



IEEE SVCE SB PRESENT'S

SPECTRUM



MAIDEN ANNUAL NEWSLETTER OF IEEE SVCE SB



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**MARCH 2025
VOLUME 1
ISSUE 1**





With Best Compliments
from
IEEE SVCE SB
(STB 14181)



SVCE TIRUPATI

EDUCATION FOR A BETTER SOCIETY

PROMOTORS

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PhD, JNTU, New Delhi



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Vice Chairman
MBA from
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Secretary
MBA from
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IEEE SRI VENKATESWARA COLLEGE OF ENGINEERING STUDENT BRANCH (STB 14181)



VISION

IEEE will be essential to the global technical community and to the contributions of technology and technical and of technical professionals in improving global conditions

MISSION

IEEEs Core purpose is to foster technological innovation and excellence for the benefit of humanity.

About Our *Story*



*“Driven by **Passion**,
Defined by **Progress**”*

Established in the year 2014, the IEEE Sri Venkateswara College of Engineering Student Branch has been a thriving platform for students passionate about technology, innovations on and professional growth. IEEE SVCE SB number is STB 14181. As part of the IEEE Hyderabad Section, our student branch actively participates in regional IEEE events, networking opportunities, and leadership programs. Additionally, Our branch is a proud part of the IEEE Anantapur Subsection, which specifically caters to the needs of students and professionals in the region by promoting IEEE's mission of advancing technology for humanity. Under the guidance of our esteemed Branch Counsellor, Dr. N. Sudhakar Reddy, and a dedicated team of faculty and student members, our branch fosters a culture of technical excellence, leadership, and collaboration. The EXECOM consists of dedicated student leaders who oversee the branch's operations, organize events, manage memberships, and foster collaboration among technical societies. Their responsibilities include planning and executing technical activities, facilitating industry connections, handling finances and funding, and ensuring the seamless functioning of IEEE initiatives within the institution.

Over the years, we have expanded our reach with multiple active societies and affinity groups, including the IEEE Computer Society (est. 2014), IEEE Women in Engineering (WIE) (est. 2014), IEEE Signal Processing Society (est. 2021), IEEE

Communication Society (est. 2021), IEEE Power and Energy Society (est. 2021), IEEE Sensor Council (est. 2021), IEEE Nano Technology Council (est. 2021), IEEE Education Society (est. 2024), and, each focusing on its respective domain by organizing technical workshops, hackathons, guest lectures, and research discussions. Our student branch has achieved significant milestones, with members excelling in various domains. The IEEE Student Branch Sri Venkateswara College of Engineering Student Branch has received substantial funding and sponsorships, allowing us to expand our initiatives. We have also successfully conducted impactful events such as IEEE SPAX 2024, a flagship professional awareness event, and IEEE STEP 2024, designed to aid students in their transition to professional IEEE membership. The growth and success of our branch are credited to the dedication of our senior members, who have continuously guided and mentored new generations of students.

At IEEE Sri Venkateswara College of Engineering Student Branch, we believe in the power of knowledge-sharing, community building, and technological advancement. Through our magazine, we bring you inspiring success stories, cutting-edge innovations, and insights into the ever-evolving world of engineering and technology. As we continue to grow, we invite you to be a part of our journey in “Advancing Technology for Humanity.”

Chief Editors Note

Dear Readers,

As we embark on the maiden edition of Spectrum, I am thrilled to reflect on the remarkable journey we have undertaken together at IEEE Sri Venkateswara College of Engineering Student Branch. This magazine serves as a vibrant platform for students to showcase their creativity, innovation, and academic pursuits.

In this issue, you will find a diverse range of articles that highlight our students' achievements, research endeavors, and IEEE related activities. We aim to inspire and inform, fostering a sense of community and collaboration among our peers.

I encourage each of you to actively participate in this initiative. Your contributions are invaluable in making Spectrum a true representation of our collective spirit and talent. Whether through articles, artwork, or feedback, your voice matters.

Warm regards,
Allabaksh Shaik
Editor-in-Chief
Spectrum



Editorial Board

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Section Editors	:	Chittepu Gnanitha Reddy Harshitha N. Hema Sai Sree
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Student Branch Counsellor's Annual Report 2024

Greetings from the Branch Counsellor's Desk!

It is with immense pleasure that I present you the annual report of IEEE SVCE SB of the academic year 2024. I extend my heartfelt appreciation to the IEEE Sri Venkateswara College of Engineering Student Branch for their unwavering commitment to fostering technological excellence and innovation. As we introduce the first edition of the student branch magazine, it is an ideal moment to reflect on the exceptional contributions of the IEEE SVCE SB in shaping the future of young engineers.

The IEEE SVCE SB has been at the forefront of transforming students into visionary leaders, equipping them with the necessary skills, knowledge, and ethical values to make a meaningful impact in science and technology. Through this magazine, we aim to showcase the journey, achievements, and endeavours of our students as they continue to break barriers and innovate in various technical fields.

The IEEE SVCE Student Branch has consistently organized technical symposiums, research discussions, and hands-on workshops—ensuring that students gain practical exposure beyond the classroom. These initiatives not only enhance technical acumen but also foster teamwork, problem-solving, and leadership, which are critical skills in today's dynamic world.

Our IEEE Student branch has been recognized as the IEEE Signal Processing Society Hyderabad Section Emerging Student Branch of the Year 2024, A prestigious accolade that highlights the dedication and perseverance of our students



Dr. N. Sudhakar Reddy
Principal SV College of Engineering

and faculty members We also congratulate Vasu Paul Srikar for being named the IEEE Signal Processing Society Hyderabad Section Best Student Volunteer for the year 2024, acknowledging his outstanding service to the IEEE community.

The recent successes of IEEE SPAX 2024 and IEEE STEP 2024 mark significant milestones in our pursuit of technical excellence, bringing together industry experts, researchers, and students for a rich exchange of knowledge and ideas. Additionally, the student branch has been proactive in securing funding and sponsorships from IEEE ensuring the execution of large-scale technical events, skill-development programs, and impactful research projects.

The guidance of our esteemed faculty members, combined with the relentless enthusiasm of our students, has

firmly established our Student Branch as a beacon of excellence in the field of engineering.

In this magazine, we present a collection of stories, experiences, and accomplishments that reflect the spirit of innovation and collaboration that the IEEE SVCE SB embodies. I encourage all budding engineers to engage actively in IEEE's initiatives, harness the wealth of knowledge it offers, and contribute toward building a future that is both technologically empowered and socially responsible.

Let us all continue this pursuit of excellence with determination, as we work together to innovate, collaborate, and lead. The future is ours to create!

OUR MENTORS

Wisdom that Shapes our Journey



Dr. N. Sudhakar Reddy
Principal



Dr. A. Tharakeswar
Vice - Principal



Dr. V. Madhurima
SAC Dean



Dr. O. Eshwar Reddy
Academic Dean



Dr. G. Prem Kumar
CS Dean



Dr. S.M. Abdul Kalam Azad
ES Dean



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HOD - EEE



Dr. R. Swathi
HOD - CSM



Dr. A. Ganesh
HOD - CSE



Dr. R. Suresh
HOD - CSD



Dr. C.H. Santhaiah
HOD - CSC



Allabaksh Shaik
Senior Member of IEEE



Dr. K. Kumar
Senior Member of IEEE



Dr. S. Rafi Kiran
Senior Member of IEEE



Bala Subbareddy
IEEE Coordinator - ECE



D. Sainath
IEEE Coordinator - CSE



N. Vasavya
IEEE Coordinator - CSE

EXECOM 2024

"A Great Leader does not tell you what to do, They Show you how its done"

The IEEE Student Branch Executive Committee (Execom) plays a crucial role in managing the activities and operations of the student branch.

Key responsibilities include:

1. Leadership and Administration
2. Event Planning
3. Membership Engagement
4. Reporting and Evaluation

Through these efforts, the Execom aims to create a vibrant community that supports students in their academic and professional journeys within the engineering and technology fields.



O. Brundasree

Chairperson
EXECOM 2024
IEEE SVCE SB



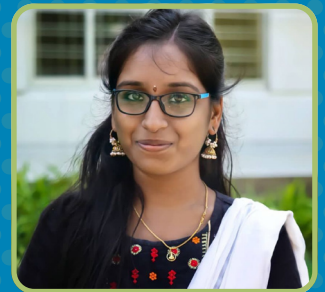
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P. Vathsalya

Secretary
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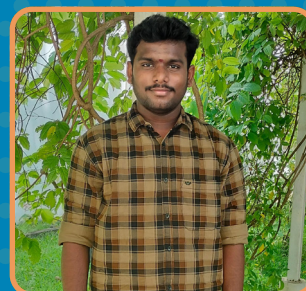
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V. Rajesh Kumar

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Chairperson
ComSoc
IEEE SVCE SB



N. Sai Jathin

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Treasurer
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Secretary
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Vice Chairperson
EduSoc
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C. Deekshitha

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EduSoc
IEEE SVCE SB



P. Vathsalya

Secretary
EduSoc
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Computer Society
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S. Usha Sai

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T. Rajasri

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Computer Society
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V. Mohith

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V.M. Neha

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Sensor Council
IEEE SVCE SB



J. Hemanth

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Sensor Council
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Akhila

Treasurer
Sensor Council
IEEE SVCE SB



T. Ramakrishna

Secretary
Sensor Council
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T. Ramakrishna

Chairperson
Nano Tech Council
IEEE SVCE SB



V.M. Neha

Vice - Chairperson
Nano Tech Council
IEEE SVCE SB



Pratap

Treasurer
Nano Tech Council
IEEE SVCE SB



K. Jayanth

Secretary
Nano Tech Council
IEEE SVCE SB



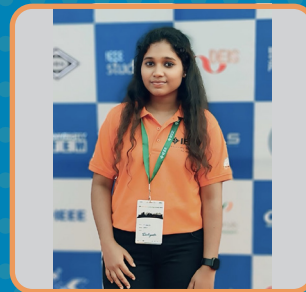
D. Bhavaja

Chairperson
WIE
IEEE SVCE SB



T. Mounika

Vice Chairperson
WIE
IEEE SVCE SB



P. Nikitha

Treasurer
WIE
IEEE SVCE SB



T. Kavya

Secretary
WIE
IEEE SVCE SB

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Dr. N. Srinivasulu Reddy
Senior Member of IEEE



Dr. V. Lakshmi Devi
Senior Member of IEEE



Dr. S. Rafi Kiran
Senior Member of IEEE



Dr. K. Kumar
Senior Member of IEEE



Allabaksh Shaik
Senior Member of IEEE

IEEE SVCE SB's EVENTS



IEEE SVCE SB INAUGURAL

On February 26, 2024, the IEEE SVCE SB 2024 Inaugural event took place. The Educational Societies' C. Deepika served as the event's chair. Dr. N. Sudhakar Reddy opened the discussion by giving an overview of the organization's aims and objectives. The head of the EEE department, Dr. V. Lakshmi Devi, addressed the audience and discussed professional technical skills. Allabaksh Shaik, a senior member and advisor of the IEEE SVCE SB SPS and SOMSOC and EDUSOC chapter, gave the next speech as the event went on. He gave a summary of financial security and IEEE knowledge, which gave the discussion a useful perspective.

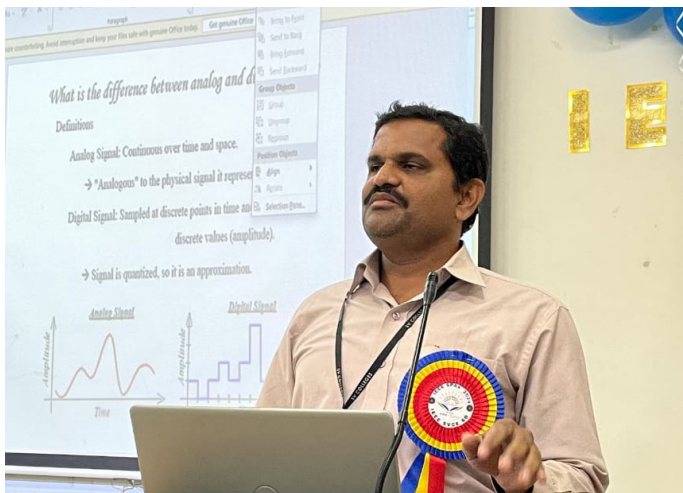
AWARENESS ON IEEE

On March 1st, 2024, the IEEE awareness program brought together academicians, professionals, and students to discuss the organization's Vision, Mission, and benefits for members. The speakers Dr. N. Sudhakar Reddy and Dr. D. Sreenivasulu Reddy gave their perspective during the event. Through networking, panel discussions and cooperative workshops, it develops technology-driven innovation by bridging



TECHNICAL DEBATE

On May 21st, 2024, there was this debate regarding Electric versus Fuel Vehicles. And let me tell you, it really got people talking about the future of transportation. You know, folks really jumped into a bunch of crucial issues, like the environmental impact of these vehicles, how much they actually cost, the kind of infrastructure we've got set up, and let's not forget about the technological advancements we're witnessing.



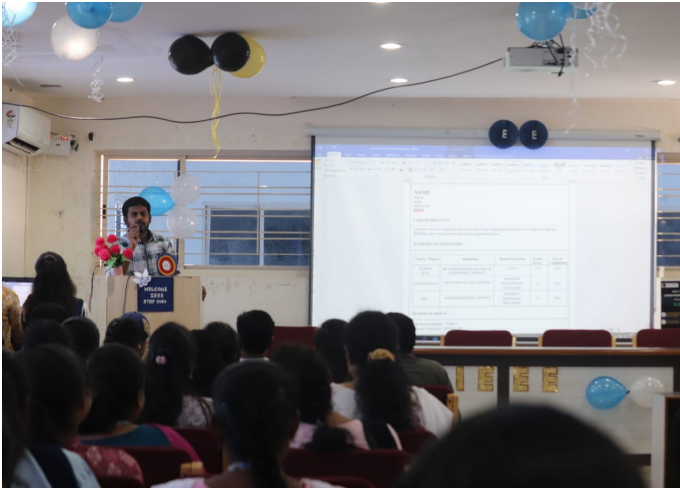
The program will wrap up with a session on writing research papers using LaTeX, presented by Dr. K. Upendra Raju, an associate professor at SVCE. This program promises to deliver valuable insights into cutting-edge research, IoT applications, Electric Vehicles, the advantages of IEEE membership, and techniques for writing research papers, making it a fantastic opportunity for students and professionals to expand their knowledge and skills.



IEEE SVCE SPAX 2024

IEEE SVCE SPAX 2024, a program for students and professionals, is ready to be held from 18 April to 20 April 2024. This will include expert talks and workshops aimed at promoting research and innovation among students. This incident on 18 April, Dr. Of. Lokesh will begin with a presentation of Krishna, a professor in SVCE. Following this, a session will be on the latest research trends in object detection. On April 19, attendees can participate in a workshop on IoT, led by K.R. Surendra and V. Nagendra Kumar, both assistant professors at SVCE. The final day, April 20, will start with a session by P. Sesi Kumar, an assistant professor at SVCE, alongside Allabaksh Shaik, a senior member of IEEE. This will be succeeded by a talk on Electric Vehicles (EVs) by Dr. V. Lakshmi Devi, professor and head of the EEE department. Following that, Venkata Renu, an ex-student of SVCE, will conduct a webinar on the benefits of IEEE membership.





IEEE STEP 2024 CAREER MAPPING WORKSHOP: PATHWAY TO SUCCESS

The Step-2024 Career Mapping Workshop happened on August 19, 2024. The goal? To shed light on various pathways to success. The event kicked off with an inauguration featuring some pretty impressive speakers. We had Mr. B. Ravi Teja, Dr. Sudhakar Reddy, Dr. D. Sreenivasulu Reddy, Dr. K. Sudheer, Dr. S. M. Azad, and Allabaksh Shaik, all sharing their insights.

Day 1: Was all about diving into career development. B. Ravi Teja led a session on resume writing. Then, Tarun Naidu Bodipati shared some valuable insights on studying abroad. There were also specialized sessions about cybersecurity, presented by experts from Rowan University in New Jersey. Plus, they tackled other essential topics like resume enhancement, neuroscience, and design verification engineering, with contributions from professionals at some well-known firms.

Day 2: shifted gears, diving into some critical discussions. Gaurav pathak took the stage and emphasized just how vital the IEEE Education Society is for all of us. Then, Guntur Renu tackled a pretty serious topic: the harsh realities of cyber crimes and shared some tips on how to keep ourselves safe in this digital age we live in. And M. Sai Prasanth, who talked about how getting involved with IEEE through volunteering can truly shape one's career and boost community engagement.

To wrap everything up, we had a valedictory session, which was a nice touch, and of course, we snapped a group photo. It captured the essence of what was, without a doubt, an insightful and enriching experience aimed at helping everyone take their careers to the next level.





IEEE DAY CELEBRATIONS

IEEE DAY 2024 was hosted by Vasu Paul Srikar, Vice Chairperson of Educational Society. The incident began with a formal lamp lighting, followed by technical and non-technical activities. Technical events included a technical quiz and a technical puzzle, testing students' knowledge and problem-solving skills with enthusiastic participation. The program had a technical quiz and a technical puzzle, challenging the students' knowledge and skills to solve the problem, which had enthusiastic participation from all. Bring an element of non-technical activities, creativity, and fun like a painting competition and a balloon balance game. The event ended with a grand ceremony, where the winners were celebrated, and all the participants were recognized for their hard work. The dignitaries expressed their praise, making the occasion a memorable and rich experience.



CELEBRATION CLOSING GALA - IEEE SVCE SB 2024

The IEEE 2024 Celebration Closing Gala, held on December 26, 2024, an impressive event! It was the grand finale to a whole string of truly inspiring happenings. So, during the evening, we got to listen to organizers and a few notable guests. They shared their insights about the achievements, the competitions, and, of course, all the enjoyable activities that unfolded. It was a night to remember! That would be the awards and recognition ceremony—what a way to celebrate innovation and all those awesome contributions to the IEEE community!



As the night wore on, the atmosphere got even more festive. There were cultural performances, some great music, and tons of networking opportunities that helped folks connect, not just within IEEE but beyond. Honestly, it left everyone feeling pumped and united, eagerly looking ahead to what IEEE has in store for the future

Dr. N. Sudhakar Reddy, our Principal, and Lakhmidevi, who heads the EEE department, getting some well-deserved recognition for all their hard work that made the event a success. Honestly, the night really captured what IEEE is all about—think innovation, teamwork, and a sense of belonging. It was amazing to see so many bright minds coming together, all aimed at shaping what's next in technology.





ARTICLES

THE BATTLE FOR TECHNOLOGICAL SUPREMACY

Artificial intelligence has become the focus of the global struggle for technological supremacy, with China and the United States fighting for control. The crucial part semiconductors play in the development of AI exacerbates this competition.

BY

GUNTUPALLI MAHENDRA



Every country strives for its continued existence. No matter what it demands to attain excellence, every country yearns for acknowledgment superb. In ancient eras, we witnessed a similar cold war between power blocs of particularly the USA and USSR during the period from 1947 to 1991. It wasn't a physical conflict. It appeared to be more like a contest for dominance. The same well-known concept expressed in an alternate manner between the U.S. and China. Initially, the dispute was based on arms, but currently the struggle depends on Artificial Intelligence. China started funding AI initiatives in 2017. It designated the initiative as "Next Generation AI Development Strategy". The main objective of the project is to position China as an international Power in AI by 2030. China is currently utilizing AI technology mainly centered around observation as the country holds the largest population in the world. China is the origin of many technological giants such as Huawei, Baidu, Alibaba, Tencent, along with a few more. The United States is certainly a technological leader in numerous areas. It launched a technological contest before other countries without even being aware. The first AI winter took place in the 1970s. Starting from that point They have been advancing AI to the current day, resulting in generative AI technologies. The Pentagon is mainly allocating funds towards the integration of AI into defense technologies like drones and autonomous submarines. America holds crucial technological giants including Google, OpenAI, Microsoft, and NVIDIA.

The crucial element of technology for running AI is the chip. Taiwan Semiconductor Manufacturing Corporation, shortened known as TSMC, is the largest and most advanced semiconductor producer worldwide. It is located in Taiwan. By observing its Importance in technology now China claims that Taiwan is a portion of its territory and threatening to take by force. America is supporting Taiwan covertly by providing weaponry and offering assistance. The United States understands that if China asserts control over Taiwan it will decrease chip exports, leading to a significant crisis regarding manufacture of electronic products. China is currently engaged in establishing a counterpart to TSMC referred to as SMIC, which stands for Semiconductor Manufacturing International Corp. However, because of certain factors, it trails behind TSMC. Currently, the No nation can influence TSMC. Our country also has a significant role in influencing AI. We aren't directly engaged in the conflict of AI, yet we can act as "Third Pillar" in this proposal. The reasons to support this claim are Mainly, we are a robust IT and software center featuring companies. such as TCS, Infosys, Wipro, and others. Another aspect is we generate leading AI researchers for the world who are currently excelling at Google, OpenAI, and Meta. Ultimately, our Government is likewise concentrating and allocating resources toward the advancement of AI through financing AI startups and conducting awareness workshops. Ultimately, based on all this context, we can definitely state that whoever prevails in this AI conflict will rise as a new global superpower.

INTERNET:THE ULTIMATE WEAPON

“The internet is a tool of war as much as it is a tool of communication.”

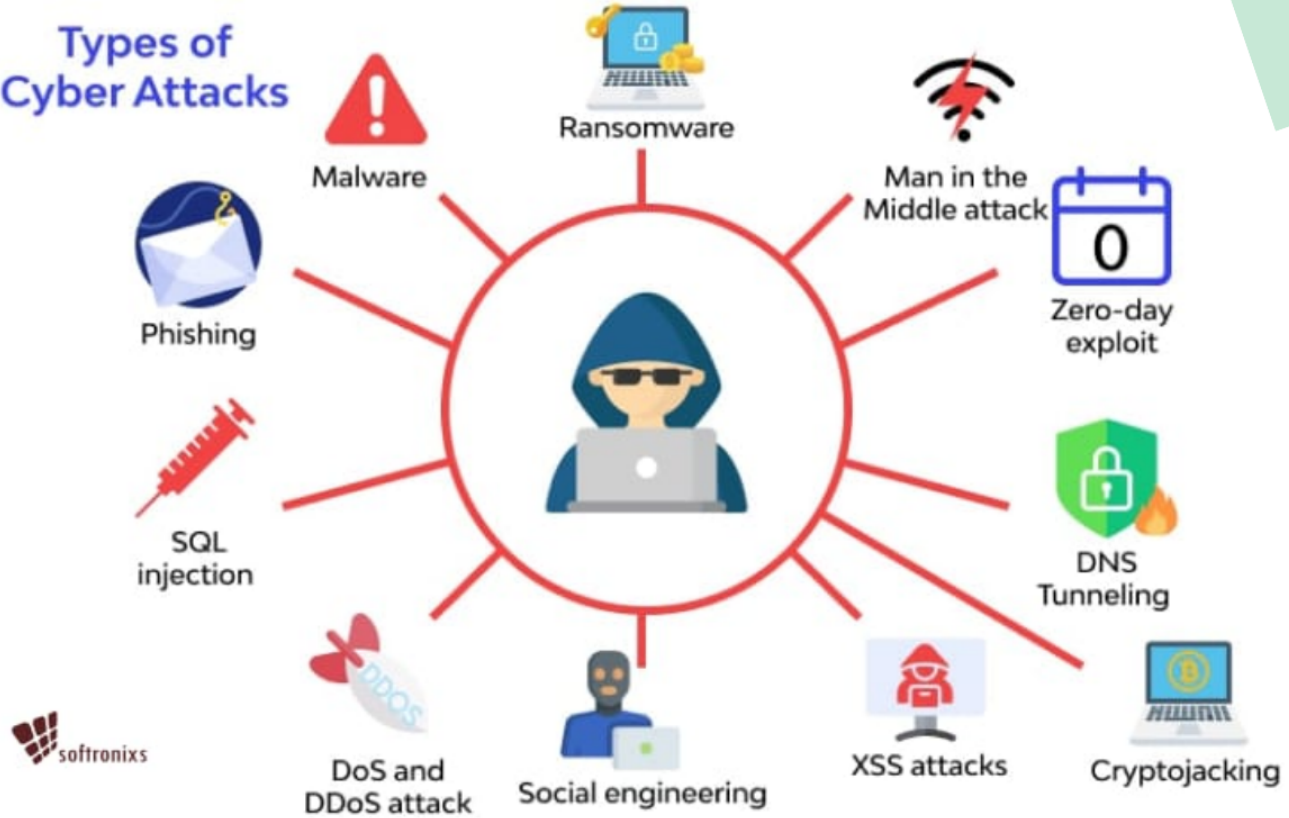
BY

MOKSHIT BALAJI GUTTURU



The internet has become the ultimate weapon in the global tech race, with nations battling for control over digital infrastructure, data, and cybersecurity. Just as semiconductors are vital to AI, the internet shapes modern power, influencing communication, finance, and national security in an interconnected world.

Types of Cyber Attacks

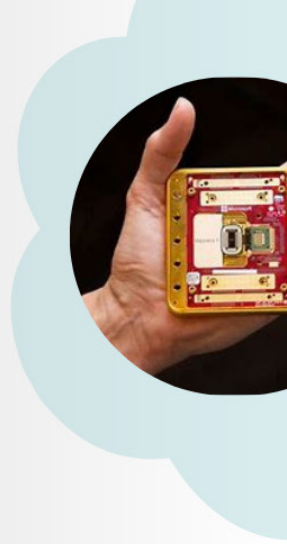


In recent years, cyberattacks and spying have increased in frequency, impacting infrastructure, corporations, and governments worldwide. Cybersecurity is more important than ever as the field of cyberwarfare changes in tandem with technological advancements. Digital attacks meant to disrupt systems, steal confidential data, or destroy property are known as cyberwarfare. Such attacks can have disastrous effects, impairing national security and interfering with necessary services. The United States recently accused twelve Chinese people of hacking American federal institutions over a ten-year period in a major case of cyber spying. According to reports, the hackers targeted American media outlets and foreign ministries that expressed disapproval of the Chinese government. The reported sale of the stolen data to Chinese law enforcement and intelligence organizations highlights the expanding use of cyber strategies in state sponsored cyber operations and foreign espionage. On December 25, 2024, another concerning event happened when the Estlink 2 submarine power line, which enables the transmission of electricity between Finland and Estonia, unexpectedly malfunctioned. Authorities in Finland think that the Russian oil tanker Eagle S, which is thought to be a member of the Russian shadow fleet, intentionally caused the damage. The reported assault draws attention to how fragile vital infrastructure is to both physical and cyberattacks, as well as the practical consequences of such disruptions in geopolitical disagreements.

Cyber warfare has also played a crucial role in modern conflicts. In August 2024, a group called IRLeaks launched a first-ever cyberattack against Iranian banks, targeting the nation's financial industry. After obtaining millions of people's sensitive credit card information and consumer data, the attackers looked for a payment in bitcoin, making this cyberattack the worst in Iran's history. The hack resulted in significant operational and financial problems, demonstrating how thieves can utilize digital flaws to bring down entire economies. The Ukrainian cyberattacks on Russia in June 2024 serve as evidence that cyberwarfare has also been a significant factor in modern conflicts. Numerous Russian government websites, including those of important departments, have been attacked by Ukrainian cybercriminals. The attacks affected civilian services by causing extensive interruptions, such as aircraft delays and data loss. This incident demonstrates how cyber operations are now a crucial part of modern warfare, impacting national security policies and military strategies. Together, these incidents show how crucial cybersecurity is becoming in a time when online dangers are just as serious as real-world conflicts. Beyond individual events, cyberwarfare has broad consequences that impact national security, financial institutions, and public services. Governments and organizations must prioritize strong cybersecurity measures as cyber threats continue to evolve in order to protect against the growing threats of ransomware attacks, cyber spying, and cyber attacks sponsored by the government in the sake of digital warfare.

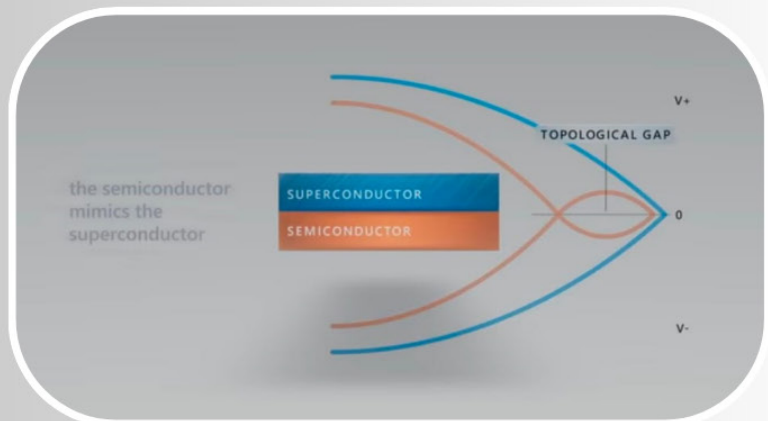
Majorana 1 – A Quantum Miracle

BY
VASAMSETTI DHANASRI



In a stunning scientific breakthrough that promises to advance quantum computing in leaps and bounds in the next few decades, Microsoft has unveiled the Majorana 1—the world’s first topological quantum chip. After 17 years of endless scientific research, what once only existed as a theory has become a reality.

Majorana 1 is the world’s first Quantum Processing Unit (QPU) powered by a Topological Core, designed to scale to a million qubits on a single chip



Qubits and their challenges

At the heart of the quantum computer lies the quantum processing unit (QPU), which is powered by qubits, the foundation of quantum computing. But these few bits are extremely unstable. Microsoft has engineered what many experts consider impossible—a stable quantum system that resists noise in disturbances that lead to decoherence.

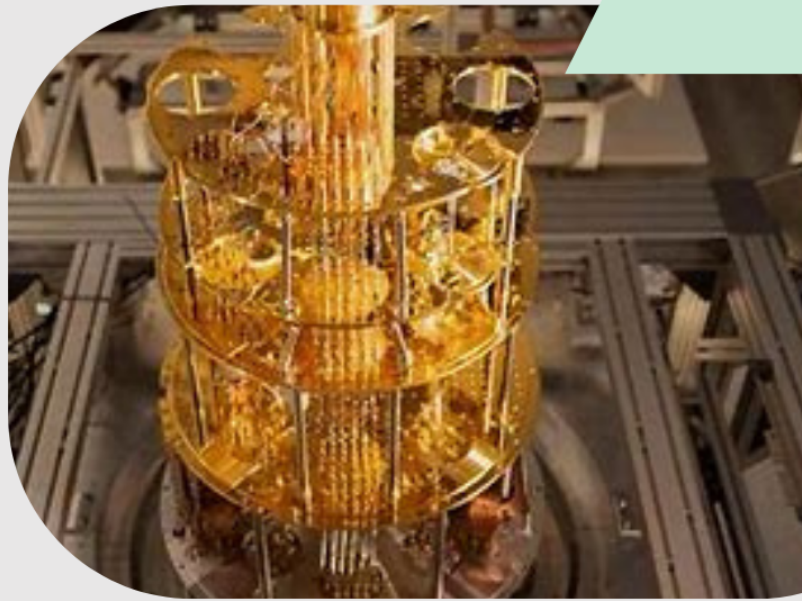
While traditional computers struggle with problems that would take millennia to solve, quantum computers offer the possibility of finding solutions in minutes. Qubits are highly sensitive to their surroundings. Even tiny disturbances like temperature fluctuations, electromagnetic interference, or atomic vibrations can collapse the wave function or quantum state, a problem known as decoherence.

To avoid this, quantum computers are shrouded. This shroud provides a sealed chamber to create a vacuum inside it, which causes a drastic temperature drop to 50mK, i.e., 0.05K above absolute zero. Yet, even these conditions haven't been enough to maintain quantum coherence. Now, we require a way to measure the error and perform error correction.

The traditional approach - quantum error correction (QEC)- attempts to overcome this by grouping physical qubits to form a more stable logical qubit. However, millions of physical qubits would be needed for practical realization, making scalable quantum computers seemingly unattainable.

Microsoft's solution

Instead of seeking to find a way to decrease the noise, Microsoft has pursued a radically different approach. They wanted to create qubits that could ignore small errors and disturbances. The answer came in the form of the Majorana particle, named after Italian physicist Ettore Majorana, who first theorized it in the year 1937. Microsoft has introduced a hardware-protected quantum system based on a new material called a topoconductor. Every particle has an antiparticle of opposite charge, be it an electron, proton, or something else. Majorana particles are unique because they are their own antiparticles. This makes them fundamentally different from normal electrons, which have distinct antiparticles, i.e., positrons. "These particles have been theoretical constructs for decades," notes Dr. Michael Freedman, director of Microsoft Quantum. "Not only have we proven they exist, but we have harnessed them as the foundation of a revolutionary computing architecture." One of quantum computing's fundamental paradoxes involves measurement; the very act of observing a quantum system disturbs it- a phenomenon known as wave function collapse. The Majorana - 1 architecture solves this problem by distributing quantum information non-locally across nanowires.



Topological superconductivity

The magic happens through topological superconductivity - a phenomenon previously confined to theoretical physics. Topological superconductivity is a rare and exotic quantum state that protects quantum information from noise. Unlike traditional superconductors, where electrons form Cooper pairs, a topological superconductor allows Majorana particles to exist at the edge of a nanowire, creating a stable and fault-tolerant qubit. Here, the nanowires are made of a semiconductor (Indium Arsenide) electron layer with a superconductor (Aluminum) layer laid on top. The wire is cooled down to 50mK, then the superconductor layer enters a zero-resistance state, i.e., it enters the superconducting state, where electrons can move up and down its length with zero resistance. Some of these pairs enter the semiconductor, allowing some semiconductor electrons to adopt superconducting properties by something called the proximity effect. When a magnetic field is applied, the electron splits into two separate quantum states at either end of the nanowire. These are the two Majorana particles or the Majorana Zero Modes. Microsoft refers to it as a "topoconductor," which is essentially a new state of matter.

TOPOLOGICAL QUANTUM COMPUTING



Future of Quantum Computing

Quantum computing is set to transform various industries due to its unmatched processing power. Even the most advanced supercomputers today struggle to accurately simulate the quantum interactions that define the properties of critical materials. But with quantum computing at this scale, breakthroughs could emerge in fields like self-repairing infrastructure, sustainable agriculture, and safer chemical innovation. What currently demands billions of dollars and years of experimental research could instead be accelerated through quantum-powered calculations. Self-healing materials could repair cracks in bridges, airplanes, and phone screens, reducing maintenance costs. Next-generation batteries with faster charging and longer lifespans could transform energy storage. In chemistry most reactions are too complex for any classical computer to solve. With quantum computing, the field of chemistry will see radical changes as new materials, new compounds can just be created.

In healthcare, quantum simulations will accelerate drug discovery and personalized medicine, leading to faster treatments. Agriculture could benefit from quantum-designed fertilizers, drought-resistant crops, and better food preservation to improve global food security. The financial sector will see enhanced fraud detection, optimized stock market predictions, and quantum-secure encryption for safer transactions. In AI and logistics, quantum computing can optimize supply chains, shipping routes, and decision-making for industries worldwide

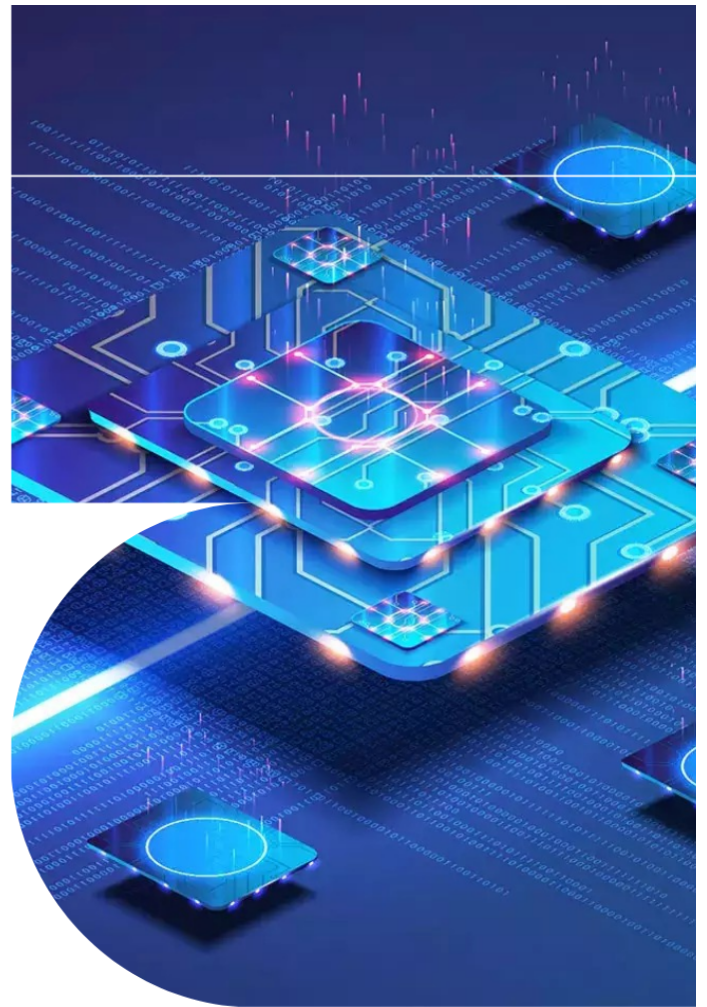
The Global Market Impact of the Majorana-1 Chip and Its Significance for India

The Majorana-1 chip marks a breakthrough in quantum computing, promising to revolutionize industries worldwide. This advancement is set to impact sectors like finance, healthcare, cybersecurity, energy, and materials science by improving computing speed, data security, and problem-solving capabilities. Companies investing in quantum computing will gain a significant competitive edge, leading to a surge in funding, job creation, and economic growth. Most jobs will also have a negative impact as a quantum computer can do what hundreds of people can do in a matter of minutes. Nations leading in quantum technology will dominate critical areas like encryption, artificial intelligence, and advanced simulations, shaping the future digital economy.

For India, the Majorana-1 chip presents a major opportunity to advance its quantum research initiatives and integrate quantum computing into key sectors. With government-led efforts like the National Quantum Mission, India can leverage this technology for secure communications, AI-driven applications, and climate modelling. The IT and semiconductor industries could benefit from collaborations with global quantum research leaders. Additionally, quantum breakthroughs in drug discovery, agriculture, and financial modelling could strengthen India's economy and global positioning. By investing in quantum computing, India can establish itself as a leader in the next technological revolution, ensuring long-term growth and strategic advantages in an increasingly digital world. A million-qubit quantum computer isn't just a technological milestone—it's a gateway to solving some of the world's most complex challenges.

Stepping stone towards Self-reliance : India's first Aerospace-Grade Semiconductor Chip

BY
D. SRILAKSHMI



India could have had its own semiconductor fab unit years ago. In 1987, India was just 2 years behind the leading chip manufacturers. But today it's almost 12 generations behind global Semiconductor leads. Bureaucratic lethargy is one prominent reason behind failure of all the efforts made towards building semiconductors. The initial Instance that signifies this is when Fairchild Semiconductor fab unit shifted its trajectory away from India to Malaysia. Robert Noyce, nicknamed "The Mayor of Silicon Valley" who co-founded Fairchild Semiconductor (1957) and Intel corporation in 1968, was hesitant to set fab unit due to strict laws for foreign investors and lack of support from Indian Government. Initially, Indian Government was quite hesitant towards advancing for any foreign investment after recent events of Freedom movement from the British. They were reluctant to give access in fear of sensitive technology being diverted to Military applications and foreign products diminishing demand of domestic electronics. After the Indo-China war in 1962, Bharat Electronics Limited (BEL) built a fabrication unit of Silicon and Germanium Chips, which were recognised for their good quality globally. But the arrival of cheaper chips from Korea and Taiwan in Market forced BEL to shut down many fab units facing difficulty in meeting price-quality standards. In Mid-1980s, BEL formed a collaboration unit with Metkern Silicon Limited producing Polysilicon wafers for Solar cells and Electronics. But this unit was built near to a railway track. Semiconductor manufacturing requires a Non-shaky environment for accurate fabrication. Despite these challenges, workers were determined and often worked late at nights when trains weren't passing by. Yet, This had to shut down due to lack of government support in issuing the promised electricity subsidy and production of low quality Polysilicon wafers. Despite recurring setbacks, India could achieve milestone of fabricating a chip of 800nm in size, which in that era (A time when today's leading manufacturers, China and Taiwan didn't begin their race yet) was a 1-2 year old cutting edge technology. Semiconductor Complex Limited (SCL) was set up in Punjab state. Beginning its journey with a 5000nm process in 1984, it attained a speedy progress to 800nm. But all the progress halted when an unforeseen occurrence of fire accident gutted about 60 crores worth of progress in SCL lab to ashes in 1989, Thus delaying India's decade long efforts towards fab units. Although in later years SCL was revived by Indian Space research Organisation (ISRO), it remained to be only an ounce of what it was before.

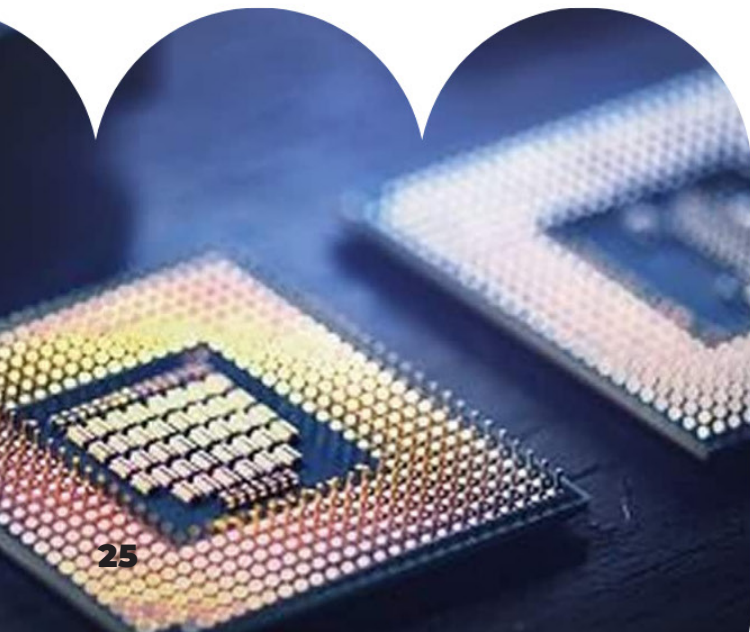
**Semiconductor Complex
Limited(SCL), Chandigarh, India**



Shakti microprocessor



**"Indigenous RISC-V controller for
Space applications (IRIS chip)"**



The semiconductor, considered to be the heart of the electronic ecosystem, has always been the eye of cyclone in worldwide politics. But the emergence of the pandemic in October 2020 remarked on the importance of chip technology, with massive disruption of various industries, from Electronics to Automotive. The proposal of US President Donald Trump towards the strategic development of critical and emerging technologies to overtake China's progress in the same fields led to the emergence of the term 'Chip war'. India, aspiring to be one among global technological leaders, could not curb its efforts towards achieving it. The saying 'Data is the new oil', implies that the ability of a country to acquire, store, and process data determines its standards in the global tech race.

India is all too familiar with the implications of denial of critical technology from the Cold War's history, when it was denied critical nuclear and cryogenic engine technologies. Thus, critical technology today is the eye of geopolitical games.


The arrival of new chip technology is posed with a modern threat of denial strategy where the adversary could be giving selective access to their technology. This is a major threat because the technology that is used by India to build Missile systems, Complex ICs, and logical circuits is heavily imported from foreign countries.

China, while not a leader in manufacturing advanced semiconductors, has about 70% of global output under its confines. The US's attempt to curb the usage of rare earth materials by China is so far successful given that the Hardware used by China, in order to make semiconductors out of rare earth materials, is imported from the United States.

However, China's power is a testimony of being largest exporter, a vital element that is being utilised by China in chip manufacturing, allows it to become a major leader in advanced chip technology due to its strict laws making Graphite export an unattainable dream.

After US's CHIPS Act emphasizing on Safe usage of Artificial Intelligence that denies export of high end tech to China, While China retaliated by banning on export of Gallium and Germanium. China also heavily subsidised its domestic IT therefore creating a scarcity of export, solid rules against export of minerals making loss beyond chip industry TSMC (Taiwan Semiconductor Manufacturing company) possessing 90% of specialised chips, began to develop a unit in Arizona (USA) after announcement of China's reunification with Taiwan by 2049.

This serves as a potential boon for India, If it capitalises on the opportunities created from the reconstruction of a global lead unit. India is infamous for its advancement in Software industry, This could serve as a testimony to develop a semiconductor fab as well. India is determinant to come at par with global chip manufacturing leaders. Modified schemes for setting up of Semiconductor fab, Display fabs and Sensor fabs act as direct evidence towards its persistent efforts.



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Vasu Paul Srikar receiving IEEE Signal Processing Society Hyderabad Chapter's
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