DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

RISE-MAGAZINE

Recent Innovations In Sophisticated Electronics

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ECE

DEPARTMENT PROFILE

Electronics and Communication Engineering has emerged as the major driving force in the present day Information Technology revolution. It is acting as a bridge between different disciplines of engineering and technology. It has penetrated into other prominent sectors such as health care, instrumentation, agriculture, automation, signal processing, remote sensing etc.., The recent developments such as IoT, Artificial Intelligence and the mercurial advancements in the field of communication.

Vision

To be a focal centre for academic excellence in competing global standards and dynamics in the field of Electronics and Communication Engineering with research and services focusing on effective communication skills, entrepreneurial, ethical and social concern.

Mission

To impart quality technical education in Electronics and Communication Engineering with well established infrastructure, state- of- the art laboratories, core instructions and cognizant faculty.

To prepare the young and dynamic Electronics and Communication Engineers professionally deft and intellectually adept with knowledge, behaviour and information competency.

To enable the learners for changing trends in the field of Electronics and Communication Engineering with a focus on career guidance, placements and higher education by Industry-Institute relationship.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1. Graduates should be cognizant in basic science, fundamental engineering stream along with core related domains in ECE and Allied fields.

PEO 2. Graduates should understand issues related to design, problem solving, and intellectually adept with knowledge, behavior and information competency.

PEO 3. Graduates should demonstrate their technical, communication, research, aptitudes along with leadership skills in professional environment to empower employability, higher education and entrepreneurs successfully through industry-institute interaction.

PEO 4. Graduate should be motivated with high ethical, human values and team work towards development of the societ.

PROGRAM OUTCOMES

ENGINEERING KNOWLEDGE: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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.

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.

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.

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.

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.

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.

ETHICS: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

INDIVIDUAL AND TEAM WORK: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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.

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 multidisciplinary environments.

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

PSO 1. An ability to get an employment in Electronics and Communication Engineering field and related industries and to participate & succeed in competitive examinations like GRE, GATE,TOEFL, PSUs, etc.

PSO 2. Should be able to design and test various electronic systems that perform analog and digital processing functions.

TINY Bluetooth low energy SoC and module

Dialog Semiconductor has unveiled the DA14531, said to be world's smallest and most power effcient Bluetooth 5.1 SoC, and the DA14531 module, that is intended to simplify Bluetooth product development and encourage wider adoption. The chip, the Smart Bond TINY, looks to lower the costs of adding BLE functionality to applications, with the aim of supporting the next wave of the IoT, that's been estimated to

include over 1 billion devices. The cost of enabling a complete IoT system has been coming under pressure and this device looks to address the growing breadth and costs of IoT devices by reducing the complete system cost through a smaller footprint and size, while maintaining performance quality. The DA14531 looks to extend wireless connectivity to applications where it would have previously been prohibitive in terms of size, power or cost, especially those within the growing connected medical field. The device is available in packages as small as 2.0 x 1.7mm. Moreover, the SoC's high level of integration means that it only requires six external passives, a single clock source and a power supply to make a complete Bluetooth low energy system. Smart Bond TINY is based on a 32-bit Arm Cortex M0+ with integrated memories and a

complete set of analogue and digital peripherals. Its architecture and resources allow it to be used as a standalone wireless microcontroller or as an RF data pipe extension for designs with existing microcontrollers. The module looks to make it easier for customers to leverage the new SoC as a part of their product development, instead of having to certify their platforms themselves. Smart Bond TINY and the module use just half of the energy of their predecessors and that low power consumption ensures a long operating and shelf life. The DA14531's integrated DC-DC converter enables a wide operating voltage (1.1 to 3.3V) and can derive power directly from environmentally-friendly, disposable silver oxide, zinc air or printable batteries required for high-volume applications, such as connected injectors, glucose monitors and smart patches.--------- **B Naveen- 16BF1A0428**

New era for semiconductors

CMOS has been an essential ingredient in IC construction for decades, but its authority could be challenged by a promising new technique. Nottingham-based start-up Search for the Next (SFN) has created a new transistor wafer process – dubbed Bizen – that it says will cause disruption to the entire electronics industry. This is made possible due to the discovery of a new type of transistor. “It’s been 50 years or so since a truly new transistor has been developed, and that’s what this is,” explains David Summerland, SFN’s CEO. “The quantum tunnelling transistor – the Bizen transistor – is a new type of transistor. It’s as different from a BJT as a MOSFET is.” The Bizen transistor might look like an existing transistor, but its key difference is in its structure. “The BJT has a metal contact, and the FET has an isolated gate. We introduced quantum tunnel mechanics as a different way to connect to that gate or base. We’ve found that quantum tunnel mechanics can be used to remove the disadvantages of a bipolar system.” This is significant as the Bizen transistor can help electronics designers build circuits that are controlled by an isolated tunnel connection, rather than a direct metal contact. That set up unlocks the possibility of simpler circuits with far fewer layers. To put that into context, the number of layers needed for Bizen range from four to eight for devices supporting low to high voltage operations, compared with ten to seventeen for CMOS. Summerland adds that that requirement for a higher number of layers means that the lead time for the development of new wafers “goes through the roof”. He knew there had to be a simpler way, so found himself looking for “a technology that was at least as good as CMOS – so it gave you that same integration, similar low power – but didn’t have that crazy lead time.” With Bizen, Summerland and his team have been able to get that time in the fab down to two to three weeks. “That’s the USP, it’s no worse than CMOS – so it’s still the designer’s dream – but it’s very fast to produce.” So, why has this remained untapped until now? Summerland explains that simulation software has been instrumental in unlocking Bizen. “Simulation tools have helped us discover things faster.

The reason the tunnelling mechanics of the Bizen transistor did not exist [until now] is because, back when CMOS was invented, the simulation tools did not exist to simulate [the potential of tunnelling]. [This discovery] required a lot of specialist simulation software – in this case it was Silvato's Athena – and that process simulation allows you to model a wafer process." Yet simulation tools alone aren't why SFN is so confident its technology will reshape how circuits are built. Summerland clarifies that simulation tools might have helped with research and development, but working with Semefab, the semiconductor and MEMs fab based in Glenrothes, Scotland, was essential in proving Bizen's worth. "A company is of no value … until it's actually produced something in silicon to prove something shown in simulation." With Bizen, designers can produce the physical silicon much more quickly, so the development time can rapidly accelerate. To date, SFN has demonstrated the Bizen digital wafer process and produced a Bizen power wafer process in physical silicon. Its IPU processor architecture exists in simulation, and the company expects to release a discrete programmable junction transistor (PJT) that uses quantum tunnel mechanics in early 2020.---------- **G Divyavani- 16BF1A0466**

EuMW highlights new frontiers for 5G

This year's European Microwave Week in Paris was dominated, as it has been for the past few years, by the latest components and test technology that are enabling 5G. The key difference this time is that 5G networks are now a reality in many countries, and the focus has moved to technologies suitable for largescale production. This is a particular challenge in the new mmWave frequency bands, where volume requirements have been much lower up to now. It has also highlighted the need for high-capacity backhaul in all its forms, including wireless links that are an economical and easy-to-deploy alternative to traditional fibre, and these are now moving up in frequency to E-Band and beyond in the quest for greater bandwidth.

In response to the need to connect areas of the world that are still off the map for mobile communications, there is also a growing emphasis on exploiting space, which is proving to be the 'final frontier' for 5G and backhaul. Among the key enabling technologies for both 5G and mmWave satellite communications are phased arrays and beamforming: advances in respect of the design, and also in addressing characterisation challenges, of this technology were prominent both in the conference and on the show floor. The number of antenna elements in a beamforming array, and their proximity to each other, also place demands on the power efficiency and thermal characteristics of the transmitter power amplifiers (PA), so advances in the design and packaging of GaN PAs and front-end modules are also increasingly in the spotlight.Space The satellite market was explored in the Defence, Security and Space Forum, where Eric Higham of Strategy Analytics said that all satellite applications are growing rapidly, and EuMW highlights new frontiers for 5G by 2028 commercial applications will account for 80% of a satellite market that will be worth a total of $94bn. 5G is the main driver for this growth – in 2029, mobile satellite traffic is forecast to be around 370,000PB per month, 30 times greater than that in 2017, and around 2.6 times greater than the yearly traffic figure for 2017. The Forum addressed the application of RF and microwave technology in extending the mobile Internet into space. Recognising that vast areas of the globe have little or no Internet connectivity, attention is focused on a new class of satellite communication services that use platforms ranging from LEO to GEO satellites. The distinction between military and commercial satellites is becoming blurred too, with some platforms offering dual-use capabilities and being financed by a combination of public and private funds. Skynet, for example, is operated by Airbus Defence and Space on behalf of the MoD, an arrangement that will continue with the recently-placed Skynet 6A contract. According to Higham, just one of the satellites in the latest ViaSat-3 GEO constellation will carry 1Tb/s of data – as much capacity as all the satellites currently in orbit put together. ViaSat-3, which is co-funded by the European Space Agency (ESA), is intended to provide 100Mb/s Internet connectivity to users.-------- **N Leela kumar- 16BF1A04E3**

5G and the security challenge

The last few years have seen multiple critical remote vulnerabilities in mobile handsets, with the potential to affect millions of users, but the impact was mitigated by legacy walled garden designs. Take the 2019 Apple iMessage bug or the 2017 Samsung SMS bug, which could be leveraged by attackers to target an Apple iPhone or Samsung Galaxy handset if the victim's number was known. If an attacker doesn't have the number but wanted to target every device in an organisation, they would either have to get access to the closed signalling network or establish their own fake base station. Both options are complex, expensive and require substantial specialist knowledge of cellular air interfaces and arcane signalling protocols like Stream Control Transmission Protocol (SCTP). Security researchers looking for vulnerabilities in mobile basebands and user equipment (UE) such as handsets and tablets for example, must invest a substantial amount of effort in supporting infrastructure to be able to test a device 'over the air' (OTA). As a minimum, a researcher would need high end radios, a GPS timing source, spectrum licensing, protocol stacks and for 3G/5G testing, programmable SIM cards to get past the mutual authentication. This substantial requirement list is why cellular vulnerabilities aren't more common. It doesn't mean they aren't there, it's just that they're beyond the reach of most. In our experience, cellular interfaces are less scrutinised than Wi-Fi/IP for example, because they're harder to reach.

Removing the wall

The flatter design of 5G networks will remove many barriers to cellular security testing; in particular the air interface which will lead to increased security focus on this previously opaque and remote interface. However, more attacks on the cellular side of user equipment are anticipated with the onset of 5G. This is because the walled garden architecture of cellular networks up until now largely shielded UE from external security because they connect to the world via a gateway, which uses Network Address Translation (NAT) to prevent attackers from accessing them directly.

Responsibility and risk

5G will see a move from a walled garden monolithic architecture to an Infrastructure-as-a-Service (IaaS) model where key components will not be owned by the network operators. This change underpins the 5G tensions between nations regarding the risk of espionage. The reason for the change is capacity. No single operator can support the quantity of devices forecast, so an elastic infrastructure service is needed. This will mean operators relinquish control, which will pass into the hands of router OEMs and middleware service providers. New technologies, like Software Defined Networking (SDN) and Network Function Virtualisation (NFV), will enable infrastructure to be more flexible and opaque than the brittle cellular network designs that we are currently used to. The responsibility of tackling security problems, as well as botnets on IoT devices, will be diluted due to shared infrastructure and is likely to be delegated to the UE OEMs who to date have not had a good track record for endpoint security. While the flexibility and potential are huge, so is the risk if the underlying infrastructure were to be compromised. By virtualising functions like SMS or voice calls, multiple functions will share a single point of failure – the hypervisor on which they are hosted. In the event of an attack on a hypervisor or hosting environment all 5G functions could potentially be compromised or disappear simultaneously, which would be worse than current outages which typically affect a single function like the May 2019 EE 'voice only' outage and the day long O2 'data only' outage. These outages describe hardware failures in brittle systems, dedicated for one function – which isn't an entirely bad idea when you run critical systems as despite the failures, EE customers could still text and O2 customers could still make calls. Precision geo-location for attackers The erosion of anonymity is another concern. 5G precision could reveal the specific floor within a building a device is located on, because the macro cells used in deployment are substantially smaller than in cellular networks. By design, each base station has a unique ID, so if you can find the base stations near or inside your target on the 5G network, much like a home router, you can begin to enumerate devices attached to it.---------- **V Swarna- 16BF1A04M5**