IEEE BITS PILANI STUDENT CHAPTER

TECH REVIEEEW

1st EDITION

An Interactive Session with V K Chaubey

What if **Smartphones** happen to be **TRANSPARENT**

A Novel perspective to Health Care

A reality check Self-Driving Cars

Unveil the Hidden Mystery of Steganography

Editorial

We are a group of enthusiastic, tech-freaks working towards enriching and inspiring a sense of curiosity towards the vast world of electronics and computation.

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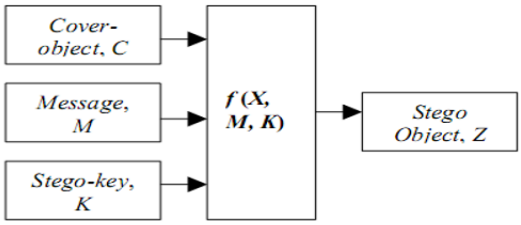
Steganography

-By Priyam Shah

The modern usage of the word cryptography evokes images of spies and espionage, of secret messages sent back and forth between agent and government, and of secret panels in briefcases to conceal stolen documents. For those who lurk on the dark corners of internet, cryptography is the science of writing a secret code while communicating over any untrusted medium, which includes just about any network, particularly the Internet. The basic goal of cryptography is to transmit information between two parties without any sort of third-party interferences. However, the fact that encrypted files are intended to attract attention to itself and that they are under scrutiny has proved to be one of the major disadvantages of cryptography.
However, we were able to solve similar real-world problems in the past as the dates take us back to ancient Greece where common practices consisted of etching messages in wooden tablets and covering them with wax; tattooing a shaved messenger's head, letting his hair to grow back and then shaving it again at point of contact with the receiver and many more. However, the basic idea behind the techniques was to somehow embed secret information within other, seemingly harmless information.
The technique based on the same principles intended to prevent the suspicion about the existence of any sort of confidential information is called 'Steganography' which literally means covered writing. Steganography can also be used to protect identities and valuable data from theft, unauthorized viewing apart from potential sabotaging by concealing the message within an unsuspicious image. In other words, steganography is more discreet than cryptography when we want to send a secret information.

Steganography works by replacing bits of useless or unused data in regular computer files with bits of different, invisible information. The basic model of steganography consists of Carrier, Message and Password. Carrier is also known as cover-object, in which the message is embedded and serves to hide the presence of the message. Message is the data that the sender wishes to remain it confidential. It can be plain text, cipher text, other image, or anything that can be embedded in a bit stream such as a copyright mark, a covert communication, or a serial number. Password is known as stego-key, which ensures that only recipient who know the corresponding decoding key will be able to extract the message from a cover-object. The cover-object with the secretly embedded message is then called the stego-object.

So, for understanding how this is done we first need to understand the basics. So, considering the simplest example, an 8-bit RGB color mode which consists of 3 eight-digit binary codes each for different shades of red, green and blue. For an eight-digit binary code the first four digits are the dependent digits i.e. the value of that binary code mainly depends on those four digits. However, the last four digits do not make much of a difference if changed. Using this information, we remove first four digits of all the binary codes of the picture that we want to preserve while sending through the network (so that we preserve the most important information regarding the picture) and replace those with the last four digits of all the binary codes of the image used to mask or cover the image. While retrieving we can just remove last four digits of the binary codes of the resulting picture and just add 0's as the last four digits just to complete the 8-digit binary code. This would preserve the most information of the picture that needs to be preserved. However, this is easier said than done. All these things consist of different algorithms and methods to change the codes of the picture.



The three biggest areas of illegitimate steganography evolve around terrorism, pornography and data theft. During the research for this website the illegitimate uses of steganography were also found to be on a global scale involving national security or were done on an academic basis to better understand the potential danger of steganography if created by individuals with ill-intentions. However, advances in steganography and the idea of combining cryptography and steganography could effectively lead us to the advent of the most reliable storage/transmission method.

Blockchain

A novel perspective to health care

-By Jash Shah

Satoshi Nakamoto (the anonymous name of bitcoin inventor(s)) created a new liquid money that profited many. In 2017 the spirit of Bitcoin finally got out of the bottle. After years of silence, Bitcoin suddenly rose to almost $20,000 and everybody suddenly turned into a 'professional crypto trader'. The word Bitcoin and blockchain have thrilled us for a while now. They have gained immense popularity in recent times. We have heard hundreds of explanations about how a blockchain work. But how does it actually work at the developer's end? Does blockchain only limit its scope to the Bitcoins and other crypto currencies? Let's find out.

First, Blockchain is neither a technology nor an application. It simply is a database that is shared across a network of computers to form a so called "Distributive ledger". A ledger simply means an account of debit and credit made by the person/institution. In blockchain, each user gets a copy of this ledger making the accounting de-centralized. Once an entry is made, it becomes almost impossible to change it. Plus, all the entries are first verified by all the users. Only then can the ledger be updated. This double layer security makes the tech "Hack-proof".
The two most important terms in blockchain networking are: P2P network and mining. The former makes the network solid and secure while the latter determines the value of the crypto currency.

P2P (Peer to peer) network basically connects all the nodes(users) to each other, directly.i.e. they don't rely on a centralized party to take care to directing and storing the data (as we have on databases like Wikipedia). This means that the network becomes much faster if more nodes are joined to it. Also, extending of the network and branching becomes easier. Coming down to mining, this is where the programmer plays his real role. Mining is the process of creating a new block (to store new records) and chain them with previous blocks. The chaining process is what makes the process quite difficult. Hashing algorithms are applied to keep the data safe, also making it impossible to reverse hash. Also, there are 2 protocols that define the miner capability: Proof of work and Proof of stake. According to the first one, the miner with maximum computational power creates a new block and earns accordingly. In case of proof of stake, a randomized system is declared a miner and the miner earns proportional to his currency holding. But this poses a problem in 'No stake' case wherein a miner is a new joiner. Also, branching facilities are only available in former case. The hashing also ensures the non-mutability of blockchains. This fact owes to the reason that changing a single unit of data may change the entire hash, thus altering the entire block. This unchains that block from the chain. Hence, for hacking a blockchain we need to own more than 51 percent of the chain, which is practically impossible.

Coming to the application part, we all know the crypto currency as one of the major application. IPCs also add an additional advantage to new joiners. This highlights the business view of the blockchain. IPCs and whitepapers are new form of stock exchanges. Apart from these, there are many more applications. The ledger, allows for a radically different method of storing information in the new era of data that is not monopolized by one central party, but commonly owned and authorized by a decentralized network of nodes. If we focus on the implications of this new trust less way of building databases and organizations alone, we can anticipate how applied blockchain will have a truly radical impact on a multitude of industries, markets and charitable causes. Following this, the encrypted, responsive nature of blockchain technology paves new ways for storing and securing the ever more increasing networks of data exchanges, which increase in traffic and volume every single year.
The tokenization aspect also means that real-life applications of blockchain technology will also help in creating new avenues of generating wealth, if we consider how various, previously solid, assets can now be liquidated and sold as fragments through a decentralized ledger. Similarly, so, blockchain allows users to monetize their activity more, whether we

consider selling their data to advertisers or creating their own content.

We will consider a huge influence of blockchain in Health care facilities:
The future of healthcare will be all about efficient data processing and sharing, bringing about a new era for one of the most promising blockchain use cases yet. Mainstream digitization of records in the previous decade has solved accessibility problems, heralded opportunity for analysing medical trends and assessing the quality of care.
Easier interaction between blockchain medical records, the databases that hold them and individual patient information can improve treatment by providing more accurate diagnoses, treatment choice, as well as cost-effective care.
The blockchain healthcare use cases increase even more if we consider smart contracts which could be employed on a healthcare-focused ledger to easily process surgery receipts between the hospital, patient and the insurance provider.

In a similar way, a ledger can also be used for supervising drug intake and distribution, regulation compliance or managing healthcare supplies. For example, an individual patient could interact with a specific blockchain healthcare platform to easily view all of their claims, medical history, transactions, as well as overdue payments. Alternatively, they can also use a blockchain to apply for transfers or schedule appointments with their immediate medical staff, which are activated by smart contracts as soon as payment is processed, and doctor confirms availability.

At its core, the problem lies in centralization. Data that is stored in one central point is far more vulnerable to being compromised, which is exactly the opposite to how blockchain technology is built. By being a ledger of information that is distributed across various a P2P network, blockchain ensures the security of data by not having a single point of failure. A hacker would need to attack countless devices at once to collect little bits of data and put them altogether, it is simply not feasible nor possible. Furthermore, decentralization ensures that even if one of these devices fails, the data remains secure elsewhere. This resilience and security have become some of the hallmarks of why blockchain technology is so revolutionary.

Transparent Electronics

-By Divyam Sharma

Transparent Electronics is a newly emerging area of Semiconductor Technology. It is the next generation of opto-electronic devices and wide-band gap semiconductors, which are generally, used to realize the invisible circuits. The Transparent Conducting Oxide (TCO) thin films having greater conductivity are highly desirable for optoelectronic devices. Flexibility, Transparency, Light weight, Lower power consumption and operating voltage are the most important characteristics of these opto-electronics devices.

Moving onto a direct implication of transparent circuits. In high-end automobiles, in rich-folks' cars, one technology has made driving extremely secure: heads up display. It is the technology of showing the driver important details of the dashboard, like the speed, indicators, and fuel economy, directly on the windshield.

If you're any bit inquisitive, you would surely wonder as to how an electronic display can be incorporated on a transparent film. It is intriguing, because you don't get to see the connecting wires and the electronic components. And it makes you wonder one thing: how on earth is there a circuit when there doesn't seem to one? Welcome to the world of transparent electronics. Still in its nascent stage, transparent electronics employs wide band-gap semiconductors for making circuits that are invisible to the human eye. So, the heads up display in a car is made possible only because of transparent electronics. However, when you doddle a bit more, you'll know that the heads-up display is just the tip of a technological iceberg. What we're dealing with here is something way beyond that. We're talking of an electronic circuit technology that will change the world of electronics forever. Transparent electronics is an emerging science and technology field focused on producing invisible electronic circuitry and opto-electronic devices. Applications include consumer electronics, new energy sources, and transportation. For example, automobile windshields could transmit visual information to the driver. Glass in almost any setting could also double as an electronic device, possibly improving security systems or offering transparent displays. In a similar vein, windows could be used to produce electrical power. Other civilian and military applications in this research field include real time wearable displays.

By now, it might be clear to you that transparent electronics is a big concept. At the same time, it is extremely complex. Its functioning can be quite a handful to understand. The two technologies which preceded and underlie transparent electronics are Transparent Conductive Oxides(TCOs) and Thin-Film Transistors (TFTs). TCOs constitute an unusual class of materials possessing two physical properties- high optical transparency and high electrical conductivity. They are generally considered to be mutually exclusive. This peculiar combination of physical properties is only achievable if a material has a sufficiently large energy band gap so that it is non-absorbing or transparent to visible light and possesses a high concentration of carriers with a sufficiently large mobility that the material can be considered a good conductor of electricity.

The three most common n-type TCOs are indium oxide(In_2O_3), tin oxide(SnO_2), and zinc oxide(ZnO). All these materials have band gaps above that required for transparency across the full visible spectrum (2.9 eV). Thin-Film Transistors are another technology underlying transparent electronics, since it is a bridge between passive electrical and active electronic applications. Although TFTs were the subject of the earliest transistor patents, the first realisation of a TFT was reported in 1961 by Weimer and fabricated via vacuum evaporation using CdS as a channel layer. None of these undertakings involved an attempt to realize a fully transparent TFT.

A heads up display in a car is a technology that is found only in some of the high-end luxury cars. That means, it isn't a cheap

technology. It isn't cheap because of the very principles of Physics that it must follow. The amalgamation of the optical and electro capabilities of a device is extremely hard to achieve. The challenge is that the transistor materials must be transparent to visible light yet have good majority carrier mobility (electrons for n-type oxides). This requires a special class of materials having contra-indicated properties because from the band structure point of view, the combination of transparency and conductivity is contradictory.

Oxides Play A Key Role

One major reason why there has been such interest and activity in transparent electronics recently is that there has been a sharp jump in the carrier mobility of transparent semiconductors, which determines transparent TFT characteristics. This now exceeds the carrier mobility of materials such as low temperature poly-Si (LTPS) and amorphous Si used in LCD panels. While there are other remaining problems, transparent oxide p-type semiconductors have also been in development. Transparent semiconductors such as GaN and diamond are already known, but they come at high cost which makes them impossible to use in transparent electronic devices demanding relatively large screens, such as displays. The candidate materials attracting the most interest can be broadly divided into two oxide categories. The first group is zinc oxide (ZnO), and the second is amorphous oxides with heavy metal content.

Advancements Made in Transparent Electronics

Significant advances in the emerging science of transparent electronics, creating transparent "p-type", through some breakthrough researches, semiconductors that have more than 200 times the conductivity of the best materials available for that purpose a few years ago. This basic research is opening the door to new types of electronic circuits that, when deposited onto glass, are literally invisible. The studies are so cutting edge that the products which could emerge from them haven't yet been invented, although they may find applications in everything from flat-panel displays to automobiles or invisible circuits on visors.

Self-Driving Cars

-By Kartik Wardhan

Transportation is an essential part of the modern world and the latest buzz in the transportation industry is Self-Driving Cars. Currently the term 'Self Driving Car' is often misinterpreted by many people. Basically, if a vehicle can take you to the desired destination without any human aid then it can be called 'Self Driving'. This is a bit different from the 'Autopilot' systems we see in present day cars like Tesla's. These cars only help the driver in situations such as collision avoidance, lane shifting, blind spot monitoring, parking, etc. A self-driving car, on the other hand, needs no driver at all. The distinction can be better understood by seeing the five levels of automation in driving:

- Level Zero – No Automation

At Level 0 Autonomy, the driver performs all operating tasks like steering, braking, accelerating or slowing down, and so forth.

- Level One – Driver Assistance

At this level, the vehicle can assist with some functions such as braking a little extra for you when you get too close to another car on the highway.

- Level Two – Partial Automation

Most automakers are currently developing vehicles at this level, where the vehicle can assist with steering or acceleration functions and allow the driver to disengage from some of their tasks.

- Level Three – Conditional Automation

At Level 3, the vehicle itself controls all monitoring of the environment (using sensors like LiDAR). The driver's attention is still critical at this level. Many current Level 3 vehicles require no human attention to the road at speeds under 37 miles per hour.

- Level Four – High Automation

The vehicle is capable of steering, braking, accelerating, monitoring the vehicle and roadway as well as responding to events, determining when to change lanes, turn, and use signals.

- Level Five – Complete Automation

This level of autonomous driving requires absolutely no human attention. There is no need for pedals, brakes, or a steering wheel, as the autonomous vehicle system controls all critical tasks.

TECHNOLOGIES INVOLVED

In a nutshell there are three technologies involved in self driving cars:

Sensors

To mimic the function of a human driver, a car must be completely aware of its surroundings. A human driver perceives the surroundings with his/her senses, especially vision and hearing. To achieve these senses, self-driving cars utilize cameras, RADARs, LiDARs and even Ultrasonic sensors.

- Cameras - Great for spotting things like lane lines on the highway, speed signs, and traffic lights. When integrated with Machine learning algorithms, they can be used to differentiate between human and non-human obstacles.
- RADAR (Radio Detection and Ranging) - Radars bounce radio waves around to scan the surrounding and are especially good at spotting big metallic objects—other vehicles. They're cheap, reliable, and can work even in fog, rain, or snow.
- LiDAR - The spinning thing you see on top of most self-driving cars is LiDAR-Light detection and ranging. It fires out millions of laser beams every second, measures how long they take to bounce back, and uses the data to build a 3D map that's more precise than what radar offers and easier for a computer to understand than a 2D camera image. But it's also crazy expensive, hard to manufacture at scale, and nowhere near robust enough for a life of potholes and extreme temperatures.

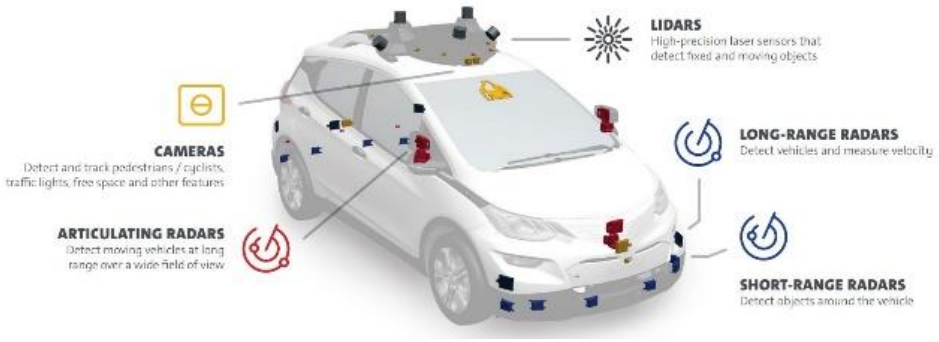
This array of sensors becomes the eyes and ears of a self-driving car. The current focus is on shrinking down the cost and size of these sensors to an economically viable level.

Connectivity

This is one aspect that puts self-driving cars one step ahead of human drivers. Connectivity means self-driving cars can communicate with each other and share their location, weather conditions, road and surface conditions and other data collected from sensors via a central hub or the internet. For example, all cars today come equipped with GPS system for navigation which is a form of basic connectivity over the internet.

Currently, internet is the only way of connecting such large number of cars, but auto makers are working on new protocols aimed specifically at connecting self-driving cars. V2V (vehicle to vehicle) and V2I(vehicle to infrastructure) are two protocols being currently developed. Vehicle-to-vehicle (V2V) communication works with DSRC (Dedicated Short Range Communications), which is a type of Wi-Fi that sends brief messages up to 10 times a second over short distances, about 1,000 feet. V2I, on

the other hand, connects the vehicle with the traffic infrastructure such as road signs, speed limit, traffic lights, lane markings, etc.
The advantages of such connectivity are many. Since the cars are connected, they can be alerted if their route is busy or jammed. Instead of carrying computing devices themselves, self-driving cars can share their sensor data to the cloud which can then be processed at a large data center and the processed information can then be sent to the car. This way we can save space as well as cost of these cars. When integrated with Machine Learning and AI, this can help in controlling the traffic flow more efficiently.
This means that self-driving cars are not only aware of their current surroundings but also of the complete route.



Data Processing and Algorithms
This is the area that has attracted most research in the recent years. Once the car has collected the data and sent it to the cloud it must be analysed to take a decision. For example, if the car detects an obstacle, should it drive around it or should it stop and wait for the road to be cleared? The car detects heavy traffic at the next intersection, should it change its route and if yes then which route should it take? These are all questions that a self-driving car needs to know the answer for. Currently, machine learning and artificial intelligence is the key to it.
The most common machine learning algorithms that are being used in autonomous vehicles are based on OBJECT TRACKING. These algorithms are aimed at improving the accuracy of pinpointing and distinguishing between objects. These algorithms can differentiate between a cow and a human and a street light. Machine learning algorithms can analyze data collected over years and identify accident and jam prone areas. Navigation systems can determine the most fuel-efficient route by looking at traffic and weather data. But, the car cannot rely on the cloud for each decision. There are certain situations which call for a quick response such as collision avoidance, blind spot monitoring, etc. So, there has to be a secondary computing system on the car which can take over if connection to cloud is lost or if the situation is critical. This is called deep learning, the technology that allows the car to make decisions on its own – getting smarter as an autonomous car spends more time on the road.

WHAT TO EXPECT IN THE NEAR FUTURE
Not everyone is going to be in a self-driving car by the next decade. There is a long road of technological, economical and legal barriers. Even the humans are not fully comfortable in giving machines total command over a vehicle. Present day prototypes by Google, Ford, Volkswagon, are not comfortable enough for daily use as computers and sensors take away a large chunk of space in these cars. Intel predicts that a self-driving car is going to consume Terabytes of data per day and with current technologies we are not sure how to meet such humongous data demands. We are definitely getting closer to make self-driving cars a reality but it will take a long time. The current focus is on shrinking down the size of sensors and increasing the processing capacity of computing devices. Right now, the closest we can get to this technology is in the form of self-driving taxis- as advertised by Uber and Lyft- which are expected to hit the roads by 2020.

Highlights of CES 2019

-By Nishant Gupta and Shashwat Khare

Samsung Galaxy X with Infinity Flex display

A foldable smartphone which can be used as a tablet-like display when open and normal smartphone when folded.

Signature OLED TV R

This is the world's first completely and essentially rollable TV. It is 65-inches in size when rolled up to its full size and rolls down in a box at its base which serves as the sound box for the TV. There is a line view also (in between the completely rolled up and rolled down views) in which there are features like clock, frame, mood, music and home dashboard. Even in the zero view the users can listen to music and play audio on the 4.2-channel, 100W front-firing Dolby Atmos audio system. It has support for Amazon Alexa and Google Home virtual assistants and supports Apple Homekit as well.

From 4K to 8K display

To actually see any difference between 4K and 8K displays we need more than 75-inch display. So, this year Sony and LG marked the beginning of their 8K displays by unveiling their 98-inches 8K LCD TV and 88-inches 8K OLED TV (world's first 8K OLED TV) respectively. Whereas Samsung followed up with a 98-inch 8K QLED TV model after its previous 85-inches one.

Dell Alienware

Dell has released its completely upgradable top-class gaming laptop. Some of its specs are: 17.3-inch IPS FHD display, 64GB of DDR4 RAM, 8-core CPU ranging from core i7 to core i9, a standard 60Hz panel or with Nvidia G-Sync, graphics powered by NVIDIA RTX Mobile graphics (with a wide range of graphics options available from GeForce RTX 2060 with 6 GB GDDR6 RAM to GeForce RTX 2080 with 8 GB GDDR6 RAM), HD webcam with dual array mic and stereo speakers.

Blockchain Integrated with the Internet of Things

In recent years, there have been several innovations in the world of technology – most of them being the convergence of two or more streams to give a new technology- like the Internet of Things. In the coming year, we can expect to see another convergence of two popular technologies- Blockchain and Internet of Things. Blockchain, mostly known for powering the crypto currencies like Bitcoin provides a secure and trustworthy base to store and display data. Being extremely difficult to hack, this technology when implemented on the Internet of Things (IoTs), will make the IoTs much more decentralized and secure.

FINFET Technology

- By Pradhit Ongole

i3, i5, i7, i9, how far can we go? Intel Co-founder Gordon Moore once stated that the number of transistors on a chip doubles yearly while the price becomes half. Although the recent pace has slowed for Moore's law, the doubling of installed transistors on silicon chips occurs closer to every 1.5 years. To continue at this pace, modern technologies such as the FinFET have become popular.

STRUCTURE

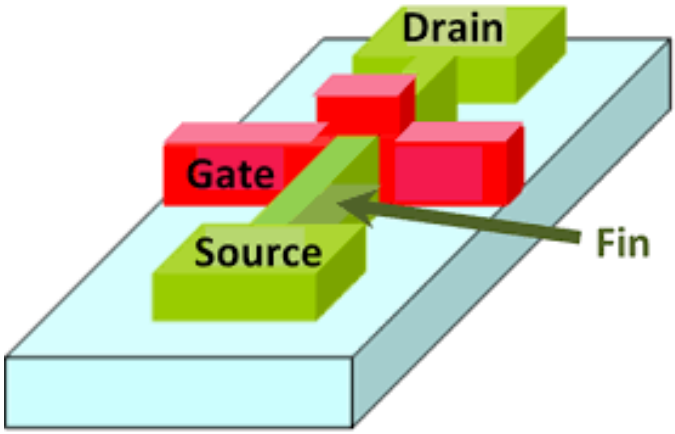
Finfet technology takes its name from its structure. It has a vertical fin on a substrate which runs between a drain and source. This protrudes vertically above the substrate as a fin. The gate wraps around the channel and is at right angles to the vertical fin. This form of gate structure provides improved electrical control over the channel conduction and it helps reduce leakage current levels and overcomes some other short-channel effects.

WORKING PRINCIPLE OF FINFET

The working principle of a FinFet is similar to that of a conventional MOSFET. The MOSFET can function in two modes: enhancement mode and depletion mode for both p-channel and n-channel types.

In depletion mode the channel shows maximum conductance when there is no voltage on the gate terminal. As the voltage changes to positive or negative, the conductivity of the channel reduces.

In enhancement mode of MOSFET, when there is no voltage on the gate terminal, it does not conduct. Unlike the depletion mode, in enhancement mode, the device conducts better when there is more voltage on the gate terminal.



Advantages of FinFET

FINFET ADVANTAGES	
PARAMETER	DETAILS
Power	Much lower power consumption allows high integration levels. Early adopters reported 150% improvements.
Operating voltage	FinFETs operate at a lower voltage as a result of their lower threshold voltage.
Feature sizes	Possible to pass through the 20nm barrier previously thought as an end point.
Static leakage current	Typically reduced by up to 90%
Operating speed	Often in excess of 30% faster than the non-FinFET versions.

Interactive session with V K Chaubey (EEE HOD.)

Q1) What is your view upon the research culture on campus and what scope of improvement do you see in that domain?

Ans. As the competition for better international ranking and recognition is growing, research is automatically gathering its pace throughout and BITS is also taking one initiative after the other for promoting research. This is done by providing incentives which earlier were not present. The institute has started to consider research as a criterion for faculty promotions, which has given research a boost on campus. The students have always been intelligent and so a complementary teaching standard can yield wonders in the form of excellent future professors at top universities or research scientists capable of winning laurels for themselves and the institute. I would also like to say that students should not hurry up with the publication of papers for the sake of CV or resume points as good research takes time. Anything lesser than good research is not worthy of time and might even be a crime in case of plagiarism detection.

Q2) What are your views regarding placements in the core branches (of electronics)? What is your advice to students regarding excelling in them?

Ans Skill is a very crucial factor on which the company hires you in case of core jobs. By skill, I mean that one should be excellent in their fundamentals and CDCs. In India, mostly the core jobs involve work of software checking, etc. Very few companies, like Texas and Nvidia take up students for actual circuitry work. A Master's degree (maybe from the US) is important for actual core jobs wherein you have practically worked with circuit designing. Mere class teaching will not suffice their needs, and that is well obvious as their design is their main source of revenue. After all being businessmen, even they won't invest a lot of money until they are guaranteed for the best. Mostly all the circuit designs are designed in the USA and the guys send over their designs to Indian debuggers and stimulators who test it over a universal platform. They might train you, but they can't spend a lot of time training you to manipulate the hardware. So, you need to be the best.

What I have observed is that, out of complete EEE department, around 30-40 % students end up taking a core job. Other 60% don't prefer it. Students take small jobs just for psychological satisfaction before planning for further studies. Money plays a role here because IT jobs (that require less effort and skill) end up providing higher salaries when compared to core jobs. But, in the long run, if a student is interested in circuits, he should pursue higher education and as he gets more skilled, his demand will increase. What I feel is that job security is much more in case of core jobs because software updates in the CS world, may ruin up a person's job. But if one is good at fundamentals of circuitry, updates won't alter his career.

Q3) Observing the recent trend from the core and most people running after IT jobs, do you think there is a need for some professional career counselling to the BITSians today? If yes will the Institute soon come up with a plan for this?

Ans Most BITS alumni are well placed in technical wings of good companies and are involved in technical jobs. They can be invited either through alumni forum or HODS or some student can take their biodata. I invite some of you those who can associate with me, let me make 3-4 student groups that will identify and talk to good technocrats in India and abroad, working at senior positions. Whenever they are visiting India, they can spare and share their experience with youngsters. This will develop an environment which may boost up students to prepare for the core. They can also help the department by suggesting some modification

in courses. We are teaching fundamentals, few electives which will make you adaptive to the technology, but it will not become rigid, in at least 5 years, if you want to survive in the accessibility of technology, every 5-8 years, some variation, manipulation, and modification in the material is required.

Some courses which are electives, train you to be more acceptable to technology, that should be updated with the help of BITS alumni, especially those who are in the industry.

Q4) What do you think of the changing scenario in the electronics industry? What do you think about the future? With Moore's law coming to an abrupt end, do you think the research scope is saturating in electronics domain?

Ans Since thousands of years, one thing is invented, and the next one is invented, so on. It is a continuous chain, it will go on. With shrink of dimensions the concept of charge transport changes (which causes problems), now if there is a problem there is (also) a solution. (Some new solutions) here are either in term of quantum concepts of the devices, changes in the architecture by making multilayer devices, quantum devices, photonic devices, and VLSI architecture. The solutions come from the human brain which has enormous capacity. The brain then thinks that it should develop some technology and then get robots to build on that. Thus, artificial intelligence comes. Now this AI can do the routine things, thus freeing our brain to do some other specialized job. Like the way children learn by doing mistakes, AI is developed to learn from automated sensors and deep learning. This is also inculcated in the hardware and software design. This is a new development which was not visible 10 years ago. Next, what will come I don't know. The next 5 years what will come, you people have to explore that. There is no end of technology, research will grow on and nobody can predict what will go on in the next 20 years. What we should worry about are the problems today. Do your own job with your best ability. Problems will come but they will be resolved with perseverance and effort.

Q5) What are your views on the technical fest of the institute – Apogee? What would be your suggestions for making the fest bigger and better?

Ans Engineering is not only about Theoretical things, if you can convert your ideas into products which will be used by society, then you'll get more visibility and appreciation. Some of you are presenting papers, academic research, discussions are all very good but sometimes when you talk about dynamic projects, one thing I observed in the past 4-5 years when I was HOD here from 2007-2012 is that at that time during APOGEE, they used to invite the HOD in discussions, events and they used to participate as well. Nowadays, the link between faculties and students is diminishing. This link must be encouraged, students should get involved with teachers, BITSians working in Industries. Alumni can come up and help in projects. Students can do projects which they are demanding and then commercialize it. You can invite BITSians involved in start-ups, to provide a platform to catch young students and motivate entrepreneurship.

I observed that the effective outcome of APOGEE is decreasing in the last 4-5 years. This requires more effort from the student side.

Q6) What expectations do you have from the technical clubs on campus? Up to what extent, have they been successful?

Ans There are many good clubs on campus with skilled and passionate members who work hard on projects as part of their club activities. Clubs provide students with a platform to work on projects with like-minded peers. Clubs should also work to replicate existing technology, so some of the products which are already there, try to rebuild them. So in your club maybe you can develop that hobby. Lot of circuits are coming every month in electronics for you, and results are also published, you can develop some small projects, so that will give you the confidence of engineering.

Suppose you develop a small bot, if you do design, prototyping and all that in your club, then it will motivate other people also to do something. This culture is nurtured because to do anything new is very difficult, we always build inertia, but if one batch tries to develop something then another batch will also do it seeing the first one do so. I love to motivate students and I try to bring IEEE and other technical associations together. I am very happy they exist. From my side I will be there for any help students need, I can also invite some of your alumni working in a lot of different fields so that they get engaged and encourage students.

Q7) As the EEE HOD what changes can we expect from your side?

Ans I want to introduce the concept of TOPIC FEEDBACK from both my faculties and students. We should re-visit our courses and fundamentals according to the given honest

feedback. Although the course structures are quite strong, I think that CDC should be taught by very dedicated teachers so that we are building your fundamentals, we cannot compromise on that. We can think of providing additional electives for that. I have completed my research work and all and now I am quite satisfied with that. It is now my job to share my knowledge and motivate other faculties to do the same. Teaching is not a duty, it's an art, a passion. Of course, all the faculties present over here (Pilani) are extremely passionate, but it's my duty to shape them to resonate to the academic environment with the students to motivate them.

I also wish to meet students and appeal them to participate actively in the class. The real problem is that students bunk classes and then they complain about not understanding the topic. On a lighter note, a student must feel the need to utilize the fees they pay to the institute. They should interact with teachers. They are welcome to enter my chamber any number of times they wish to.

A teacher's main job is to trigger the motivation. Sometimes, students don't find a teacher up to their expectation, they are welcome to give that feedback to the teacher. It's the only way one can improve the teaching. The teacher needs to spend time with their students to improve and inspire them.

Of course, feedbacks at the semester-end won't help the student filling up the form, but, it may help the upcoming batches. It's not always about filling your own pockets, but making others also rich.

Ultimately, we will be known by our profession, identity, and fame of our students. So, of course, we would thrive to train you for the best and put in our sincere efforts. I feel so happy when my old students text me or mail me about their success story. So, we would try our best to reduce the resistances from your life and make you to resonate in phase to excel in your future personal and professional life.