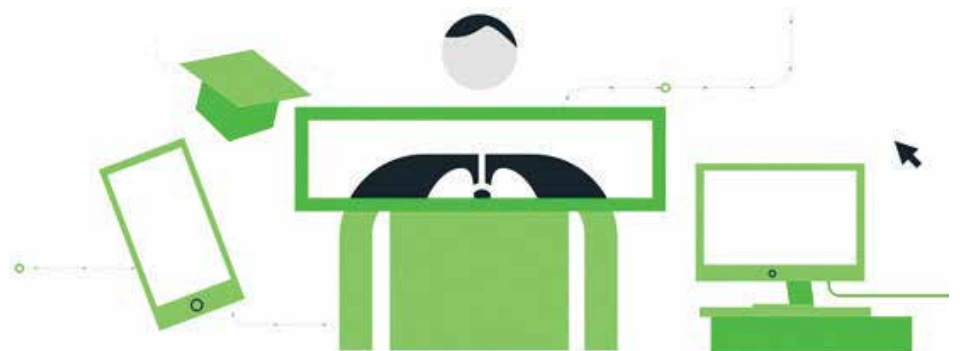


Image 4: Artificial Intelligence applications for businesses

business situations and companies should think carefully about how and where they use this technology. Most experts recommend striking a balance between robot and human employees, where robots are used to maximize and enhance humans' current capabilities rather than entirely replace them.

With so many benefits, it's not surprising that AI and automation is already being employed by many companies. One of the unique features of artificial intelligence is that it's extremely flexible and can be used for nearly every purpose imaginable. So, how do companies currently employ the technology?

Research from Narrative Science shows that almost 25% of companies use AI applications for predictive analytics, while 22% use it for machine learning (an algorithm that allows devices to "learn" based on data). Other uses include natural language processing, voice recognition, virtual personal assistants and chatbots, and diagnostics.

Regardless of the size of your company, there are ways that you can integrate AI applications into your daily business practices, often for free or at little cost.

Automated email

Platforms like Gmail use AI to give you reminders about emails that need to be followed up, while applications like MailChimp allows you to automate marketing campaigns and send tailored emails. The development of automated email platforms has dramatically changed the face of direct mail marketing and is an essential channel for any business to leverage.

Share documents

Especially important if you manage a global team, Google Docs and GSuite allow teams to collaborate on and share live-updates of documents. With more flexibility and agility in collaboration on documents, this facilitates the growing

trend of teams operating from remote locations.

Job applications

HR departments can streamline the recruitment process with Applicant Tracking Systems like SmartRecruiters or Zoho. These systems can scan through job applications and CVs to select candidates with the right experience, skills and know-how, giving recruiters more time to focus on interviewing potential candidates and focusing on finding the perfect person to fill the vacancy.

Invoicing and online accounting

As any business owner knows, balancing the books and creating invoices can be a time-consuming process. Software like Sage Business Cloud Accounting can make the process easier by automatically creating invoices and quotes, reconciling your bank accounts and tracking expenses. Saving you valuable time, which can instead be spent on financial planning and strategy.

Automated process tools

If none of the above options suit you, then you can create your own. If This Then That (IFTTT) is a powerful tool which allows you to create your own automated process, also known as Applets. Applets pair a wide range of platforms with IFTTT to streamline nearly any task. For example, you can create an automated time tracking Applet, automatically save email attachments to Google Drive, log calls on Excel, and much more.

Team management

Task management tools, like Basecamp, Trello, and Google Calendar, have become an integral part of any busy business. Automated team management platforms like Asana, Slack and Sage Business Cloud People are quickly

becoming included in this toolkit.

Asana helps manage remote teams by sending automated reminders and reports to keep everyone on the same page while Slack can automate team management tasks like scheduling team meetings or managing team communications. Sage Business Cloud People gives HR teams instant visibility into team performance so you can provide additional support when needed and address any potential issues before they become a problem.

Artificial Intelligence future in business

While many people worry that advancements in AI and automation technology will result in a loss of jobs, this isn't necessarily the case. Companies that want to adopt a robotic workforce should think carefully about areas where the technology could have the greatest results. Instead of completely replacing all human employees, often the best approach involves a collaboration of both.

Robots should work alongside human employees to improve human capabilities and help us create a world where businesses and humans benefit. A world where companies can reduce costs while humans focus on more meaningful and exciting career opportunities. Freeing us all from the mundane admin tasks of our current roles



Stacey McIntosh, editor-in-chief of Sage Advice UK, Sage

NVIDIA DeepStream on Jetson AGX Xavier

AI solutions for Video Analytics
& Robotics applications

Jetson AGX Xavier provides performance similar to a GPU workstation, with up to 32 TeraOPS (TOPS) of compute in an deployable, energy-efficient (15W to 30W) module. It's ideal for delivering resource-intensive autonomous AI Inferencing capabilities to Intelligent platforms.

The Developer Kit provides all the components and JetPack software needed to get up and running. It includes the Jetson AGX Xavier compute module, open-source reference carrier board, cooling solution and power supply. Multiple I/O ports are provided.

FEATURES

- > DeepStream SDK embedded AI vision system
- > Scalable, real-time video analytics for up to 30 FHD streams





Re-Defining Embedded Vision SMART IMAGING FOR THE VISION OF THINGS

› Darren Bessette, FRAMOS

Embedded Vision has been the buzz word in the imaging industry for quite a while. Unquestionably, there is a huge potential for Embedded Vision to change industries' business models, to take vision to the next level, and to allow devices to see and think in all industrial and consumer markets. But how is this different than the classic vision technology? How can all industries, virtually all devices and every thing, leverage and benefit from the embedded Vision of Things?

The Internet of Things (IoT) creates the swarm intelligence of holistic systems by connecting all devices among one another to interact accordingly. Embedded Vision technologies provide the eyes and brain power (AI) for autonomous decision making without any human interaction to empower the Vision of Things (VoT) to act intelligently within the Internet of Things.

What differentiates Embedded Vision from Classic Vision?

Regular vision systems are mainly built

with a camera that is connected to a host PC with a known data interface. The system is mostly separated into the machine that runs and the controlling process that does the inspection. The processing of the video stream and images are mostly outsourced and often needs user interaction for validation and/or decision making. A surveillance application may recognize people, but a security officer needs to validate any abnormal occurrence to determine if it is a threat that needs an immediate response. In comparison, a security based Embedded Vision application would be able to assess the threat, determine that the threat is a person of interest and alert the authorities to react accordingly. In this case, the vision technology inside of a device, a complete system with intelligent on-board processing, is able to provide an appropriate response without any human operator oversight. Embedded Vision is not only part of the device, it is its smart eye. In its entirety Embedded Vision minimizes or removes

human interactions within the imaging pipeline and allows machines to make their own decisions by capturing, analyzing and interpreting the data all-in-one.

From a developer's standpoint, classic vision systems were mostly made to support numerous verticals with a multitude of possible tasks to be programmed. This broad variety is the main reason for the large processing space requirements needed off-board. Embedded Vision tends to be more laser-focused in its applications, it is designed for a specific task. This "purpose-build" approach opens new possibilities and frees processing space to be used for neural intelligence algorithms. From the vision manufacturer perspective, he does not have to provide a one-fits-all product and cover all possible use cases, but can be specialized and focus his development on the "how" of a specific system which will be customized later by the OEM developer to satisfy his unique requirements.

Classic Vision

Separated system for capturing image streams and processing, outsourced analysis for decisions, made to support many possible tasks.

Embedded Vision

Fully integrated all-in-one system capturing image streams, on-board processing and interpreting data, autonomous decision making, resulting in an action. Made for a specific task.

How IoT applications benefit from Embedded Vision

Embedded Vision does not only take pass / fail or yes / no decisions based on some criteria, it provides a broader form of intelligence leveraging neural networks that massage and analyze the image data and information. Embedded Vision systems moves from pre-defined actions based on specific inputs to specific reactions to spontaneous situations, with real-time decision making and resulting activities. This is similar to how smart cameras work but allow for adaptation and expansion with evolving responses as more scenarios are encountered and evaluated. Also, the "smarts" are being deeply integrated into every kind of device, more and more. This creates new IoT devices that are more aware and better able to process inputs from their surroundings, further propagating how Embedded Vision is enabling more VoT devices.

Most industrial and consumer products are internet-aware today, exchanging data with one and other using local networks and the cloud. With the addition of vision, these devices will be controllable via eye tracking, face or gesture recognition. As an example, a refrigerator with embedded vision inside would be able to recognize what food has been consumed and then automatically add it to the family's online shopping list. Using intelligent embedded vision, security applications can count people, create heat maps,

or identify persons of interest and share the visual and analytics data within networks. When it comes to self-driving cars, embedded vision steers the vehicle within its lane on the road and avoid obstacles that may appear without any warning. This example highlights the importance of Embedded Vision in this application to not only to see but to understand the scene and react accordingly.

From a technical perspective, a smart embedded vision system not only recognizes defects or abnormalities based on pre-defined criteria, it is capable of determining an appropriate response to correct or avoid them. Embedded Vision provides a more comprehensive view of the world by recognizing, understanding and identifying the environment without further external interaction.

What is required for a fully embedded vision product?

It is all about efficiency. Embedded Vision brings vision technology to its simplest formula "capture, process, respond". The building blocks of a true embedded vision systems are:

- Sensor or Sensor Module
- Control unit to receive the images and direct them to the processing unit
- Processing unit that is either local or cloud based that provides the full image pipe line
- Purpose build algorithms and neural networks that provide the intelligent processing of the images

Embedded Vision requires more analysis and processing of the image data, so an embedded vision product



Figure 1: Embedded vision systems typically combine a camera, processing device and interface

typically includes back-end processing that is done on either an ISP or GPU. Intelligent algorithms running on these devices allow the machine to analyze the incoming video data, process them and interpret them to make decisions and react accordingly. Embedded vision products provide not only data but results based on this data.

"Embedded Vision does not have to be small but it has to be smart." – Darren Bessette

Typical embedded vision components come in small form factors, but this does not mean that they can only be used in small or low-cost devices. As with the example provided previously, self-driving cars are the exception to using embedded vision in small, low cost devices. A better way to think of embedded vision is to think of smart imaging that do not need human interaction to process and react to the video stream. Embedded Vision is enabling machines to see and think, powering the Vision of Things of the future.



Embedded vision examples: Home robotics, e. g. robot vacuum cleaners



Darren Bessette, Category Manager and machine vision expert, FRAMOS

Out Of the box

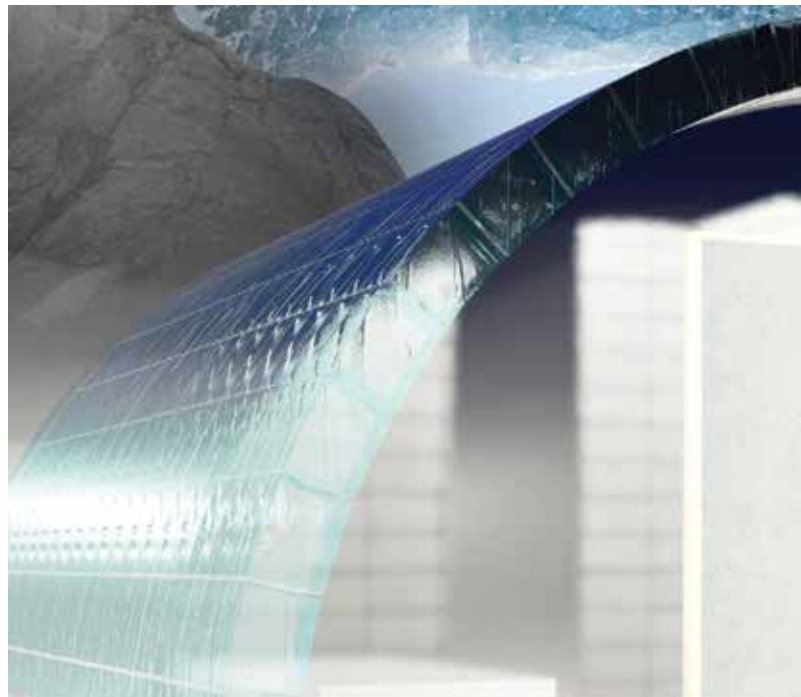
University students full of ideas for living on the moon

Students from 13 European universities, including EPFL, have joined forces to design a lunar habitat as part of IGLUNA, a project sponsored by the European Space Agency (ESA) and headed by the Swiss Space Center. The students' work will be put on display in June on a glacier in Zermatt

There's something romantic about the idea of living on the moon. But a huge number of human and technological challenges will have to be overcome first. These challenges are just what students from 13 universities in nine different European countries have been working on since the start of the academic year. They are members of a pioneering project called IGLUNA that is being run by the EPFL-based Swiss Space Center under the European Space Agency's ESA_Lab pilot project.

In mid-January – halfway through the project – the participants met up at CERN. All 19 teams, including four from EPFL, attended. In addition to providing progress reports, they were able to fine-tune their work thanks to discussions with the other teams. Their goal is to have a seamless fit among the systems they are developing, as they work together towards a common goal: to demonstrate the feasibility of creating a habitat in the ice of the moon's poles where astronauts could be housed for short- or long-term missions. The results of their year-long collaborative effort will be put on public display in June, in one of the cavities of the ice palace in the Petit Cervin glacier in Zermatt.

"This initiative is very inspiring," says Bernard Foing, the IGLUNA project supervisor. "Not only is it teaching people about space-related issues, it is also a platform for developing innovative technologies and solutions while laying the groundwork for a Europe-wide scientific collaboration. And it's really capturing the imagination of young people." In addition to his work on IGLUNA, Foing serves as an adviser to the ESA and is a professor at VU University in Amsterdam.



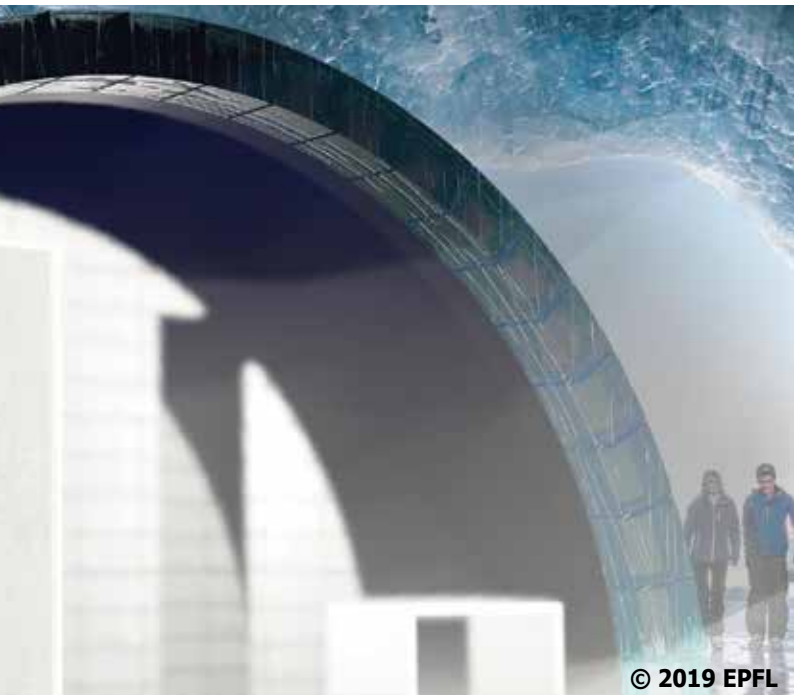
All aspects of human life

Creating a long-term habitat on the moon is fraught with challenges. "That's why this particular goal was selected," says Tatiana Benavides, project coordinator at the Swiss Space Center. "If you want to build a livable environment – especially one that's far from earth – you need to take into account all aspects of human life. This includes producing food, energy and oxygen, building shelter, providing tools and enabling communications."

At EPFL, a PhD student in materials science is exploring the possibility of printing 3D objects – such as an ice saw – within the habitat. A team of environmental engineering students from EPFL and UNIL are putting their heads together to come up with a long-lasting and self-operating greenhouse for growing vegetables. And students from EPFL's architecture and civil engineering program either have a hand in designing the habitat's structure – a vault made from carefully assembled blocks – or are part of a virtual reality team whose goal is to create an interactive virtual environment with indoor surroundings.

Teams at other universities are hard at work on their own

Out Of the box



tasks. They are developing oxygen and electricity production processes; a mechanism to grow algae; a system to use urine to fertilize plants; exercise facilities; a laboratory; a communications and control system; inflatable living modules; a robot to dig paths into the ice – and more.

“We have architects, biologists, computer scientists, geologists and engineers from all over Europe: it’s an extraordinarily multidisciplinary and multicultural project,” adds Benavides. “With this initiative, ESA’s goal is to encourage these young people to work together even though they live in different countries and study at different schools.”

The project

The nature of the project is to stimulate student education and exchange through an international, interdisciplinary, and collaborative project on the topic: “A Human Habitat in Ice: Demonstrating key enabling technologies for life support in frozen worlds”. The topics covered on the project go from the habitat conception and construction to life support systems, power management, communication and navigation, as well as human well-being and science. Within these topics, the teams

- each supported by their professors – are developing modules such as a greenhouse to grow food or an oxygen generator for life support. These 18 student projects shape together a human habitat in ice, which will be constructed and tested in a field campaign in Zermatt, Switzerland in June 2019.

The teams

Students apply their knowledge to solve a technological challenge, increasing in parallel the maturity of technologies relevant to the space domain. The following universities are implied in IGLUNA: ■ École Polytechnique de Lausanne EPFL, Switzerland ■ Eidgenössische Technische Hochschule Zürich ETHZ, Switzerland ■ University of Lausanne UNIL, Switzerland Elements to build IGLUNA 2 ■ Lucerne University of Applied Sciences HSLU, Switzerland ■ Zurich University of Applied Sciences ZHAW, Switzerland ■ Politecnico di Milano, Italy ■ RWTH Aachen, Germany ■ Tallinn University of Technology, Estonia • Technical University of Crete, Greece ■ University Politehnica of Bucharest, Romania ■ University of Strathclyde, United Kingdom ■ Warsaw University of Technology, Poland ■ VU Amsterdam, the Netherlands

The student teams met at ETH Zürich from 12-14 September 2018 for the IGLUNA kick-off event to mark the start of the student projects. During the event, the students got to know each other, worked together, learned about design thinking tools, developed their project descriptions and requirements, and presented their projects.

Field Campaign

The field campaign will take place at the Glacier Palace in Zermatt from 17-30 June 2019. During these two weeks, all the teams will meet, bring together their technologies, and present their demonstrators. Inside the glacier cave, the teams will build a 36m² human habitat. The Glacier Palace will be open to the public, and visitors will have the opportunity to observe the experiments.

IGLUNA, as a demonstrator pilot project, is aimed at supporting and accelerating the ESA_Lab initiative. The lessons learned from IGLUNA will help for the implementation of future ESA_Labs. The Swiss Space Center serves as coordinator for the events and main systems engineering activities.

Author: Sarah Perrin – Mediacom & The Swiss Space Center

Cypress Advances Premium Automotive Infotainment User Experience with Wi-Fi 6 Connectivity Solution

Cypress Semiconductor Corp. the embedded solutions leader, announced the expansion of its industry-leading wireless connectivity portfolio for automotive infotainment with a trio of new products. The Wi-Fi® and Bluetooth® combo chipsets and supporting software serve as application development platforms that enable multiple users to connect and seamlessly stream unique content to as many as 10 mobile devices simultaneously. The new infotainment platforms include a Wi-Fi 6 (802.11ax) and Bluetooth combo solution that features Cypress' Real Simultaneous Dual Band (RSDB) architecture. RSDB has become the de facto standard for premium connected infotainment experiences, enabling two unique data streams to run at full throughput simultaneously by integrating two complete Wi-Fi subsystems into a single chip. Wi-Fi 6 enables gigabit-level throughput and improves reliability for content streaming to multiple devices at once.

Cypress also added two Wi-Fi 5 (802.11ac) and Bluetooth combo solutions to its portfolio, empowering car makers and automotive system suppliers with a scalable platform solution to address a wide range of vehicles with a uniform software architecture that minimizes development and system integration costs.

"Car makers are looking to provide multi-user access and media streaming in their vehicles that is comparable to a premium personal media experience at home; Cypress offers the industry's only product lineup designed specifically for automotive infotainment with a platform approach for suppliers and OEMs to use our low-, mid- and high-end solutions to cover the range from economy to luxury vehicles," said Brian Bedrosian, vice president of marketing for the IoT Compute and Wireless Business Unit at Cypress. "Software development for automotive wireless connectivity use-cases is becoming increasingly complex. Our scalable platform enables the sharing of software development costs across infotainment systems for various models. These new solutions demonstrate our drive to integrate leading-edge technology as part of our focus on bringing world-class Internet of Things connectivity to our customers across markets."

Premium infotainment systems require high-throughput, multi-role, concurrent operation to implement wireless

mirroring for applications such as Apple® CarPlay, Android Auto and Mirrorlink. Cypress' Wi-Fi and Bluetooth combo solutions meet these needs and also offer simultaneous Wi-Fi Hotspot and content access, and multi-band/multi-radio coexistence for video and Bluetooth audio. The Cypress CYW89650 2x2 plus 2x2 Wi-Fi 6 and Bluetooth 5.0 combo solution delivers more than 1Gbps throughput, and the RSDB architecture enables concurrent operation for these use cases in high-performance infotainment systems without audio or video degradation. The new CYW89459 2x2 Wi-Fi 5 and Bluetooth 5.0 combo with RSDB builds on the success of Cypress' existing automotive Wi-Fi 5 solutions, enabling more connected devices to the head unit and including emerging features such as WPA3 security, Wi-Fi Location™ and Wi-Fi Aware™. Together with the new cost-effective CYW89373 1x1 Wi-Fi 5 and Bluetooth 5.0 combo, the portfolio provides mass market to luxury class vehicles with advanced wireless performance and medium coexistence management for an uninterrupted entertainment experience.

Cypress' automotive wireless solutions are fully automotive qualified with AEC-Q100 grade-3 validation. Cypress' existing solutions have been designed in by numerous top-tier car OEMs and automotive suppliers and are in production vehicles today supporting infotainment and telematics applications such as smartphone screen-mirroring, content streaming and Bluetooth voice connectivity in car kits. More information on Cypress' automotive wireless solutions is available at <https://www.cypress.com/products/automotive-wireless>.

Cypress is demonstrating its automotive wireless solutions, along with its full portfolio of embedded systems solutions for automotive systems and the IoT, here at CES 2019 in South Hall 2 of the Las Vegas Convention Center in meeting room MP25776.



Renesas Electronics Launches Digital Isolators with Superior Radiation Performance for Small Satellites in Low Earth Orbit

Renesas Electronics Corporation, a premier supplier of advanced semiconductor solutions, introduced two plastic packaged, radiation-tolerant digital isolators that provide the highest isolation protection (2,500VRMS) from high voltage spikes in power supply stages and serial communications interfaces used in low Earth orbit (LEO) Small Satellites (SmallSats). Private "New Space" companies plan to launch thousands of SmallSats forming large constellations that operate in multiple LEO planes. SmallSat mega-constellations provide ubiquitous broadband Internet of Things (IoT) communications anywhere across the globe, and Earth observation high-resolution imaging for sea, air, and land asset tracking.

The passive input ISL71610M and active input ISL71710M offer superior performance across key electrical specifications, including isolation voltage, data rate, common mode transient immunity, propagation delay, quiescent current, and dynamic current. Renesas' Giant Magneto Resistive (GMR) digital isolators are ideal replacements for optocouplers that are susceptible to cloudy optics from total ionizing dose (TID) radiation. Both GMR isolators also out-perform transformer-based digital isolators that experience electromagnetic interference (EMI) due to radiated emissions from edge and dipole radiation. The Renesas GMR digital isolators are characterization tested at a total ionizing dose (TID) of up to 30krads(Si), and for single event effects (SEE) at a linear energy transfer (LET) of 43MeV•cm²/mg.

In isolation partitioned power supply designs, the ISL71610M and ISL71710M provide an instantaneous 2.5kVRMS of isolation and 600VRMS continuous working voltage at 85°C. In serial communications subsystems that need the transmitter and receiver electrically isolated from each other, the ISL71610M operates up to 100 Mbps, and the ISL71710M up to 150 Mbps. Both offer the New Space industry's highest data rates—6x higher than competitive solutions—which make them ideal for serial communications links, such as RS-422, RS-485, and Controller Area Network (CAN). The ISL71610M and ISL71710M both have significantly lower quiescent current than the competition, and the ISL71710M has nearly 4x lower dynamic current than

Class V isolators.

"The ISL71610M and ISL71710M use a GMR inductive structure that is inherently immune to radiation effects, and build on Renesas' six decades of spaceflight experience," said Philip Chesley, Vice President, Industrial Analog and Power Business Division, Renesas Electronics Corporation. "GMR makes our space-grade digital isolators more desirable than optical-based designs, and Renesas' radiation-tolerant plastic flow provides the optimal cost versus radiation performance in comparison to Class V isolators."



Custom tailored Micro Coax Cables for high Speed Transmission

High resolution displays, CCD-Cameramodules and internal wiring often require special connections due to high datarates. ElectronAix delivers custom tailored cable assemblies with micro coaxial connectors and -wires to meet individual customer request, no matter if length, binding, connection or a mixed assembly of micro coax, twin coax or discrete wires. Also extended length >2m is possible.

High data rates in electronic designs challenge designers. For example in IPCs two PCB might be connected by a cable assembly. Once it comes to PCI express signals, standard assemblies are no more capable. But also other applications require data rates of sometimes 10Gbit/sec. and more.

ElectronAix is focused on the design and production of custom solutions. Customers define connector, length and binding and ElectronAix produces following this request.

Peter Stremmer, founder of ElectronAix has a strong focus on customer satisfaction: "A good performance for this type of cables can be only achieved, when the manufacturing process follows exactly the requirement

of the connector. We manufacture 100% following the requirements of customers and connector makers, even when it's 20 pages to be regarded."

ElectronAix auto solders a wire range from AWG46 to AWG32. Mixed assemblies with micro coax, twin coax and discrete wires are possible but must be checked case by case. We can process all kind of micro coaxial connector from 0,25mm to 0,5m pitch.

The production is TS16949 and from I-Pex approved. Most steps are automated for high reliability and stability.

Additionally we can make a TDR-test for first articles or AQL-based to proof the performance of our cables.



ROHM provides automotive-grade wireless charging solution with NFC communication

ROHM has recently announced the development of an automotive wireless charging solution with integrated NFC communication. This solution combines ROHM's automotive-grade (AEC-Q100 qualified) wireless power transmission control IC (BD57121MUF-M) with STMicroelectronics' NFC Reader IC (ST25R3914) and 8-bit microcontroller (STM8A series). In addition to being compliant to WPC's Qi standard supporting EPP (Extend Power Profile) that enables the charger to supply up to 15W of power, the multi-coil design enables a wide charging area that provides some spatial freedom in vehicle applications (2.7x greater charging range vs single coil configurations). This means that consumers do not need to worry much about exactly aligning their smartphones to the provided charging area in order to be able to charge wirelessly.

Wireless charging technology, commonly used in portable devices such as smartphones to improve the safety and resistance to water and dust of connectors, is seeing increased adoption in infrastructure applications

including vehicles, hotels, airports, cafes, and similar public locations. At present, Qi, the most popular standard, has already been adopted by the European Automotive Standards Group (CE4A) as the charging standard in vehicles, and by 2025 it is predicted that most cars will be equipped with Qi-based wireless chargers.

Meanwhile, NFC communication provides user authentication to allow Bluetooth/WiFi communication with infotainment system, lock/unlock the doors, and allow engine start. NFC also enables vehicle setting customization for multiple drivers such as seat and mirror positioning, infotainment pre-sets, and navigation destination pre-sets.

A reference board integrating this solution will be exhibited at the 11th International Car Electronics Technology Show at Tokyo Big Sight from January 16-19, 2019. In the future ROHM plans on releasing a sample reference board that will allow users to easily configure a wireless charger for automotive use compatible with the latest Qi standard (EPP), when combined with our Qi certified receiver board (BD57015GWL-EVK-002) already on the market,

ROHM is committed to develop solutions that will enable greater convenience and performance for the rapidly expanding wireless charging market.

Availability: February (The reference board), April (BD57121MUF-M)



IoT Provider Increases Location Services Accuracy 3X Using New Bluetooth 5.1 Direction Finding Feature

Silicon Labs releases new Bluetooth® software for the Wireless Gecko portfolio, the industry's most comprehensive connectivity solution for the Internet of Things (IoT). Silicon Labs' commercial, industrial and retail customers can enhance their location-based

services, such as indoor navigation, asset tracking, space utilization and point-of-interest engagement, using the direction finding feature added to Bluetooth in version 5.1 of the Bluetooth Core Specification.

To help meet the growing demands of the location services market, Bluetooth has added a new direction finding feature, allowing devices to determine the direction of a Bluetooth signal. The new feature supports multiple methods for determining signal direction including angle-of-arrival (AoA) and angle-of-departure (AoD), and Silicon Labs' implementation of the new Bluetooth feature enables detection of signal direction within 5 degrees. To date, Bluetooth asset tracking and indoor positioning solutions have typically provided location accuracy within a range of 3-4 meters. With the Silicon Labs Bluetooth 5.1 solution, developers can create products that improve location accuracy down to the sub-1-meter level, opening the door to applications previously not possible.

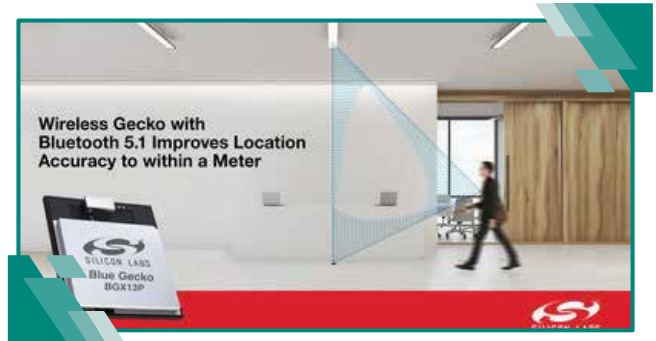
"The Silicon Labs Bluetooth direction finding solution provides a huge leap in location services accuracy for the industry," said Matt Johnson, Senior Vice President and General Manager of IoT products at Silicon Labs. "The combination of the Silicon Labs wireless solution and the new features added in Bluetooth 5.1 will help developers transform industries and improve people's lives."

In addition to improved location services, Bluetooth 5.1 also helps developers:

- Reduce power consumption with sleep clock accuracy updates
- Improve smart home connection performance using GATT caching functionality
- Optimize beaconing for Bluetooth mesh in crowded RF environments with the advertisement channel index feature

"The Bluetooth community continues to find ways to meet evolving market needs and open new opportunities," said Mark Powell, Bluetooth SIG Executive Director. "The addition of Bluetooth direction finding demonstrates this commitment to drive innovation and support the incredible growth opportunity within the location services market."

Silicon Labs' direction finding software, including support for the AoA method, is available today to selected customers through the Silicon Labs Simplicity Studio development kit.



T-Contact Products From Harwin Now Available Globally via Digi-Key, Mouser and TTI Channels..

Following on from the release of its narrow-pitch T-Contact offering last year, Harwin has now secured supply chain support from leading distributors Digi-Key, Mouser and TTI.

Intended for incorporation into Harwin's flagship Datamate series, each T-Contact makes use of an innovative 6-finger mechanical design, which has been machined out of a single piece of Beryllium Copper. Consequently, these compact and lightweight female contacts are able to deliver up to 8.5A in a 2mm pitch high-reliability connector – thereby boosting the current carrying performance of the previous generation of Datamate contacts by 250% and setting a new benchmark for the industry as a whole.

In addition to its elevated conductive properties, Beryllium Copper exhibits considerably greater spring performance than conventional connector contact materials (such as brass or phosphor bronze). Consequently, Harwin's T-Contacts are able to endure 1000 mating cycles. Thanks to their gold plating, they have heightened levels of operational robustness – with a working temperature range of -55°C to +125°C, 100G shock resistance and vibrational resilience of 40G (390m/s²) for 6 hours. This means that they are suitable for deployment in even the most uncompromising of application environments.

"The longstanding relationships that we have with Digi-Key, Mouser and TTI have been instrumental in the company's continued growth – enabling us to address key markets all over the world," states Giorgio Potenza, Strategic Market Manager at Harwin. "Now, through the assistance of these highly-valued distribution partners, and the extensive commercial reach that

they command, we can explore opportunities for our improved T-Contact-based Datamate connector portfolio in areas like unmanned vehicles, avionics and satellites.”

“The T-Contact presents a unique proposition to engineers. Because of our proprietary one-piece design, the constituent materials can be significantly thicker, thus reducing the overall contact resistance and increasing conductivity, as well as allowing enhanced thermal properties to be benefitted from,” adds Ridhwan Islam, Field Applications Engineer, Harwin.



ETHERTRONICS®, AN AVX GROUP COMPANY, ANNOUNCES NEW PORTABLE MILLIMETER WAVE MEASUREMENT SYSTEM

AVX Corporation, a leading manufacturer and supplier of advanced electronic components and interconnect, sensor, control, and antenna solutions, announced that Ethertronics, an AVX Group Company, has released the new Ethertronics® ETH-MMW-1000 Millimeter Measurement System: a compact, cost-effective, extremely accurate, and easily adaptable portable solution for testing 5G antennas and other devices at millimeter wave (mmWave) frequencies. Suitable for all mmWave system development and validation — including 5G communications, telecom industry research and development, university research, and other mobile communications and mmWave device testing — this new modular, mobile, far-field measurement solution offers a shielded environment to ensure stable measurement results over a wide frequency range, requires no up or down frequency conversion to ensure excellent phase stability and accuracy, and is easy to install and relocate within both new and existing laboratory and production environments.

The ETH-MMW-1000 Millimeter Measurement System is a fully anechoic aluminum enclosure on a mobile

chassis with steerable lifting wheels that enable quick and easy relocation and provide optimal stability during measurements. It is equipped with sliding doors for easy access to the center of the system and the device under test (DUT), as well as a distributed axis positioning system that is comprised of a height-adjustable, PVC, azimuth mast rotator that rotates the DUT about the Phi axis and a Theta ring positioner that elevates the measurement horns around the DUT.

Designed to accommodate various device sizes, weights, and form factors, the system is available with several mechanical interfaces for the mast, including a 300mm-diameter half-sphere with dedicated notches that allow users to easily position DUTs, such as tablets and phones, both horizontally and vertically. Standard system components also include a slip ring within the mast that allows users to bring both power and digital control signal to the DUT, a rectangular horn antenna, rubberized absorbers, an integrated gigahertz control unit, and an assembled RF path comprised of high-performance cables, rectangular waveguides that minimize path losses and ensure maximum measurement accuracy, measurement horns, amplification stages, and switches. No up or down frequency converter is used on the RF path to ensure excellent phase accuracy and stability. The Millimeter Measurement System also includes an integrated computer complete with Ethertronics Antenna Measurement software for measurement control and data acquisition and Ethertronics Antenna Viewer software for post-processing and tabular or graphical data output. In addition, each system comes with installation, training, and warranty services. Optional components and services include calibration kits, custom mast and interface materials and designs, and post-warranty service plans.

The Millimeter Measurement System can perform passive antenna testing, active signaling, and non-signaling testing with complete devices and is compatible with most vector network analyzers (VNAs), spectrum analyzers, and communication testers manufactured by Keysight Technologies, Rohde & Schwarz, and Anritsu. “Designed with both current and future application utility in mind, the new ETH-MMW-1000 Millimeter Measurement System leverages Ethertronics’ antenna design, manufacturing, and testing expertise, an array of quality components, and a space-efficient but comprehensive and effective modular, mobile design

to deliver maximum performance and an optimal user experience when testing 5G antennas and other electronic devices at millimeter wave frequencies extending from 18GHz to 75GHz and beyond,” said Olivier Pajona, chief scientist and general manager at Ethertronics, an AVX Group Company.

Ethertronics’ ETH-MMW-1000 Millimeter Measurement System employs far-field, spherical technology with myriad measurement capabilities, including oversampling, gain, directivity, efficiency, beam width, cross polar discrimination, 3-D radiation pattern, radiation pattern in any polarization, effective isotropic radiated power (EIRP), total radiated power (TRP), effective isotropic sensitivity (EIS), and total isotropic sensitivity (TIS). Each measurement frequency has a dedicated path associated with a common amplification stage, but combinations of several mmWave frequency bands, including 18–26.5GHz, 26.5–40GHz, 33–50GHz, 40–60GHz, 50–67GHz, and 50–75GHz, are possible. The number of measurement probes can also be optimized to hasten measurement time. The system requires a minimum of two measurement probes to cover H and V polarizations, but can accommodate up to 12 probes on the ring positioner.

The mobile Millimeter Measurement System is compatible with test devices up to 45cm in size and 10kg in weight. Lead-time for the Millimeter Measurement System is currently three months.



TE Connectivity extends M12 portfolio with the L-code PCB/panel-mount power connectors

TE Connectivity (TE), a world leader in connectivity and sensors, has extended its portfolio of M12 connectors to include L-code PCB/panel types that offer a compact high-power solution for automation devices.

“Our new connectors take up 40 percent less space than Mini 7/8 connectors traditionally used for high power connections, allowing for more freedom and flexibility when designing machines and systems,” says Ruud van den Brink, TE’s product manager, Industrial Communication Europe. He points out that M12 L-code power connectors, an extension of the current M12 IEC standard, have been selected by PROFINET user organization PROFIBUS & PROFINET International as the standard for 24-volt power supply systems used in PROFINET devices.

The new connectors handle currents as high as 16A per pin – the highest in TE’s M12 family – providing reliable and efficient power distribution. They are IP67 rated, which means they are protected from dust and resist water immersion at depths of up to one meter for 30 minutes.

L-code PCB/panel-mount M12 power connectors are available through TE’s global distribution network, which provides customers with short lead-times and fast responses for technical support.



Toshiba Memory Europe Unveils Industry’s First UFS Ver. 3.0 Embedded Flash Memory Devices

Toshiba Memory Europe GmbH (TME) has started sampling the 128GB[1] version of the industry’s first Universal Flash Storage (UFS) Ver. 3.0 embedded flash memory devices. The new line-up utilizes the company’s cutting-edge 96-layer BiCS FLASH™ 3D flash memory and is available in three capacities: 128GB, 256GB and 512GB[2]. With high-speed read/write performance and low power consumption, the new devices are ideal for applications such as mobile devices, smartphones, tablets, and augmented/virtual reality systems. Consumers continue to demand increasingly higher

performance and an improved user experience from their devices, and the UFS standard is constantly being refined in order to support this evolution. Due to its serial interface, UFS supports full duplexing, which enables both concurrent reading and writing between the host processor and UFS device. With the introduction of UFS 3.0, JEDEC, the global leader in the development of standards for the microelectronics industry, has enhanced previous versions of the UFS standard to help product designers enable significant improvements in mobile devices and related applications.

The new devices integrate 96-layer BiCS FLASH™ 3D flash memory and a controller in a JEDEC-standard 11.5 x 13mm package. The controller performs error correction, wear leveling, logical-to-physical address translation, and bad-block management for simplified system development.

All three devices are compliant with JEDEC UFS Ver. 3.0, including HS-GEAR4, which has a theoretical interface speed of up to 11.6 Gigabits per second per lane (x2 lanes = 23.2Gbps) while also supporting features that suppress increases in power consumption. Sequential read and write performance of the 512GB device are improved by approximately 70 percent and 80 percent, respectively, over previous generation 256GB Toshiba devices.

Toshiba was the first company to introduce UFS devices and has been shipping since 2013. The introduction of these UFS Ver. 3.0 devices maintains Toshiba's leadership position in storage for next generation mobile devices which they will continue through driving further advances.

Samples of the new devices will be on show at Toshiba's booth (Hall 3A – 424) at the Embedded World 2019 Exhibition and Conference (26-28 February – Nuremberg, Germany).



Rohde & Schwarz strengthens its monitoring and IP contribution business fields by integrating GMIT GmbH

In 2010, Rohde & Schwarz expanded its product line by adding software based, cloud-enabled solutions from GMIT GmbH. The next logical step has now been taken – to fully integrate the subsidiary into the parent company. In doing so, the company is following its strategic goal of offering digital products as a service. The key products R&S PRISMON and R&S RelayCaster will be transferred to Rohde & Schwarz and marketed through a broader global service and sales network as well as through a partner network. "We have been working on this shift towards digital products for some time and now have the right organization to focus more on this market," emphasizes Hannes Strobel, Vice President Monitoring & Headend.

All GMIT GmbH employees will be taken on by Rohde & Schwarz GmbH & Co KG until the integration is completed and will remain the contacts for this product area. All contractual obligations and warranties vis-à-vis partners and customers remain in effect.

The R&S RelayCaster IP contribution solution helps ensure the reliable feed and distribution of live A/V content via unmanaged IP networks, which is especially advantageous for providers with large networks.

The R&S PRISMON monitoring and multiviewer solution for broadcast and streaming media provides a single platform for automatic, convergent monitoring of media content transported in networks.



Fast-Recovery Super-Junction MOSFETs from STMicroelectronics Bring Superior Performance to Bridge and ZVS Converters

STMicroelectronics' MDmesh™ DM6 600V MOSFETs contain a fast-recovery body diode to bring the

performance advantages of the Company's latest super-junction technology to full- and half-bridge topologies, Zero-Voltage Switching (ZVS) phase-shift converters, and applications and topologies generally that need a robust diode to handle dynamic dV/dt .

Leveraging ST's advanced carrier-lifetime control technology, the MDmesh DM6 MOSFETs have reduced reverse-recovery time (t_{rr}) to minimize power dissipation in the diode when turning off after freewheeling. Recovery softness is optimized to enhance reliability. In addition, very low gate charge (Q_g) and on-resistance ($R_{DS(ON)}$), together with a capacitance profile tailored for light loads, allow higher operating frequencies and greater efficiency, with simplified thermal management and reduced EMI.

Ideal for equipment such as charging stations for electric vehicles, telecom or data-center power converters, and solar inverters, the new devices enable superior energy ratings with more robust performance and increased power density.

Part of the STPOWER™ portfolio, the MDmesh DM6 family comprises 23 part numbers covering current ratings from 15A to 72A, with gate charge (Q_g) ranging from 20nC to 117nC and $R_{DS(ON)}$ from 0.240Ω down to 0.036Ω respectively. The choice of popular power package options includes the new low-inductance leadless TO-LL, PowerFLAT 8x8 HV, D2PAK, TO-220, and TO-247 with short leads, long leads, or Kelvin pin for applications requiring precision current sensing.

The MDmesh DM6 family is in production now. Please contact your local ST office for pricing and sample requests.

600V MDmesh™ DM6 fast-recovery MOSFET
 advanced carrier-lifetime control technology

Samsung Introduces New Ultra-Slim 20Mp ISOCELL Image Sensor for Full-screen Display Smartphones

Samsung Electronics, a world leader in advanced

semiconductor technology, introduced its smallest high-resolution image sensor, the ISOCELL Slim 3T2. While being the industry's most compact image sensor at 1/3.4 inches (approximately 5.1-millimeters diagonally), the $0.8\mu\text{m}$ -pixel ISOCELL Slim 3T2 delivers 20-megapixel (Mp) resolution for both front and back cameras in today's sleekest mid-range smartphones.

"The ISOCELL Slim 3T2 is our smallest and most versatile 20Mp image sensor that helps mobile device manufacturers bring differentiated consumer value not only in camera performance but also in features including hardware design," said Jinhyun Kwon, vice president of System LSI sensor marketing at Samsung Electronics. "As the demand for advanced imaging capabilities in mobile devices continue to grow, we will keep pushing the limits in image sensor technologies for richer user experiences."

With 20-million active $0.8\mu\text{m}$ -sized pixels, the ISOCELL Slim 3T2 not just provides excellent clarity and detail. It also offers high color fidelity by adopting Samsung's

SYSMOP
Technologies

From idea to product
 Research | Development | Verification | Manufacturing

Design & Implementation

- Requirements definitions
- Initial concept design
- Final design (Hardware, Software and mechanical design)

Project Management

- Project planning
- Project control and management

Startup support

- Project management
- Feasibility testes
- Project design

Test & Manufacturing

- Verification testes
- Validation test support
- Test fixture design and manufacturing.

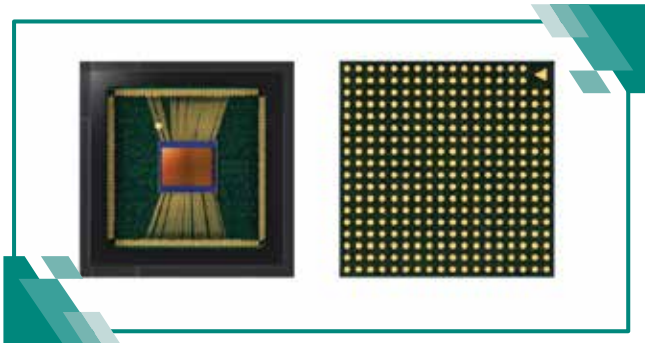
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ISOCELL Plus technology that enables sensors to capture and absorb more light information for accurate color reproduction even with sub-micrometer-sized pixels.

In order to support smartphones with the latest display features such as the 'hole-in display' or 'notch design,' front-facing image sensors need to minimize their size while being able to capture high-quality images. The 1/3.4-inch 3T2 snugly fits into a tiny module making more space for the display. In addition, Samsung's Tetracell technology, which merges four pixels to work as one, lets the 3T2 take brighter and sharper pictures in low-light settings as the color filter array's light sensitivity increases to that of a 1.6µm-pixel image sensor at 5Mp resolution.

When applied in rear-facing multi-camera settings for telephoto solutions, the 3T2 adopts an RGB color filter array instead of Tetracell technology. The small size of the image sensor also reduces the height of the tele-camera module by around seven percent when compared to Samsung's 1/3-inch 20Mp image sensor, allowing more elegant smartphone designs. Compared to a 13Mp sensor with the same module height, the 20Mp 3T2 retains 60-percent higher effective resolution at 10x digital zoom that presents clearer and more accurate results.

The Samsung ISOCELL Slim 3T2 is expected to be in mass production in the first quarter of this year.



First motorised luminaire with Dynamic Beam Shaping and smart wireless controls

formalighting, a leader in motorised architectural lighting products, has introduced luminaires that make aiming, directing, and shaping light easier and faster to configure and adjust. Working together with LensVector, a specialist in Dynamic Beam Shaping™

technology and Casambi, the market-leading developer of wireless lighting control systems based on Bluetooth Low Energy (BLE), formalighting's new luminaires prove the longstanding expectation, that solid-state lighting capabilities will exceed those of the previous generation of light sources.

Michael Monsonogo, General Manager of formalighting, commented: 'We are delighted to be introducing the world's first motorised luminaire with LensVector's Dynamic Beam Shaping and Casambi's smart wireless control technology. We believe in utilizing the most exciting new technologies to address the design challenges faced by lighting professionals.'

For the first time, lighting designers and electrical consultants can effortlessly add new lighting effects to projects by using the new fixtures in formalighting's MOTOLUX range. The integrated technology within the motorised luminaires offers smart control over the beam angle, movements of the fixture, as well as the intensity and the white colour tuning of the light.

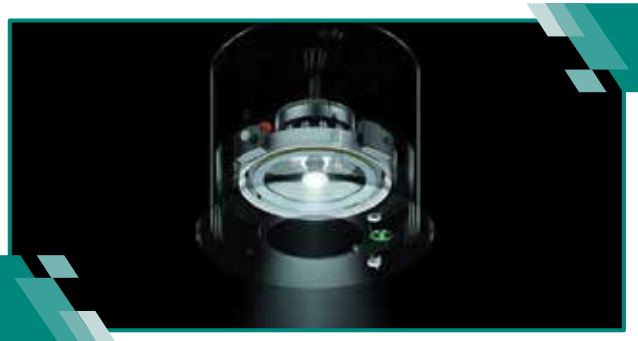
LensVector's Dynamic Beam Shaping technology turns liquid crystal molecules into a series of modifiable micro-lenses. The technology delivers unmatched precision beams and dynamic dramatic effects. It allows the beam from MOTOLUX luminaires to be adjusted along a continuum from a less-than-ten-degree narrow spot angle to a very wide 50-degree flood, flowing fluidly through all the all points in between.

Casambi's wireless control technology enables lighting designers to take advantage of the full featured professional lighting control platform Casambi provides as well as the fast-growing range of 'Casambi ready' control devices (including sensors and switches) from an ever-growing list of leading manufacturers.

Brent York, President and CEO of LensVector, commented: 'The marriage of great design and technology allows MOTOLUX users to precisely control the beam of light in a simple and convenient manner via Bluetooth app on their smartphone. We're excited to see how the LensVector technology is being applied to add value to LED luminaires.'

Casambi's CEO Timo Pakkala commented: 'Casambi's market-leading position in wireless lighting control is demonstrated by this innovative lighting collaboration with formalighting and LensVector. MOTOLUX is part of the growing community of Casambi-ready connected luminaires and supporting digital devices for professional lighting schemes used in retail stores, art

galleries, restaurants and hotels, among other venues. Created for environments needing frequent scene changes, MOTOLUX motorised fixtures will quickly and easily re-configure a space to meet the demanding requirements of end users. Eliminating the need for ladders and scissor lifts, the MOTOLUX range of track, pendant and recessed fixtures can pan and tilt, dim to warm and change colour temperature on command. They can be controlled individually or in groups with no special equipment, giving users a level of control and time savings that translate to cost savings.



60 mm thyristor modules from Infineon Technologies Bipolar combine right fit functionality with proven reliability

Infineon Technologies Bipolar GmbH & Co. KG has redesigned the product portfolio of 60 mm thyristor/diode modules with pressure contact technology. The new Eco Block family addresses the demand for cost-efficient larger modules for battery chargers, static and bypass switches and windmills. Additionally, the modules are a perfect fit for soft starters as well as rectifiers for drives and uninterruptable power-supply (UPS). Due to its higher junction temperature, they are aiming at applications with air-cooled designs.

The Eco Block modules feature all essential functions and make use of the pressure contact technology while stripping down costly extras. They provide best-in-class thyristor and diode blocking stability leading to high reliability and an outstanding lifetime. The pressure contact technology guarantees a short-on-fail feature, which in return prevents arcing. This allows for simplified safety designs in terms of unit shielding and fusing effort. Infineon Technologies Bipolar offer the new 60 mm modules with a high overload capability. Combined, these features help to minimize failure rates and reduce system cost. With its proven reliability and

functionality, the Eco Block offers the best value for money for a 60 mm pressure contact module in the market.

Availability

The new 60 mm Eco Block family with pressure contact technology is available in high quantities. All modules are offered in the topologies thyristor/thyristor and thyristor/diode with a blocking voltage of 1600 V or 2200 V and in current ratings from 420 A to 630 A. Additional module types in 70 mm are planned for release in the course of 2019. For an optimized performance and keeping customer's production fast and clean, the next portfolio extension will be pre-applied Thermal Interface Material (TIM). More information about Infineon's Eco Block family is available at www.infineon.com/ecoline.



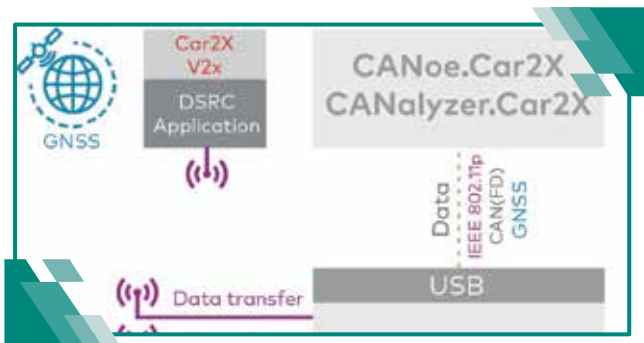
First Network Interface for Car2x/V2X Communication

Vector is presenting the VN4610 network interface – its first special solution for IEEE-802.11p and CAN-(FD) based applications. As an interface to the CANoe.Car2x test tool, the interface advances 802.11p-based ECUs to production readiness quickly.

The VN4610 is a network interface with a USB interface for accessing IEEE-802.11p and CAN-(FD) networks. Users benefit from the ease of receiving and sending IEEE-802.11p messages in implementing their Car2x-/V2X applications. The received IEEE-802.11p messages are transferred to the application time-synchronous to the CAN-(FD) messages. The built-in GNSS receiver provides the GNSS time and the current GNSS position. The VN4610 satisfies all technical hardware requirements for safely testing DSRC applications over IEEE-802.11p radio channels. It routes all received messages from the two radio channels, unfiltered, to a test tool such as CANoe.Car2x for analysis. The

advantage for the developer is that messages can be analyzed which would be rejected by an ECU due to timing, geo information or Car2x/V2X protocol errors. In addition, latency measurements can also be performed because the time stamps of messages are synchronized to the bus channels.

In interplay with the CANoe.Car2x test tool, the VN4610 offers a tuned solution for creating an environment simulation for testing Car2x/V2X applications. The user uses the VN4610 interface to send the transmitted messages and configures the communication parameters for the various tests – easily and individually.



Dual-Radio Bluetooth®/LPWAN IoT Development Kit from STMicroelectronics Enables Creatively Connected Smart Devices

By supporting concurrent communication over Bluetooth® Low Energy (BLE) and Sub-1GHz wireless, the STMicroelectronics STEVAL-FKI001V1 dual-radio development kit gives unrivaled flexibility to envision, build and connect IoT devices like smart sensors, finders and trackers which can be configured, updated, remotely monitored and tracked using various network topologies, protocols and services.

Built to unleash extra creativity for smart-home or smart-building scenarios as well as asset-tracking, energy-management, smart-farming and industrial monitoring and control use cases, the STEVAL-FKI001V1 brings together ST's BlueNRG-1 Bluetooth System-on-Chip and S2-LP sub-1GHz transceiver. The powerful dual-radio architecture enables simultaneous operations on a variety of radio-frequency bands and protocols such as Bluetooth LE or proprietary 2.4GHz, Sub-1GHz, and Sigfox.

Users can quickly create smart objects that connect to each other locally through mesh or point-to-point connections and support flexible ways of connecting to

the Cloud. For instance, a convenient sensor ecosystem for smart-home could be easily forged with local sensor networking leveraging either BLE or Sub-1GHz wireless link and the whole system connected to the Cloud through a local gateway or directly via a seamless Sigfox ubiquitous link, for surveillance or remote monitoring purposes – all based on same STEVAL-FKI001V1 kit.

The BlueNRG-1 Bluetooth 5.0 certified solution ensures convenient setup, configuration or modification of device settings during installation or maintenance and permits monitoring of networked node sensors through a stylish app running on any Android or iOS device.

The sub-1GHz S2-LP transceiver allows local networking as well as LPWAN installations including global Sigfox connectivity, which allows capabilities such as real-time notification of events. Moreover, users can leverage out-of-the-box Sigfox-ready networking to track and remotely localize devices or assets.

The kit can readily be expanded through its Arduino™ Uno V3 connectors with the vast and comprehensive ST X-NUCLEO offering, including expansion boards with MEMS sensors, motor control, GNSS receivers or industrial input/output and power drivers.

The STEVAL-FKI001V1 development kit is also fully interoperable with the recently announced BlueNRG-Tile board, to further empower developers' creativity to easily build end-to-end smart-sensor solutions including the sensor node, local gateways and global Cloud connectivity.

Leveraging the BlueNRG-1 SoC's versatile interfaces and ultra-low-power Arm® Cortex®-M0 core with 256KB of embedded program memory, users can connect their own choice of external sensors and process the data acquired locally in real-time. The STEVAL-FKI001V1 comes with an easy-to-use SDK that simplifies development and compresses time-to-market while preserving flexibility, scalability, and extensibility. In fact, it could also be used in conjunction with the ST BlueNRG-Mesh software package to create extensive networking on a large-scale installation. OTA firmware update is possible via the BLE connection.

Based on a ready-to-use WS2118 RF dual-radio module from Jorjin, the STEVAL-FKI001V1 provides a convenient, pre-certified solution for developers to quickly move from early concept-feasibility phase to prototyping, field trials and volume production. The programmable ultra-low-power radio module has flexible power management and wake-on-event

capability that allows multi-year lifetime from a small primary battery.

The STEVAL-FKI001V1 development kit is available now from ST distributors, or directly through st.com, priced \$56.00.



ams introduces world's smallest 1D time-of-flight sensor for accurate proximity sensing and distance measurement in smartphones

ams, a leading worldwide supplier of high performance sensor solutions, introduces the world's smallest integrated 1D time-of-flight distance measurement and proximity sensing module.

The sensor is ideal for implementing presence detection, for example to trigger the operation of a facial recognition system when the user's face is in range. Supplied in a 2.2mm x 3.6mm x 1.0mm package, the new TMF8701 sensor fits in a narrow bezel, helping smartphone manufacturers to realize widescreen phone designs that have a high display screen to body ratio.

"Smartphone manufacturers have been clear about the drawbacks of today's 1D time-of-flight sensors: they are too large, and their performance degrades noticeably in adverse lighting conditions and when the display screen is dirty," said Dave Moon, Senior Product Marketing Manager in the Integrated Optical Sensors business line of ams. "The TMF8701 addresses all of these concerns, providing customers with a device in a smaller footprint which also offers exceptional rejection of contamination and interference."

The TMF8701 integrates a VCSEL infrared emitter, multiple SPAD (single photon avalanche photodiode) light detectors, time-to-digital converter, and a histogram processing core. The device implements

all histogram-based presence detection, distance measurement and proximity sensing algorithms on-chip.

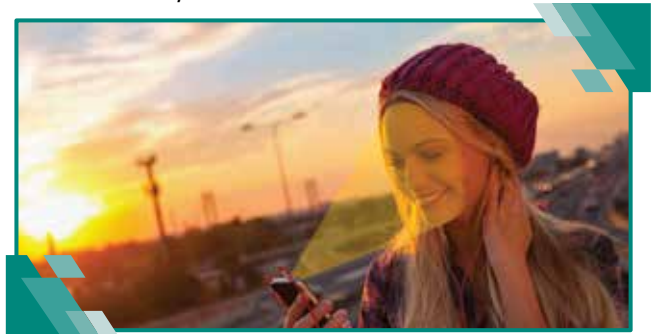
The TMF8701 separately identifies reflections from fingerprint smudge contaminations on the display screen and optical reflections from objects beyond the cover glass, such as the user's face, maintaining reliable performance even when the sensor's aperture is dirty.

The Class 1 Eye Safe VCSEL emitter has excellent immunity to interference from ambient light and produces accurate distance measurement in all lighting conditions: the module achieves accuracy of $\pm 5\%$ when measuring distance in the range 20-60cm in normal lighting conditions. Even in bright sunlight (100klux), $\pm 5\%$ accuracy is maintained at a range of up to 35cm. The low-power operation of the TMF8701 – it draws only 940 μ A in proximity sensing mode when sampling at 10Hz – makes it the ideal companion to a smartphone's face recognition system. Always on, it triggers the higher-power face recognition system to start up when the ToF sensor detects the presence of an object up to 60cm from the display screen.

The proximity sensing capability of the device can also be used to trigger the display and face recognition system to switch off when detecting a reflective surface at a distance of 0-10cm from the screen.

The accuracy of the TMF8701's distance measurements also supports the selfie camera's LDAF (laser detect auto-focus) function, especially in low-light conditions. The TMF8701 time-of-flight sensor is in mass production now. Unit pricing is \$2.60 in an order quantity of 5,000 units.

An evaluation kit for the TMF8701 is available. For sample requests and more technical information, go to www.ams.com/TMF8701.



Flex Power Modules broadens portfolio to meet rising demand in industrial and railways sectors

Flex Power Modules is introducing new DC-DC power modules for the industrial and railways sectors, broadening its product range to meet increasing demand in these sectors, as well as providing additional versions of existing products, with different input/output voltage ranges. The modules are provided in sealed and encapsulated packaging, to ensure they will work reliably when subjected to dust, moisture, severe vibration and other harsh conditions.

For industrial applications, Flex Power Modules provides high-reliability, high-performance and rugged DC-DC solutions in standard form factors, often running from 24V or 12V supply voltages, rather than the 48V more commonly found in information and communications technology (ICT) applications.

For railway applications, the company provides a series of products that can meet the most stringent electrical and environmental specifications. Modern railway systems need a wide range of DC-DC converters to power different monitoring and control units, and the new series of products mean that Flex Power Modules can now meet a broader range of requirements.

Olle Hellgren, Director of Product Management and Business Development at Flex Power Modules, commented: "While Flex Power Modules has traditionally been best known for its power products in the ICT sector, we have always had a strong offering for the industrial and railways sectors, and the success of our existing PKE and PKM-A modules has encouraged us to invest in offering more products for these applications – to ensure more customers can benefit from the high quality and reliability of our power solutions."

The DC-DC modules support a wide range of input voltages, to cover the needs of different applications. For industrial products, this includes 9 to 36V, 18 to 36V, 9 to 75V and 18 to 75V. Other modules provide input ranges of 43 to 160V and 66 to 160V, to cater to different railway application bus voltages, including 72V, 96V and 110V.

Flex Power Modules provides multiple product families for the industrial and railway sectors, and currently offers five ranges: the PKV Series (1.65-3W), PKE 3000 Series (15-30 W / Vin at 9-36 V), PKE 5000 Series

(15-30 W / Vin at 18-75 V), PKE 8000A Series (40 W / Vin at 9-75 V) and PKM 7000A Series (100W / Vin at 66-160 V). The new products are well suited to a broad range of applications, including process control, factory automation, robotics, alternative energy, smart grid, and test and measurement. More families and additional input and output voltage combinations will be added in the coming months.

Additionally, the company's PKR and PKU-E product families – which are already available to customers – are also suitable for industrial applications.



Microchip's First Libero SoC Design Suite Release Boosts FPGA Designer Productivity and Delivers One Unified Design Suite for Latest Families

As each new generation of devices scale, Field Programmable Gate Array (FPGA) designs are increasing in complexity and resource utilization, making designer productivity essential to accelerating time to market. Microchip Technology Inc. (Nasdaq: MCHP), via its Microsemi Corporation subsidiary, announced the release of Libero SoC version 12.0, delivering new gains in runtime and quality of results, as well as one unified design suite for all the company's latest-generation FPGA families, including new production releases of PolarFire FPGAs.

Libero SoC v12.0 reduces design flow runtimes and, with the improved quality of results, it provides results in fewer design iterations and improves customer productivity. By upgrading to Libero SoC v12.0, designers will see runtime reduction of 60 percent for timing, 25 percent for place and route and 18 percent for power results. They will also see an average increase of four percent in quality of results for larger designs and a 10 percent improvement for the PolarFire MPF300/TS-1 device.

"Libero SoC v12.0 is the result of our determination to offer a comprehensive, easy-to-adopt, easy-to-learn FPGA design suite," said Rajeev Jayaraman, vice president of software for the FPGA business unit at Microchip's Microsemi subsidiary. "This latest release is focused on delivering the many essential elements needed for efficient design implementation, while further enabling the growing adoption of the low-power PolarFire family across each of our key market segments."

Libero SoC v12.0 is being released simultaneously with the production release of the PolarFire MPF100T, PolarFire MPF200T and PolarFire MPF300T devices. The release includes production timing and power for PolarFire MPF300T-1 devices, as well as support for two new industry-leading devices for the aerospace and defense market segments—the low-power, radiation-tolerant RT4G150L, which offers 25 percent savings for standard speed grade; and military-grade support for the SmartFusion2 M2S150T/S FCV484 device.



Tiny, low profile, 150W AC-DC power supply from XP Power features medical (BF) and ITE approvals.

XP Power has announced its EPL150 series, a range of high density, low profile, open-frame AC-DC power supplies aimed at space-critical, cost-sensitive, industrial, ITE and healthcare applications.

The EPL150 series produces 100W output with convection cooling and 150W with as little as 10CFM airflow. The product has a 101.6 x 50.8mm footprint and its low profile of 25.1mm makes it ideal for space-constrained applications. Class-leading power density is enabled by high efficiency, up to 95% typical at 150W with better than 85% achieved down to 10% load. No load losses are less than 0.5W giving reduced running costs and compliance

with the latest environmental goals and legislation.

The parts are approved for use in Class I or Class II (earth free) applications for highest flexibility.

The EPL150 series features comprehensive safety agency approvals including IEC60950-1-1 for ITE, IEC62368-1 for ITE and IEC/ES60601-1 for medical.

Medical approvals are for two means of patient protection (2 x MOPP) from input to output and one means of patient protection (1 x MOPP) from both input to earth and output to earth, suitable for BF applied-part applications. Patient leakage current is less than 50µA and isolation test voltage is 4kVAC, input to output and 1.5kVAC from input to earth and output to earth.

Low-noise outputs available are 12,15, 18, 24, 28, 36 and 48V with a useful additional 12V fan supply provided, rated at 0.5A. Input is 80 – 264VAC and operating altitude maximum is 5000m making the parts suitable for worldwide use.

Full power is available to +50°C with derating to +70°C ambient temperature with comprehensive protection included for overvoltage, overload and short circuits.

The EPL150 series will find applications in many industries including automation and process control, broadcast, ITE, oil and gas and medical where the combination of small size, efficiency, performance and safety approvals will be attractive.

"The EPL150 series is a great addition to our range with its medical ratings, small size and competitive price. Its class-leading efficiency will give our customers a cool-running fit-and-forget solution," said Gary Bocock, Product Director at XP Power.

The series is available from Digi-Key, element14, Farnell, RS Components, approved regional distributors, or direct from XP Power and come with a 3-year warranty.



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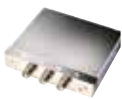
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