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NARAYANA ENGINEERING COLLEGE
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Department of
Electronics and Communication Engineering

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Vision of the Institute

To be one among the premier institutions of the country for professional Education in producing technocrats with Competent skills, Innovative ideas and Ethics strong to serve the nation.

Mission of the Institute

- To provide an environment most conducive to learning with state of the art infrastructure, well equipped Laboratories and research facilities to impart high quality technical education.
- To emphasize on innovative ideas and creative thinking and prepare them to meet the growing challenges of the industry.
- To inculcate the leadership qualities, multi-disciplinary approach, ethics and lifelong learning in graduates to serve the diverse societal needs of our nation.

Vision of the Department

To produce technically competent Electronics & Communication Engineers with a motive to meet the needs of the industry and evolving society through advanced research, professional ethics and lifelong learning.

Mission of the Department

- To enrich the technical skills of the students through effective teaching-learning practices, continuous assessment methods and eminent faculty.
- To continuously enhance creative thinking, research ability and innovative skills of students through training on core and multidisciplinary technologies and skill enhancement programs.
- To inculcate leadership qualities, ethics, social responsibility and gratitude through outreach programs.

Program Educational Objectives (PEOs)

PEO-1: Attain the global and local opportunities and reach greater heights in their chosen profession by demonstrating technical expertise.

PEO-2: Gain recognition by exhibiting problem solving expertise for addressing significant problems of industry and society.

PEO-3: Become good leaders with ethics and support, contribute and encourage diversity and inclusiveness in their workplace and society.

Program Outcomes (POs)

PO-1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO-2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO-3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO-6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO-7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO-9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multi disciplinary settings.

PO-10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi disciplinary environments.

PO-12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

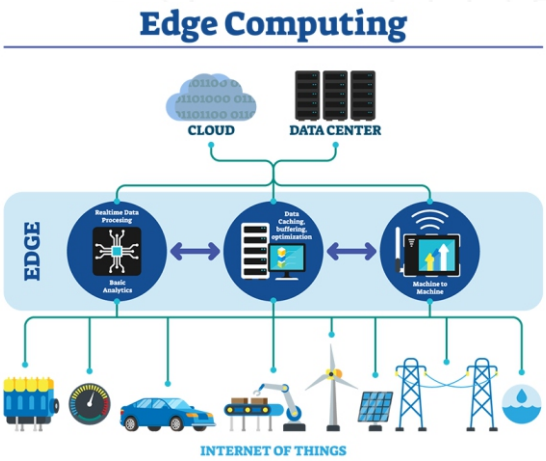
PSO-1: Responsive to ideas: Apply the knowledge on core Electronics and Communication Engineering in order to develop skills to analyze, design and develop innovative solutions for the real world problems.

PSO-2: Domain Expertise: To develop interpersonal skills to demonstrate proficiency using the latest hardware and software solutions by maintaining professional and societal responsibilities.

Professor Desk

The Department of Electronics and Communication Engineering was established in the year 2001. It offers UnderGraduate (UG) programme in Electronics Communication Engineering& Post Graduate (PG) programme in Digital Electronics and Communication Systems(DECS). The Department has well equipped laboratories such as Communication Lab, Advanced Microprocessor Lab, Electronic Circuits Lab, Microwave Lab, DSP Lab , Optical Fiber Communication Lab. The Department has highly educated faculty members having a vast experience in their fields. The Department has a well-balanced workforce having experience in academics and in Industries. Students are given education as well as training exposure in order to get placed in highly reputed MNCs.

Edge computing will be critical for digital transformation



Technology enabled solutions are becoming ever more critical to the day-to-day operations of many enterprises. Among the most impactful technologies are artificial intelligence (AI), Internet of Things (IoT), cloud computing, and next generation communication technologies such as 5G. Edge computing may garner fewer headlines, but it is a key enabler for many solutions that utilise the emerging technologies listed above, writes **Jim Morrish**, a founding partner at Transforma Insights.

Fundamentally, edge computing makes processing and storage resources available in close proximity to edge devices or sensors, complementing centralised cloud resources and allowing for analytics close to those end devices.This results in a number of benefits that can be very relevant in an enterprise context, including:

(Near) real-time responsiveness: Analytics that may have previously been undertaken in offsite cloud locations can potentially be supported locally, avoiding the need for raw data to be transferred to a cloud location and for results of any analyses to follow the same path back to a local device. Accordingly, the time taken for a system to respond to new input information can be reduced to near real-time.

Improved device-to-device communications: Communications and the exchange of data between devices that are colocated together can be routed more directly, and without need to transit cloud infrastructure. In fact, edge intelligence can potentially allow processing resources to be shared between a number of local devices, with certain devices able to call on processing resources residing in other nearby devices in a seamless way.

Improved robustness, resilience and reliability: With more analytics undertaken locally to data sources, systems are not as susceptible to disruption in the case that a connection to a remote cloud location fails. Effectively, edge computing can allow local devices to operate to some extent autonomously of any cloud infrastructure. In some situations, edge devices can operate almost completely autonomously and independently of any connection to cloud infrastructure.

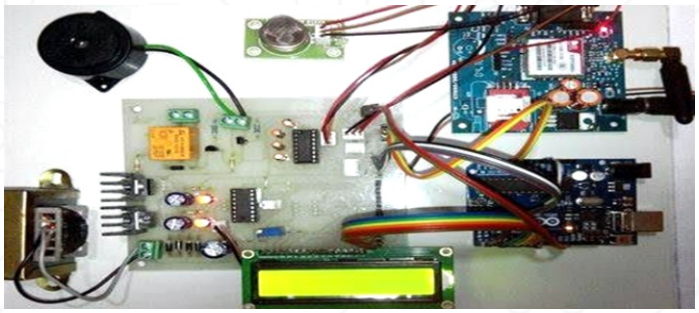
Improved security and data protection: With more data processed locally, many security and privacy issues associated with transmitting data to cloud locations can potentially be mitigated, and it can be easier for enterprises to demonstrate compliance with data privacy and data sovereignty requirements. Alternatively, edge computing can be used to anonymise data locally before onward transmission to cloud infrastructure.

Regulatory compliance: Locally managed information potentially only needs to comply with local regulations, rather than multi jurisdiction regulations that might apply in a cloud environment.

Reduced operating costs: Undertaking more analytics locally, supported by edge computing, can reduce the amount of data that needs to be sent to cloud locations for processing, so reducing communications costs associated with data carriage. It also reduces the burden of processing that must be supported by cloud infrastructure and more importantly the amount of data that needs to be stored in the cloud, reducing costs for cloud infrastructure.

SHAIK HANEEF
17F11A0493

IoT based Gas Leakage Detection system project using Arduino



Liquified Petroleum Gas (LPG) is nowadays commonly used in households, industries and other places as it is very convenient, affordable and eco friendly and less hazardous than its other alternatives.

It has proven to be one of the most reliable and easily controlled fuels. It is supplied to various places in cylinders or pipelines. Hence, it can leak both as a liquid or as a gas if it is not handled cautiously. Accidents and disasters related to LPG gas leakage are not unheard of. These leakage accidents can cause huge fire and explosion.

These accidents are caused usually caused due to negligence and careless handling of the gas. If the gas leakage is not detected in the early stages, then it can lead to a very big disaster, as nowadays we can find the supply of LPG gas in almost every household. So, a lot of people have to face danger in case of such catastrophe.

In this Gas leakage detection system project, we propose an Arduino and IoT based gas leakage detection system, which will help in detecting any gas leakage with the help of MQ5 gas sensor and send this data over the internet to the IoT module and that will in turn alert the user about this gas leakage.

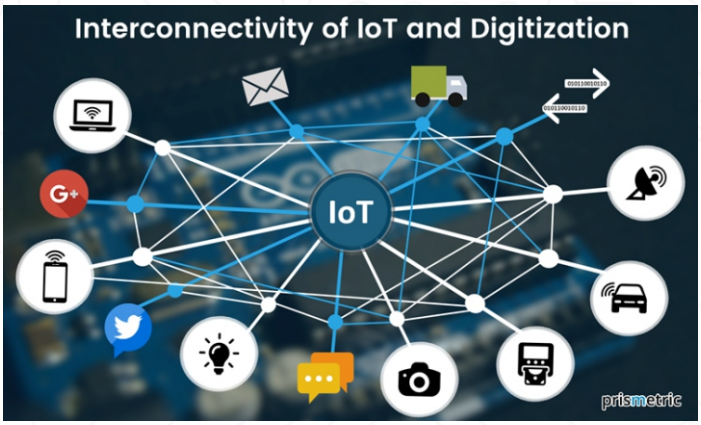
Hence, following this process, we can detect gas leakage in the early stages and prevent any future accidents.The finished device is connected to the IoT module over Wi-Fi.The maximum and minimum parameters of the gas can be set in the device accordingly.The device will continuously monitor the level of gas in the surrounding air with the help of MQ5 gas sensor. The signals from this sensor is continuously being sent to the Arduino circuitry.

If any abnormal reading is found, which is more than the set parameters of the maximum level that can be present in the air, the RGB LED lights will glow red and instantly the solenoid value will turn off and these readings will be transferred over the IoT module and the user will be alerted about this leakage.

Once the gas leakage is detected, the buzzer is turned ON and a 'Leakage detected' message is displayed on the LCD. If the values of the gas present in the air is within the set parameters, then the RGB lights glow green.Therefore, with the help of this project, we can easily detect LPG gas leakage with the help of IoT and Arduino and prevent any hazardous accident.

KUTTUBAINA RESHMA
18F11A0450

IoT connectivity



The problem with IoT connectivity is that demand is stretching the suppliers. Before we even get to 5G, the network providers have got their own version of network slicing to do within their own operations, with decisions to be made about how they divide up their time, energy and budgets. Network providers need to decide which connectivity technologies they should buy, in order to build the right supply. Which begs the question: what do these enterprises intend on doing and how?

At the moment, one of the significant choices is between two cellular technologies, narrowband IoT (NB-IoT) and LTE-M. That's NB as in narrow band and low power, versus LTE-M as in 4G networks. Which is better suited to cater to demand depends on what enterprises actually ask for.

The **GSMA** says three billion more devices will be connected by 2025. That will triple by 2030, according to data from network provider **BICS**, which also reports that demand for data roaming nearly doubled in 2018. Demand has been shaped by governmental stimulus. One fifth of smart city connections have been encouraged by the EU's Smart Grids Task Force for smart energy. Operators like **Orange**, **Deutsche Telekom** and **Vodafone** – which have built NB-IoT networks – did so because connections into big vertical markets fit the NB-IoT use case of generally transmitting small amounts of data infrequently. The operators have seen that connectivity is the lowest common denominator and the big profits are in what they offer over the top of these connections. Which is why Vodafone's M2M strategy is about cloud services, not connections. Deutsche Telekom and Orange have opened IoT labs to develop application-specific IoT prototypes in order to maximise the value of the connections they supply.

Few of the IoT apps need much power for their devices, but they do need to be both on and connected for long periods of time. Think smart meters in homes, sensors in smart cities and farming applications. In this context NB-IoT is the kindest technology to batteries and devices can stay on for a decade. Since it meets 5G standards it is guaranteed longevity. "It's here to stay and a safe choice for long-term IoT projects," says Mikaël Schachne, the chief marketing officer and vice president of Mobility and IoT at BICS. NB-IoT doesn't just need staying power, it needs to be easy to install in the initial stages and available globally, which it isn't yet.

Connections in the hardware in a smart factory must stay on all the time so the devices and sensors must work anywhere the hardware is used. Users must activate and connect the hardware by turning on the device – so the whole process has to be painless and easy.

That gets hard if each branch in each country has to buy a local SIM card and manually insert it into the hardware. This complicates the already challenging integration with local IoT platforms and commercial agreements with local mobile operators. The complexity is multiplied with each country in which the hardware was deployed.

"Native global connectivity is required and this is only possible with roaming," says Schachne.

IoT can only fulfil its potential if the new devices can have low power and no borders.

There will be other challenges for NBIoT though. Mobile operators have to install new core network elements in order to accommodate NB-IoT, which means roaming coverage has to be redeployed and tested with each roaming partner. Is it worth the effort for them? Devices that use network resource but generate very little data usage might not fit into their model of return on investment (ROI). The operator is entitled to say show me the money.

LTE-M has fewer mobile operators running it but since it's natively everywhere that 4G roams it has wider global coverage than NB-IoT. Therefore, the opportunities for world connectivity with LTE-M are greater. In a time of security vigilance, LTE-M is a safe bet if your hardware needs firmware updates because, by comparison,

the NB-IoT downlink speed is too limited. LTE-M also supports real-time communication, though will only support devices with a battery life of a few years.

If your ambition is to roll out services domestically, right now, the choice must be LTE-M. The NB-IoT roaming footprint will grow but it'll take some time to be truly global. NB-IoT supports long battery life with devices remaining connected for up to ten years, which is great for things like smart meters, but less ideal for real-time communications, says Schachne.

One of the impediments of the roll out of IoT is the lack of common standards, especially when it comes to the best network technology to use, says Nicolas Hauswald, the chief executive of communications specialist **Etelm**.

The choice over NB-IoT or LTE depends on the type of sensors and devices that are gathering information.

Then there is the difference in how NB-IoT and LTE-M networks typically operate. NB-IoT networks are usually delivered by telecoms operators who provide access to the network to their customers. On the other hand, LTE-M can be run as a private network, with the business running it taking responsibility for its creation and management.

K JASWANTH REDDY
19F11A0425

Why does IoT need 5G?

John Vickery, a principal technology partner in the Enterprise CIO unit at **BT**, says it makes sense not just to look at why IoT needs 5G, but to consider that a major use of 5G will be IoT, which will help to fund the investment in 5G. "There are a lot of ways at the moment to do IoT without 5G, but as an explosion of scale happens in IoT, the amount of data flowing over the 5G network will increase dramatically," he says, adding that 5G will have the capacity to carry it economically.

"Ultimately, it's about the combination of the two, and what they will do for businesses and consumers," he explains, pointing out that all the additional data "leads to deeper insights and better interventions and actions, and our customers can take better strategic decisions."

He acknowledges that although the telecoms industry has this ambition to bring 5G and IoT together, it has yet to work out exactly how the combination will bring about the desired outcomes, but states: "We are beginning to see the green shoots of some uses cases."

Bengt Nordström, the chief executive at consultancy **Northstream**, part of Accenture, comments: "5G is needed for mission-critical IoT where applications require super low latency and ultra-high reliability with cases like remote surgery, discrete automation, such as motion control, and the use of drones."

"Another IoT use case that might need 5G is massive IoT where there are millions of connected devices per kilometre," he adds. "For instance, consumers now have more and more devices that are connected, smart cities and autonomous cars are becoming a reality, and even stadia are connected."

Autonomous vehicles aside, Vickery says other applications that need low latency communications and could greatly contribute to the greater safety of workforces include remote manoeuvring of massive cranes, which can be done from the ground. Automated vehicles – from drones to heavy plant machinery and trucks – could also improve safety in dangerous environments such as mines, agriculture and shipping.

He agrees that not only can 5G help shift vast amounts of data, affordably which is a key consideration, see **Figure 1**, in realtime, but that edge processing and storage, which are facilitated by 5G's network architecture, could be used in certain applications. Here an application is isolated at the edge to reduce congestion on the network – for example, avoiding sending high definition streams across a network – or where localisation and data sovereignty are important, such as within a manufacturing plant. Vickery says: "5G is encrypted end-toend – by nature – and LTE and 5G have some of the most robust security embedded". Nordström adds: "Narrowband IoT (NB-IoT), a technology built on 4G, is evolving to address the need to ensure so many simultaneous devices and connections work seamlessly at the same time,

and it might be considered as part of the 5G tech family. This 5G service would likely be deployed as part of the operator's macro network."

This notion of 5G being a network of networks rather than a single, ubiquitous infrastructure is key, and in particular, as well as interoperability with 4G, it relies heavily on fibre networks – in all wireless technologies, the trick is to keep the airborne leg of the journey as short as possible and get the data onto a physical, wired network.

Mikael Sandberg the chairman of **VXFIBER**, stresses: "You can't add fibre to 5G network but [you can] add 5G to fibre, and in almost all conversations we have – we are talking to 30 UK cities now – that is either not understood or ignored, but 5G starts underground with fibre."

VXFIBER works with local councils that have smart city ambitions to help them identify what they want to achieve and look at how fibre will help them and their community, as well as understand what assets they have and how they could be harnessed. Sandberg adds, "Part of that is to look at how councils will prepare for 5G".

He continues, "5G and IoT are high on these councils' agendas, but to make it possible they need fibre as much as 5G. Often their understanding of IoT through 5G is vague. People paint pictures of use cases but the stark reality is that cities need to consider the basic infrastructure they need to make it possible."

Sandberg gives the English town of Oxford as example of where fibre, 5G and IoT will provide a solution to what has proved an intractable problem with many repercussions: it is one of the most congested cities in the UK. In three years' time, the council is to launch a self-driven park-and-ride service through electric vehicles – and the fibre infrastructure supporting 5G to provide real-time data is essential.

He explains a dedicated fibre passive optical network is not good enough for these purposes, as even a dedicated line can split the signal at the base station among users and applications that require super low latency and ultra-high reliability cannot run on an unknown input. This is why trailblazer Stockholm has a dedicated fibre end point every 50m in the city centre, with fewer in less dense urban areas at 250m apart.

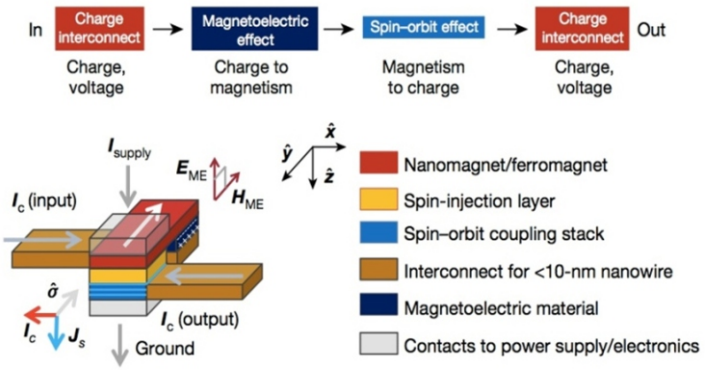
Tom Winstanley, the vice president for New Ventures and Innovation, **NTT Data** UK agrees that 5G will not be enough to support IoT without full-fibre infrastructure but is already foreseeing that. "Even 5G will not be able to achieve ubiquitously connected society because you can't build enough data centres and network points to build the society we envision," he says.

At the end of last year, NTT announced a research agenda for photonic wireless networks and recently DoCoMo, another unit of NTT, published a white paper on 6G. As Winstanley says, with IoT you need at least a ten-year research horizon to meet the future demands and potential of smart cities and other possible innovations, as fostered by the NTT Data global Open Innovation Contest. Recent entries include autonomy as a service, composed of vehicles, drones and robots as proposed by unmanned.life, and Iotic Twins, which are not a 3D model or visualisation of an asset, but a through-life, semantically defined virtualisation of an asset.

It seems like whatever the generation of communications technology, IoT applications will evolve to exploit its speed and other attributes.

SHAIK HASEENA
18F15A0411

Good device management can underpin successful data strategies



When it comes to device management, the challenges are about far more than initial configuration and setup, they are about the ability to mitigate problems and flexibly change functionality during the life of the device, which could be deployed in the field for more than a decade in some IoT areas. While managing IoT devices and managing data from IoT devices are two related but separate issues, ultimately, good device management can underpin an organisation's successful data strategy. That said, it is clear that the industry has a challenge on its hands.

With the onset of digital transformation, the volume and diversity of connected devices in enterprises today has increased drastically. And while this might help companies introduce operational efficiencies into the workplace, it also leaves huge security gaps for those that are unaware of the pitfalls of poor device management.

Digital transformation: According to security vendor **Forescout**, it can be estimated that any business undergoing digital transformation has about 30-60% more devices on its network than the IT department actually knows about. Chris Sherry, the regional vice president of EMEA North at Forescout, says: "Naturally, when asked to imagine devices in the workplace, most people immediately think of smartphones and laptops. But what about the printer that sits in the corner of the office, or the surveillance camera monitoring the car park? Not only that, but development in industrial IoT (IIoT) has meant that operational technology such as sensors, actuators, controllers and even light switches are all becoming IP-enabled too despite the fact they were never intended to be. As a result, IT teams are scrambling on how to account for them and manage them."Sherry says a major factor to overcome is that different lines of businesses don't see eye-to-eye on what the management strategy should look like. "To gain full control and visibility of all devices on a network, enterprises need to use tools that consolidate them into a single, unified device visibility and control platform. It is all about IT asset management (ITAM) with better streamlined visibility and automation," he says.

Remote monitoring: Manfred Kube, the head of communications, analytics and IoT Solutions at **Thales**, says: "For most IoT use cases, it is virtually impossible to send regular physical maintenance workers to each and any device as this would be time consuming and kill your total cost of ownership (TCO)." Kube adds that the most efficient approach is to use analytics tools that monitor IoT devices remotely and address challenges in realtime. Companies must deploy integrated and connected hardware solutions, plus strong encryption schemes, to ensure efficient management and tight security to enable devices to be patched with the latest software, firmware, applications and security, that will enable them to evolve to support new use-cases in the years ahead.

Cloud providers: To help deliver what is required, a number of IoT providers are building ecosystems to enable comprehensive solutions that address all segments of the market. This includes the involvement of big cloud service providers **Google**, **Microsoft** and **Amazon** that have tailored solutions. Each of these three can help partners and customers to securely provision, authenticate, configure, control, monitor and maintain all of their IoT devices. The importance of addressing the evolving edge networking environment is also coming into play. IoT devices will increasingly be located closer to customers at the edge to help reduce latency, for applications such as 5G, artificial intelligence and driverless cars.

From a device management perspective, the biggest problem is going to be updates. For most large organisations, it's hard enough to keep every desktop and laptop device up to date, let alone the addition of hundreds of new devices at the edge of a network. The evolving ecosystems to support IoT device lifecycle management can be illustrated by the approach **Arm** has taken. Its Pelion Device Management aims to provide simple, secure and flexible IoT management capabilities for a range of device profiles. Multiple deployment configurations are available to suit the customer's needs, including cloud and edge options, an on-premise solution with cloud-like capabilities or a hybrid of the two. About a year ago, Arm acquired **Treasure Data** and brought together its data management technology with Arm Mbed Cloud solution, in addition to connectivity management technology resulting from its acquisition of **Stream Technologies** to launch the Pelion IoT Platform. The Pelion IoT Platform consists of three major components covering device management for provisioning, identity and access management and updates; connectivity management to support wireless connectivity standards for any device and the enablement of eSIM secure identification; and data management for the analysis of trusted data from individual devices and enterprise wide and third party big data deployments.

Standards: When considering any solutions though, it is also important to consider standards and best practice, which is something that non-profit organisation **Global Platform** is supporting. Driven by around 90 member companies, the organisation develops international

standards for enabling digital services and devices to be trusted and securely managed throughout their lifecycle, when deployed in the payments, telecoms, transportation, automotive, smart cities, smart home, utilities, healthcare and government sectors.

RAPUR SWARNALATHA
18F11A0487

How MNOs can maximise 5G monetisation opportunities

Mobile network operators (MNOs) are investing billions in 5G infrastructure but are they failing to maximise the monetisation opportunities by applying traditional telecoms business models to this new era.

Many mobile operators are still trying to digest their over-investment in 3G technologies caused by a frantic race to secure spectrum and the belief that, if you built a network, users would come.

The 'build it and they will come' strategy ran out of road more than 15 years ago as 3G networks became a technology in search of a reason to exist. However, reasons soon emerged and the 4G age has proved to have a multitude of higher bandwidth services that rely on the spectrum acquired for 3G and utilise 3G as a fallback when there is no 4G. Don't forget, among all the 3G excitement, that this still happens frequently and parts of the world still await 4G.

Today doesn't really resemble the early noughties when users simply weren't ready to do more than telephony, messaging and unconnected games on their mobiles. Now, people expect rich, high speed, low latency experiences and it's no longer just about people. The machines are here too, demanding cellular networks enable connection of the prosaic and the complex.

Mobile operators have customers lining up for 5G to enable services from IoT to augmented reality. The versatility of 5G supports enormous device density per cell, huge throughput and ultra-low latency. These attributes singly or together open up a raft of opportunities but mobile operators know that they can't address these with precision by applying traditional telecoms models such as charging per-minute or megabyte of network utilisation.

MATTAM SRUTHI LEELA
17F11A0453

5G and MEC encourage edge intelligence to become pervasive

There are a few things that are coming together in this scenario. First, there is the high bandwidth provided by 5G deployments. 5G has three bands of operation: low band, mid-band and high band. High band/mmWave allows massive amounts of data to be transferred over mobile networks. But the caveat is that mmWave doesn't travel too far and is easily interruptible by obstacles. So, an ideal environment for mmWave to be used optimally would be within a building.

This caveat brings us to the second element of the scenario, which is digital transformation. Enterprises often embark on a digital transformation journey but end up trapping themselves into what I call digital transliteration. Digital transliteration is when an enterprise simply digitises its processes status quo using modern technology. I see this as a wasted opportunity to optimise business processes to break free of traditional constraints and evolve to operate in a realm of new possibilities.

The third element here is the need for closedloop digital twins. Historically, digital twins were state-recording systems whose data was heavily used in analytics to understand the systems, assets, and process behaviour. But given the drive towards automation, digital twins are now the intelligence behind their physical counterparts. Data is not just flowing one way from the physical asset, be it equipment or people or even a business process, to its digital representation. The flow needs to be bidirectional, where data comes from the physical-to-digital path, and the response instructions fl

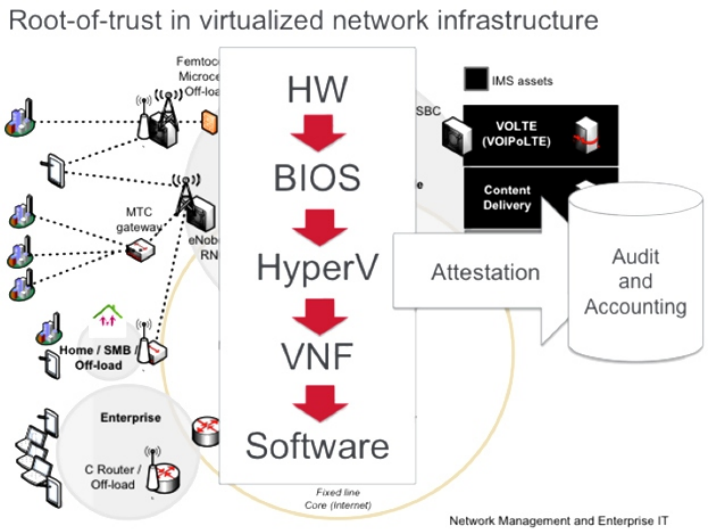
Now in the digital-tophysical direction. This bidirectional digital conversation completes the picture of the real-time control loop that is going to be a fundamental requirement for successful transformation based on machine-tomachine communication.

The factors in this scenario profoundly impact how enterprises see the value of data. Data's value for analytics is well established by now. But what is hidden is the value of data captured in the first few milliseconds. The low latency event-driven servicing becomes especially significant when we are talking about the digital automation of business processes. Just a few examples of the hidden value from our experience at VoltDB are an 83% reduction in fraudulent transactions completing, 100% prevention of distributed denial of service (DDoS) attacks on the network, and 100% detection of bots before they intrude into a bidding process. All of these have stringent latency service level agreements (SLAs) to make these decisions. Data usage is going to augment post-event analytics by using that intelligence for inevent decision making. Low latency decisions impacting operations require low latency availability of event data. mmWave in private 5G settings will accelerate the shift to tapping into the first ten milliseconds of data's life.

SYED ARAFATH RABANI
19F15A0401

Can we communicate privately?

Wi-Fi currently remains the most prevalent wireless technology in enterprise networks, but private 4G LTE cellular technology, and soon 5G, can be much more reliable and cost-effective when it comes to various industrial use cases around IoT, writes Antony Savvas.



Problems around Wi-Fi can include susceptibility to spectrum noise and also interference from steel walls, for instance. In addition, Wi-Fi can be cost prohibitive when it is called upon to provide coverage for large geographic areas, because of the large number of Wi-Fi access points needed.

The alternative: Though cellular wireless is often thought of as a carrier service, factories, offices, public sector organisations, farms, fleets and other locations can instead benefit from deploying private mobile cellular technology. This alternative can complement or even replace Wi-Fi for applications that support IoT devices – often deployed over large areas – and which generate large amounts of data. A private cellular network consists of cell sites and core network servers supporting dedicated connectivity for an organisation's specific requirements – independent of the cellular networks of mass service providers accessed by the public.

Companies can customise such networks for mission-critical applications and they can optimise the network for low latency to support service level agreements (SLAs). And this is without interference and contention from using congested public wireless spectrum.

SANNAREDDY BHAVANA
19F11A0459

Battery Tech Breakthrough: 10-Minute Charge Time Paves Way for Mass Adoption of Affordable Electric Car

if new car sales are going to shift to battery-powered electric vehicles (EVs), they'll need to overcome two major drawbacks. First, they are too slow to recharge. Second, they are too large to be efficient and affordable. Instead of taking a few minutes at the gas pump, some EVs can take all day to recharge depending on the battery.

"Our fast-charging technology works for most energy-dense batteries and will open a new possibility to downsize electric vehicle batteries from 150 to 50 kWh without causing drivers to feel range anxiety," said Wang, whose lab partnered with State College-based startup EC Power to develop the technology. "The smaller, faster-charging batteries will dramatically cut down battery cost and usage of critical raw materials such as cobalt, graphite, and lithium, enabling mass adoption of affordable electric cars."

The technology relies on internal thermal modulation, an active method of temperature control to demand the best performance possible from the battery, Wang explained. Batteries operate most efficiently when they are hot, but not too hot. Keeping batteries consistently at just the right temperature has been major challenge for battery engineers. Historically, they have relied on external, bulky heating and cooling systems to regulate battery temperature, which respond slowly and waste a lot of energy.

the temperature from inside the battery. The researchers developed a new battery structure that adds an ultrathin nickel foil as the fourth component besides anode, electrolyte and cathode. Acting as a stimulus, the nickel foil self-regulates the battery's temperature and reactivity which allows for 10-minute fast charging on just about any EV battery.

"True fast-charging batteries would have immediate impact," the researchers write. "Since there are not enough raw minerals for every internal combustion engine car to be replaced by a 150 kWh-equipped EV, fast charging is imperative for EVs to go mainstream."

PALAKONDA VENKATA PRATHYUSHA
17F11A0462

LTE modules speed cellular IoT product development

Particle, a platform-as-a-service provider, offers the B Series of LTE modules and development kits to help companies quickly move from prototype to production. These components help companies add cellular connectivity to their products, providing product teams with everything they need to get started and deploy at scale.

The series comprises the Boron 404X cellular-enabled development board for prototyping and the B-SoM production-ready cellular system-on-module for scaling.

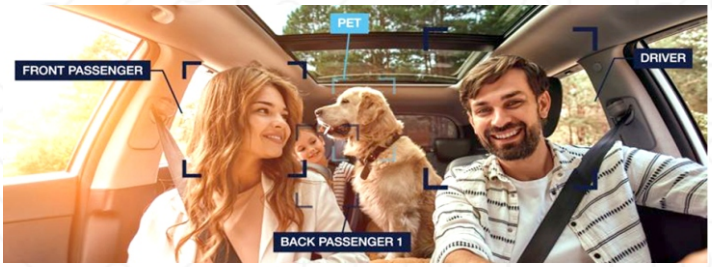
This addition follows the launch of Particle's Supply Secure hardware portfolio, a proactive program that updates and replaces legacy hardware with assured inventory that supply chain teams can confidently deliver to enterprise customers.

Both the Boron and B-SoM boards leverage the full-stack Particle integrated IoT platform-as-a-service, which combines customizable software, connectivity, and hardware. Boron and B-SoM provide reliable cellular connectivity for a wide range of use cases, like moving assets, remotely deployed assets, and products that need backup connectivity.

Boron offers breadboard-friendly prototyping on the open-source Feather form factor with 20 GPIOs for interfacing sensors, actuators, and other electronics. Based on the M.2 form factor, the B-SoM enterprise-grade module features embedded EtherSIM, which automatically selects the best LTE networks globally across 350+ carriers.

PITCHIKALA BABY APARNA
20F15A0408

Image sensor improves in-car safety and comfort



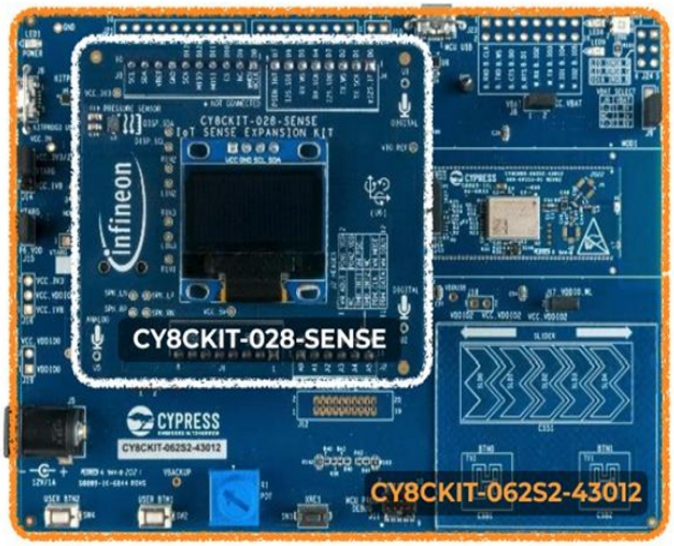
ST's VD/VB1940 automotive-grade dual image sensor monitors the entire vehicle interior covering both the driver and all passengers. While driver monitoring systems (DMS) promise greater road safety by assessing driver alertness, ST's sensor can empower applications like child-presence detection, passenger safety-belt checks, vital-sign monitoring, gesture recognition, and video/picture recording.

The VD/VB1940 is a 5.1-Mpixel image sensor with both rolling and global shutter modes. Specifically designed to manage RGB and near-infrared (NIR) operations, the sensor outputs RGB Bayer color images on one side and full-resolution NIR images on the other side. The device captures the high dynamic range (HDR) color images needed for an occupant monitoring system, plus the high-quality NIR images typically captured by standard DMS sensors.

The VD/VB1940 captures up to 60 frames/s at full resolution and is fully configurable through an I^2C serial interface. Compliant with ISO 26262 standards and ASIL-B safety levels, the part contains cybersecurity features that prevent hacking.

V ANATHA BABU
19F15A0409

Cross-platform tools ease ML development on PSoC 6 MCUs



Users of Edge Impulse's Studio environment can now access Infineon's Modus Toolbox for building edge machine learning applications on PSoC 6 MCUs. The collaboration expands the modus toolbox MCU configuration software and ecosystem to now include the Edge Impulse cloud platform.

Develop and configure applications on the Infineon PSoC 6-based CY8CKIT-062S2-43012 Pioneer Kit coupled with the CY8CKIT-028-SENSE expansion kit for interfacing accelerometer, gyroscope, magnetometer, microphone, pressure, and temperature sensors. Data from these sensors are used with Edge Impulse Studio for generating TinyML-based AI models, optimized for low-power, low-cloud-cost edge environments. Models can then be deployed on any PSoC 6-based MCU.

"With the performance and extremely low-power design of the PSoC 6, running TinyML models down at the edge becomes even more capable than before. By using Edge Impulse to simplify the barrier to machine learning, product makers can focus on real data they collect from the device to make an innovative and effective product.

GODHA HARATHI
20F15A0404

BRAIN TWISTER

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ESTD: 2001

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Regret is unnecessary.
Think before you act.

- William Shockley