



Message from the Director



Dr K.L.Narayana
Director
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Alumni Reflections

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Dear Readers,

As we embark on another journey through the corridors of nostalgia and progress, I am filled with immense pride and joy to witness the remarkable achievements of our alumni. Each stride they take in their respective fields resonates with the ethos of excellence and innovation instilled in them during their tenure at IcfaiTech.

In this edition of our Alumni Magazine, 'ECHO', we celebrate the accomplishments of our distinguished graduates who continue to push the boundaries of knowledge and creativity. Manish Kumar Nirala's insightful exploration of Chatbot as a Service sheds light on the transformative potential of generative AI in reshaping customer interactions. His elucidation on industry trends and ethical considerations serves as a guiding beacon for businesses navigating the dynamic landscape of customer service. Sunil Kumar's work on renewable energy integration underscores the importance of sustainable practices in ensuring a reliable energy supply. Naresh Kumar Erothi's impassioned call to embrace innovation and shape the future and Neha Pavuluri's journey from student to trailblazer in the realm of generative AI is a testament to the transformative power of IcfaiTech education. Finally, Amandeep Rana's visionary leadership in AI and automation exemplifies the adaptability and resilience required to thrive in today's rapidly evolving landscape. As we delve into these stories of our alumni, let us draw inspiration from their journeys and reaffirm our commitment to excellence and innovation. Together, let us continue to strive for greatness and make a positive impact on the world.

I wish all the success to alumni of IcfaiTech Hyderabad and thank and appreciate them for contributing articles for the alumni magazine, 'ECHO'. I also congratulate Alumni relations team for their continued efforts to build strong alumni-institutes relations and bonding.

EDITORIAL

It brings us to 3rd issue of 'ECHO', gaining strength and momentum in its journey from the time of inception. The ingenuity and in-depth analysis of the subject matter in the articles by respective alumni, is testimony of efforts and thoughts applied by each alumnus. The objective of 'ECHO' is to get thought provoking articles from the alumni on trends and practices in industry, future requirements of skill sets and technology upgradation benefitting the students. The response of alumni is encouraging, they are upbeat and show great interest and enthusiasm to write for the young students. The articles provide peek into the current technologies and practices and likely future changes, all this prepares students for their future roles and challenges of the profession. Additionally, for students to see the alumni in the prime positions and roles brings to them sense of pride and confidence and perceive them as idol and role models. It inspires students to aim and set higher goals in career. The alumni relations team at IcfaiTech Hyderabad is committed towards working to build a strong alumni-students bonding, interaction and networking.

This edition presents hosts of articles from our distinguished alumni each carved a niche for him/her in the profession having reached position of respect and repute in the career. Manish Nirala, an alumnus of Icfaitch Hyderabad and MBA from IIM Ahmedabad, writes on chatbot as a service (CaaS). The extensive penetration of chatbot as predicted in services and human-machine interactions is breath-taking. The emergence of generative AI and services like chatGPT is only a beginning of the storm that CaaS can create in future. Naresh Kumar Erothi is upbeat on prospects of data driven banking industry, leveraging AI and data analytics for enhanced customer experience. He shows students how to create path to success and work on it in-order to achieve success.. Sunil kumar, brings out the intricacies of smartgrid technology that is making power grid move away from fossil fuels towards environment friendly power generation from solar and wind. A well thought out article on challenges and opportunities in smart grid. Amandeep presents the changing landscape of telecommunication industry in face of AI and how important it is for embracing and navigating the Evolving Landscape of Technology. Neha Pavuluri delves into the fascinating world of generative AI, exploring its capabilities, and diverse applications across various industries. Sangeetha Nath has made an excellent article on Drones technology and its potential in wars fought in modern times. The part-2 of the article appears here. Beginning this edition, we feature a new column on Alumni achievements and successes. The honors and awards received by alumni will go a long way in inspiring students and instilling in them self-belief and confidence. We wish many more laurels and awards for our striving alumni and with their professional growth and progress hold flag of IcfaiTech always high.

Dr Digvijay Vishwanathan Nair

*Faculty In-charge Alumni Relations Cell (ARC)
IcfaiTech Hyderabad*

IcfaiTech

Faculty of Science & Technology (FST)



IcfaiTech provides quality education and training in the fields of science and technology

Programs offered @ IcfaiTech

- ▶ B.Tech
- ▶ M.Tech
- ▶ B.Sc.
- ▶ BCA
- ▶ Ph.D (Full-time & Part-time) in Sciences

Body of Knowledge

IcfaiTech integrates into its learning system an innovative and emerging body of knowledge. The following are its highlights:

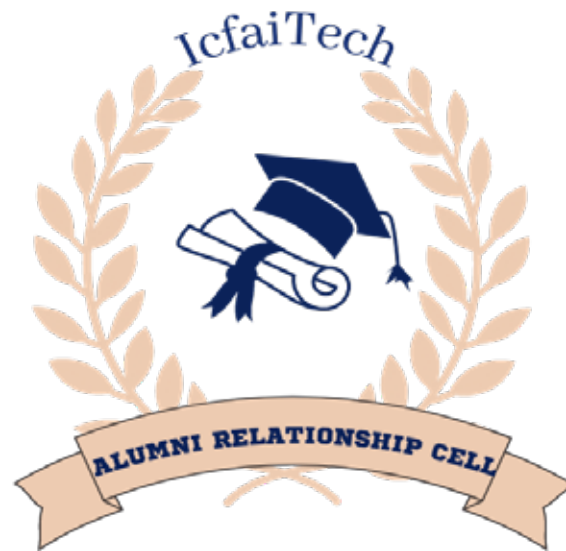
- ▶ Cutting-edge course curriculum capturing the contemporary and effective pedagogy, with emphasis on both fundamentals and applications.
- ▶ Encouraging students to not only articulate science and technology needs but also provide appropriate solutions.
- ▶ Developing appreciation for synthesized multidisciplinary learning by way of internships, measurement techniques, workshop practices and other group learning assignments.

Objectives

- ▶ To acquire a reputation as a highly purposive, innovative institution setting the pace for workable reforms in professional education, suitable and most relevant for the Indian cultural milieu.
- ▶ To provide high-quality, cutting-edge and career-oriented education programs in science and technology, to student population across the country.
- ▶ To provide highly motivated and successful science and technology graduates to meet the current and projected needs of the knowledge-workforce.



IcfaiTech
Faculty of Science & Technology (FST)



Alumni Reflections

Chatbot as a Service: Transforming Customer Interactions



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Chatbot as a Service (CaaS) is reshaping customer interactions for large enterprises, leveraging generative AI to deliver personalized experiences. As the industry evolves, businesses are recognizing the potential of CaaS to enhance service delivery, optimize costs, and drive efficiency and hence stand to benefit significantly from adopting CaaS, but they must navigate potential pitfalls to ensure ethical compliance. In this article, we delve into the world of Chatbot as a Service (CaaS), exploring its latest developments, the impact of generative AI, industry trends, and ethical considerations.

The latest developments in chatbots are blurring the lines between human and machine interaction, offering businesses unprecedented opportunities to engage with customers in meaningful ways. One of the transformative developments is Generative AI which has revolutionized Conversational AI by enabling chatbots to understand and respond to human language with remarkable accuracy and sophistication. Traditional rule-based chatbots are giving way to dynamic conversational agents capable of generating human-like responses in real-time. From limited interactions, chatbots have evolved into charismatic personalities. Positive and engaging chatbots improve user experience and drive traffic to websites.

Metrics from the industry showcase the impact of generative AI on Conversational AI. Businesses

employing generative AI-powered chatbots have witnessed significant improvements in customer satisfaction scores, with a reported increase of up to 30%. Additionally, average response times have decreased by approximately 40%, leading to enhanced user experiences and higher engagement levels. Further Enterprise AI initiatives are predicted to enhance productivity and creative problem-solving by 50% and up to 40% improvements in software development tasks.

Furthermore, developments such as the rise of low-code/no-code platforms and the integration of chatbots with omnichannel customer engagement strategies are driving innovation in the field. These trends underscore the growing importance of chatbots as a strategic component of modern customer service initiatives.

Hence it is not surprising that by 2025, organizations will allocate over 40% of their core IT spending to AI-related initiatives, driving product and process innovations.

Chatbot as a Service offers numerous benefits for large enterprises seeking to streamline customer service operations, optimize costs, and enhance user experiences. Some of the key benefits include:

- ▶ **Improved Customer Service:** CaaS enables enterprises to provide instant, personalized assistance to customers round-the-clock, leading to higher satisfaction levels and increased loyalty.
- ▶ **Cost Optimization:** By automating routine inquiries and tasks, CaaS helps enterprises reduce the workload on human agents, resulting in significant cost savings. Studies indicate that businesses adopting CaaS solutions can achieve cost reductions of up to 30% in customer service operations.

- ▶ **Operational Efficiency:** CaaS streamlines workflows and processes, enabling enterprises to handle a higher volume of inquiries with greater efficiency. Through seamless integration with existing systems and platforms, CaaS solutions facilitate data exchange and collaboration across departments.

- ▶ **Scalability and Flexibility:** With CaaS, enterprises can scale their chatbot capabilities dynamically to meet evolving business needs and fluctuating customer demands. Cloud-based CaaS platforms offer scalability and flexibility, allowing businesses to deploy chatbots rapidly and adapt to changing market conditions.

While CaaS offers significant benefits, it also raises ethical considerations that businesses must address to ensure compliance and responsible AI deployment. Recent failures of generative AI-powered chatbots, such as Google's Gemini, highlight the importance of ethical considerations in CaaS. For example, Google's Gemini chatbot faced backlash for generating inappropriate responses and perpetuating harmful stereotypes. Such incidents underscore the need for rigorous testing, ongoing monitoring, and ethical guidelines to prevent unintended consequences and ensure user safety. Businesses leveraging CaaS must prioritize ethical considerations, including transparency, fairness, accountability, and privacy protection. By implementing robust ethical frameworks and responsible AI practices, enterprises can mitigate risks and build trust with customers.

In summary, the future of customer service revolves around conversational experiences, with CaaS leading this evolutionary charge. Through the responsible and ethical implementation of CaaS, enterprises can distinguish themselves in the market and forge enduring connections with their customers.



Naresh Kumar Erothi

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Reflecting on my college days at ICFAI from 2002 brings forth a flood of cherished memories, painting a vivid picture of a simpler time. It was an era when Information Technology was just beginning to gain momentum, offering limited career options like being a developer or joining a call centre, topics that often dominated our gossips and chats. However, amidst the bustling campus life, it was the connections we formed and the camaraderie we shared during moments of need that truly enriched our experiences. Fast forward to today, the IT landscape has matured, presenting a plethora of options in technology from AI and Cloud to digital solutions. As we stand on the precipice of a world brimming with technological wonders and engineering marvels, it's crucial to recognize our pivotal role as the vanguards of innovation. The knowledge and skills we've cultivated are the very tools that will shape the future—a future where our endeavours will not only showcase human ingenuity but also pave the way for hope and progress. Embracing the challenges that lie ahead, we must allow our curiosity to guide us and our creativity to serve as our compass. The world eagerly awaits the emergence of our daring ideas and revolutionary solutions. It's time for the engineers of tomorrow to gear up and seize the boundless opportunities that await us. The canvas of possibilities stretches infinitely before us, offering us the chance to leave an indelible mark, to innovate, to inspire, and to reshape the world, one ingenious solution at a time. With courage and passion, we march forward, for the future is ripe for our shaping!

Now, let's delve into the dynamic realm of banking technologies and the transformative impact of data on the future of finance. In the years to come, we anticipate a seismic shift in the banking landscape, driven by the boundless potential of data technology. Banks will leverage artificial intelligence (AI) capabilities to deliver tailored services with unprecedented precision, while open banking will foster an environment ripe for innovation and collaboration.

Blockchain technology will redefine transaction security and transparency, and quantum computing holds the promise of unlocking new frontiers in data processing and encryption. As cybersecurity threats evolve, banks will fortify their digital infrastructure to safeguard the trust and security of their clientele.

The banking experience will evolve into an immersive journey, with technologies like virtual reality (VR) and augmented reality (AR) offering novel avenues for customer engagement. The Internet of Things (IoT) will facilitate seamless financial transactions, blurring the lines between the physical and digital realms. Sustainability will emerge as a central tenet, with banks leveraging data to drive environmentally and socially responsible decision-making.

The banking industry is undergoing a seismic shift, driven by a tidal wave of data and the power of analytics to unlock its potential. This isn't just about fancy dashboards; it's about fundamentally transforming how banks operate and interact with customers.

The future of data-driven banking presents exciting opportunities for those with data science and analytics expertise. Engineers and data scientists will be instrumental in building the powerful tools and algorithms that unlock the true potential of data. The age of one-size-fits-all banking is fading. By harnessing the power of data and analytics, banks are creating a future of personalized financial services, streamlined operations, and a more secure banking experience for everyone.

Look beyond 2024—banking's horizon stretches further! AI anticipates your financial needs, offering automated products and real-time investment strategies. Physical branches? Perhaps obsolete. Banking seamlessly integrates into daily life via voice assistants and wearables. Cash and cards? Central Bank Digital Currencies loom large. But fear not, branches evolve into experience hubs with consultations and workshops. The industry? A dance of consolidation and collaboration between traditional banks and agile Fintech start-ups. Engineers hold the key, crafting secure AI and user-friendly interfaces for this financial revolution. Your skills will mould a future of personalized, accessible, and tech-driven banking.

As budding engineers, we possess a unique vantage point to spearhead innovation and shape the trajectory of banking technologies. Here are some strategies to guide us along our path to

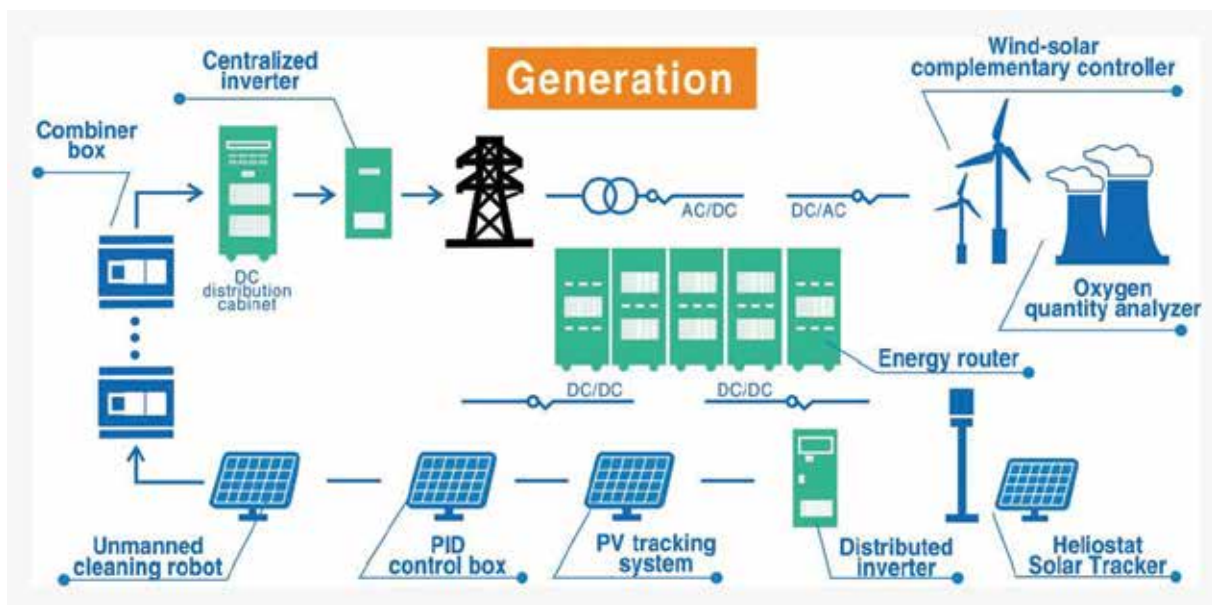


Success

- 1. Set Clear Goals:** Define your aspirations and chart a definitive course towards achieving them. Break down your objectives into manageable tasks and establish deadlines to hold yourself accountable.
- 2. Continuous Learning:** Dedicate time each day to expand your knowledge and refine your skills. Leverage online courses, tutorials, and workshops to deepen your proficiency in relevant domains.
- 3. Hands-on Experience:** Seek out internships, research projects, or part-time roles within the banking industry to gain firsthand exposure to real-world challenges and solutions.
- 4. Network and Collaborate:** Surround yourself with mentors, peers, and industry professionals who can offer guidance and support. Collaborate with interdisciplinary teams to tackle complex problems and glean insights from diverse perspectives.
- 5. Stay Resilient:** View setbacks as opportunities for growth and learning. Cultivate a mindset of perseverance and resilience in the face of adversity.
6. In closing, dear students, the future of banking technologies lies within your grasp. By nurturing your skills and embracing the opportunities that await, you possess the power to drive profound change and leave an indelible imprint on the world. Together, let's embark on a journey to forge a brighter future for the banking industry and beyond.



Renewable Energy Integration to Grid: Challenges and Solutions



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Renewable energy sources, such as wind and solar power, have gained significant traction in recent years as the world looks to transition to more sustainable energy sources. However, integrating these renewable sources into the existing grid poses several challenges that must be addressed to ensure a reliable, stable & better quality of energy supply to customers.

Till March 2024, India has installed renewable energy capacity of 18.5 gigawatts (GW) and by 2030 the capacity expected to reach 35-40GW. Today, our country ranks fourth in the world in Renewable Energy Installed Capacity. Around 40 percent of India's installed capacity comes from non-fossil fuels, which is great achievement.

One of the main challenges of integrating renewable energy into the grid is its intermittent nature & absence of grid inertia. Unlike traditional fossil fuel-based power plants, which can generate electricity around the clock, renewable sources like wind and solar power are dependent on weather conditions and can fluctuate throughout the day. This variability can pose challenges for grid operators in managing the supply and demand of electricity.

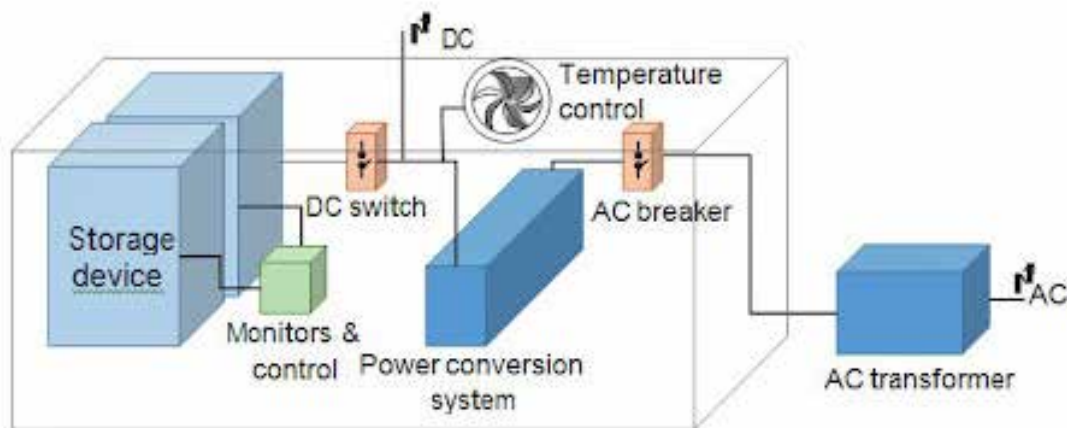
Grid inertia refers to the ability of the grid to maintain its stability and reliability in the face of fluctuations in supply and demand. Traditional power plants that rely on fossil fuels have inherently high levels of inertia, which helps to stabilize the grid by providing a stable frequency response.

Another challenge is the need for investment in grid infrastructure to accommodate the increasing amount of renewable energy being generated. This includes upgrading transmission and distribution systems, as well as implementing new technologies to better manage the flow of electricity from renewable sources to consumers. Without these investments, the grid may struggle to handle the influx of renewable energy, leading to potential reliability issues.

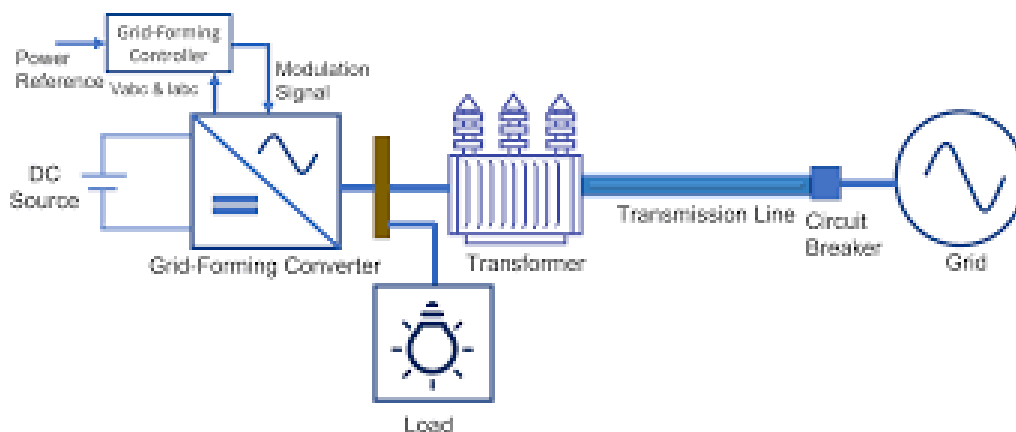
Furthermore, the integration of renewable energy sources can also pose technical challenges, such as voltage and frequency fluctuations, which can impact the overall stability of the grid. Grid operators must implement advanced control systems and technologies to ensure that the grid can effectively handle the variability of renewable energy sources.

To address these challenges, there are a number of solutions that can be implemented. Such as:

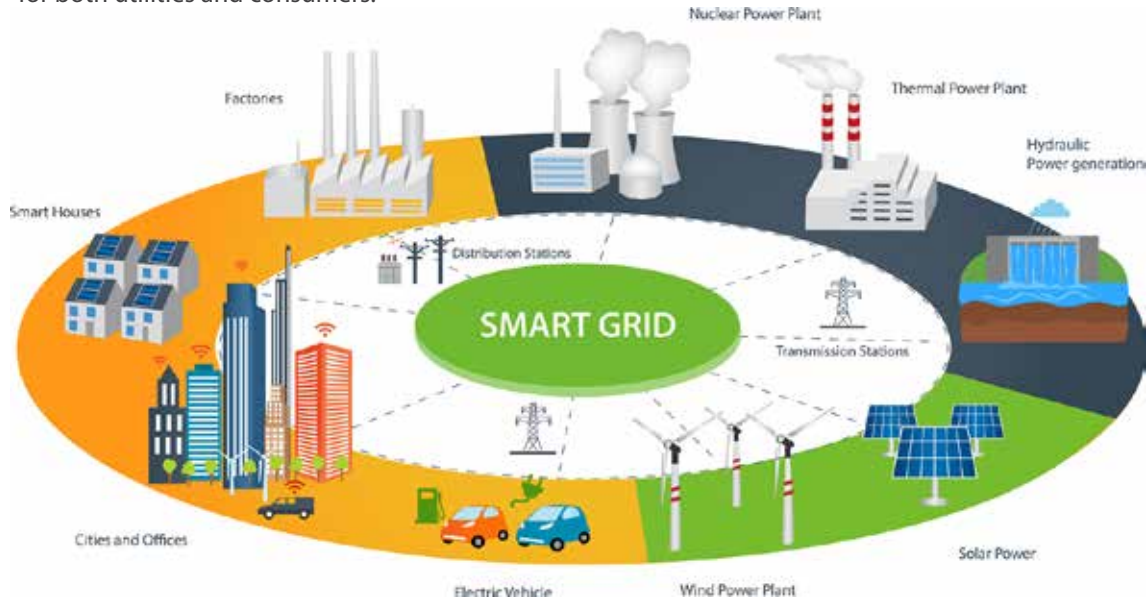
- **Energy storage technologies**, such as batteries, that can store excess renewable energy for use during times of low generation. This can help to smooth out the variability of renewable energy sources and ensure a more consistent and reliable energy supply.



- **Grid-forming inverters**, which can mimic the inertia provided by traditional power plants. These inverters can help to stabilize the grid by providing a stable frequency response, even when solar power generation fluctuates. This technology has the potential to revolutionize the way solar power is integrated into the grid, making it more reliable and efficient.



- ▶ **Smart grid technologies** have ability to detect and respond to power outages more quickly. By using sensors and advanced communication technologies, the grid can pinpoint the location of an outage and reroute power to minimize disruptions. This not only improves reliability but also saves time and money for both utilities and consumers.



Additionally, grid operators can implement advanced forecasting and grid management tools to better predict and manage the output of renewable energy sources. By improving the accuracy of forecasting, grid operators can better match supply and demand, reducing the risk of power outages or grid instability.

Conclusion

It is clear that the integration of renewable energy into the grid poses a number of challenges, but with the right investments in infrastructure and technology, these challenges can be overcome. By addressing these challenges, we can build a more sustainable and resilient energy system that benefits both the environment and society as a whole.

To Academician/Students:

In renewable energy integration, now a days control system & Power electronics together play vital role. Our academicians should try to focus on discussing, developing tuning efficient control models along with power electronics for Generators, turbine governor, exciter, power system stabilisers to visualise voltage & frequency behaviour. We are dependent on west/European countries for the control models. MATLAB helps in testing & visualising models.

Embracing Change: Navigating the Evolving Landscape of Technology



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In today's rapidly changing world, professionals across all industries are faced with the challenge of staying ahead of the curve. From technological advancements to shifting market dynamics, the pace of change can often feel overwhelming. However, for those who are willing to adapt and embrace new opportunities, the possibilities for success are endless.

As an AI and Automation Strategy Head at Rakuten Mobile Inc., I've had the privilege of witnessing firsthand the transformative power of embracing change. In my role, I've had the opportunity to work with cutting-edge technologies and innovative solutions that are reshaping the telecommunications industry. From implementing AI-driven automation systems to optimizing network performance, our team is committed to driving meaningful impact and delivering exceptional value to our customers.

One of the key lessons I've learned throughout my career is the importance of continuous learning and professional development. In today's fast-paced world, the ability to adapt and acquire new skills is essential for staying relevant and competitive. That's why I've made it a priority to stay informed about the latest trends and developments in the field of technology. By attending conferences, participating in workshops, and seeking out opportunities for growth, I've been able to stay ahead of the curve and position myself as a leader in my field.

One area that has particularly fascinated me is the intersection of AI and telecommunications. As AI technologies continue to mature, we're seeing a wealth of opportunities emerge for revolutionizing the way we operate and deliver services. For example, by leveraging machine learning algorithms, we've been able to optimize network performance, reduce downtime, and enhance the overall customer experience. These advancements have not only improved operational efficiency but have also opened up new revenue streams and business opportunities for our organization.

Another success story that comes to mind is our recent deployment of AI-powered chatbots to enhance customer support services. By leveraging natural language processing and machine learning algorithms, we've been able to provide personalized and efficient support to our customers, reducing wait times and increasing satisfaction rates. This innovative approach has not only improved the overall customer experience but has also helped us streamline our operations and drive cost savings. Looking ahead, I'm excited about the future possibilities that AI and automation hold for the telecommunications industry. From autonomous networks to predictive maintenance solutions, the potential for innovation is limitless. By staying curious, embracing change, and continuously learning, we can unlock new opportunities for growth and drive meaningful impact in the ever-evolving world of technology. In conclusion, the journey to success in the modern professional landscape is marked by a commitment to lifelong learning, a willingness to embrace change, and a passion for innovation. By cultivating these qualities and seizing opportunities as they arise, we can navigate the complexities of the modern workplace with confidence and resilience.

Together, let's embrace the future and unlock the endless possibilities that lie ahead.



Unleashing Creativity: The Evolution and Applications of Generative AI



Neha Pavuluri

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(2017-2021)
Software Engineer (LTIMindtree)

I started my undergraduate education in Computer Science Engineering at IcfaiTech which has been nothing short of transformative. From the moment I stepped onto campus, I felt a sense of belonging and possibility. I am grateful to the professors who helped me and motivated me to do my best. As I reflect on my time at IcfaiTech, I am filled with gratitude for the opportunities, growth, and memories that have enriched my academic journey.

In the realm of artificial intelligence (AI), generative AI stands out as a beacon of innovation, offering unparalleled capabilities in creativity and innovation. Unlike traditional AI systems that are often used for classification or prediction tasks, generative AI focuses on the generation of novel outputs that can be indistinguishable from those crafted by humans. Let's delve into the fascinating world of generative AI, exploring its capabilities, and diverse applications across various industries.

1. Image Generation and Editing: Generative AI algorithms, particularly Generative Adversarial Networks (GANs), are used to generate realistic images of objects, scenes, and even people. These images can be used in computer graphics, virtual reality, and entertainment industries for generating visual content, creating realistic prototypes, and even enhancing photo editing tools.

- 2. Content Creation and Marketing:** Generative AI algorithms can be used to generate content for marketing campaigns, social media posts, and advertising materials. AI-generated content can include text, images, videos, and even interactive experiences, helping businesses streamline their content creation processes and engage with their audience more effectively.
- 3. Drug Discovery and Molecular Design:** Generative AI is being used in pharmaceutical research to generate novel molecular structures with desired properties. AI-driven drug discovery platforms can accelerate the process of drug design, identify promising candidates for further experimentation, and optimize drug efficacy and safety profiles.
- 4. Autonomous Systems Training and Simulation:** Generative AI is used to simulate realistic scenarios for training autonomous systems such as self-driving cars, drones, and robots. AI-generated simulations enable developers to test and validate the performance of AI-driven systems in virtual environments before deploying them in real-world settings, enhancing safety and reliability.

Looking ahead, the future of generative AI is filled with promise and potential. As algorithms become more sophisticated and datasets grow larger, we can expect to see even greater advancements in creativity and innovation. From enhancing accessibility and inclusivity to revolutionizing how we create, interact with, and perceive content, generative AI is poised to shape the future of technology and human creativity in profound and transformative ways. As we continue to explore the boundless possibilities of generative AI, one thing is certain: the era of artificial creativity has only just begun.





COUNTERING ROBOTIC SWARMS : (Part-II) INNOVATIVE SOLUTIONS TO FUTURISTIC AERIAL THREAT



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Major Indian Army

Counter Drone Technology

Counter Drone systems rely on a variety of techniques for detecting and/or intercepting drones. The main detection and interdiction methods employed by products currently available on the market, as well as the principal platform types are highlighted in below.

(a) Detection, Tracking and Identification Methods.

- ▶ **Radar:** Detects the presence of small unmanned aircraft by their radar signature, which is generated when the aircraft encounters radio frequency pulses emitted by the detection element. These systems often employ algorithms to distinguish between drones and other small, low flying objects, such as birds. Radio-frequency (RF) detects, locates and in some cases identifies nearby drones by scanning for the frequencies on which most drones are known to operate.
- ▶ **Electro-optical (EO):** Identifies and tracks drones based on their visual signature. Infrared (IR) identifies and tracks drones based on their heat signature.
- ▶ **Acoustic:** Detects drones by recognizing the unique sounds produced by their motors. Acoustic systems rely on a library of sounds produced by known drones, which are then

matched to sounds detected in the operating environment.

- ▶ **Combined Sensors:** Many systems integrate a variety of different sensor types in order to provide a more robust detection, tracking and identification capability.

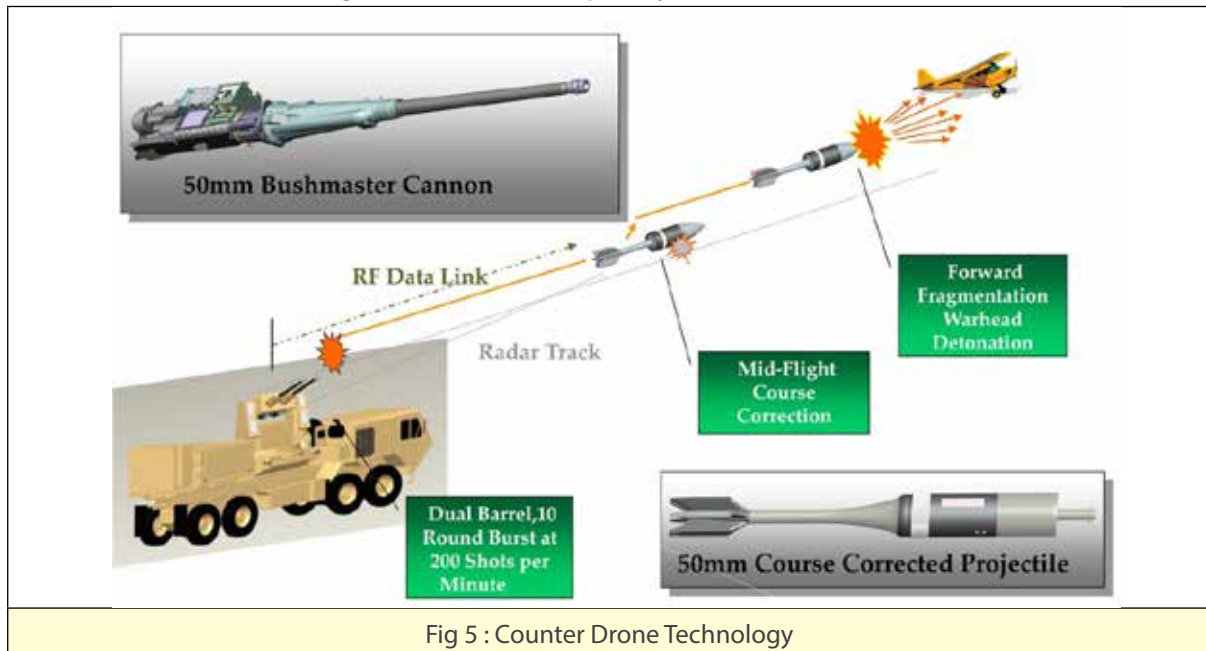


Fig 5 : Counter Drone Technology

(b) Interdiction Methods

- ▶ **RF Jamming:** Disrupts the radio frequency link between the drone and its operator by generating large volumes of RF interference. Once the RF link, which can include WiFi links, is severed, a drone will usually either descend to the ground or initiate a “return to home”.
- ▶ **GNSS Jamming:** Disrupts the drone’s satellite link, such as GPS or GLONASS, which is used for navigation. Drones that lose their satellite link will usually hover in place, land, or return to home.
- ▶ **Spoofing:** Allows one to take control of or misdirect the targeted drone by feeding it a spurious communications or navigation link. A range of measures such as cyber attacks, protocol manipulation and RF/GNSS deception are included in this category.
- ▶ **Dazzling:** Employs a high-intensity light beam or laser to “blind” the camera on a drone.
- ▶ **Laser:** Destroys vital segments of the drone’s airframe using directed energy, causing it to crash to the ground.
- ▶ **High Power Microwave:** Directs pulses of high intensity microwave energy at the drone, disabling the aircraft’s electronic systems.
- ▶ **Nets:** Designed to entangle the targeted drone and/or its rotors.
- ▶ **Projectile:** Employs regular or custom-designed ammunition to destroy incoming unmanned aircraft.
- ▶ **Collision Drone:** A drone designed to collide with the adversary drone.
- ▶ **Combined Interdiction Elements:** A number of C-UAS systems also employ a combination of interdiction elements to increase the likelihood of a successful interdiction. For example, many jamming systems have both RF jamming and GNSS jamming capabilities in the same package. Other systems might employ an electronic system as a first line of defense and a kinetic system as a backup measure.

Innovative Ideas to Counter Robotic Swarms

(a) Low Cost-Per-Shot Weapons

Low cost-per-shot weapons consist of exotic technologies like lasers and electromagnetic rail guns as well as more traditional technologies like machine guns. Lasers and rail guns are appealing counter-swarm weapons because they are electrically powered and therefore have relatively low costs for each shot, significantly lower than a missile assuming power sources are available.



Fig 6 : Anti Drone Weapons

(b) Counter-Swarm:

One method of taking out a swarm could be with another swarm. As long as the counter-swarm is cheaper or more effective than the enemy swarm, it can be a relatively low-cost way to defend against enemy swarm attacks.

(c) High-Powered Microwaves (HPM):

HPM can potentially blanket a wide area with EM energy to disrupt or destroy electronics, thus taking out an entire swarm in one move. While high-powered microwaves currently have limited range, they could be effective for terminal defence against some types of swarm attacks, or could be mounted forward on platforms that intercept and knock out swarms further away from the assets being defended.



Fig 7 : High-Powered Microwaves (Leonidas)

(d) Collapse the Swarm:

Communication jamming can also be an effective means of disrupting a swarm by preventing coordination among individual elements, “collapsing” the swarm so that it disintegrates into many disparate, un-coordinated elements. While such jamming would not destroy individual swarm elements, it would prevent swarm elements from fighting in conjunction potentially making individual elements easier to target and eliminate.

(e) Hijack the Swarm:

The ultimate tactics in counter-swarm is to hijack the enemy’s swarm for one’s own purposes. The swarms could be hijacked by spoofing incoming data, generate signals in the environment to induce certain swarm behaviours, or by direct communication hacking.

Integrated Counter Swarm System

The likelihood of manifestation of Robotic Swarm in the third dimension is very high. Present technology to counter UAVs/ Drones have been fielded. To prevent the swarm from accomplishing its mission, it is paramount to integrate maximum possible number of the counter mechanism. An integrated system must be capable of the following :-

- ▶ Direct the robotic swarm at an optimum distance using electronic intelligence.
- ▶ Track the centre fix of the swarm in three dimensions.
- ▶ Carry out continuous spectrum analysis of the swarm.
- ▶ Initiate following soft kill options to disorient/ disrupt/ take over the swarm like HPM, Communication Jamming and Cyber Attacks.
- ▶ In case options fail or succeed only partially, then we should have the ability to carry out hard kill of the swarm with LASER Weapons, Low Calibre High Rate AD (LOCHIRAD) Guns, Laser Activated Anti-Swarm Nets and Launch of a “Counter Swarm”.

Counter Swarm System Under Development.**(a) Anti UAV Defence System (AUDS).**

The AUDS system combines electronic scanning radar target detection, electro-optical (EO) tracking and directional RF inhibition capability. The Blighter A400 series air security radar detects small UAVs in all weather conditions at low altitudes among clutter. The Chess Dynamics Hawkeye Deployable System (DS) and EO Video Tracker, featuring both a long range color camera and a high sensitivity thermal imaging along with state-of-the-art video tracking technology, is able to track the UAV combined with radar target information. The operator is then able to make a timely and informed decision to use the Enterprise Control System (ECS) smart RF inhibitor to selectively interfere with the C2 channels on the UAV allowing the system to defeat the UAV mission.



Fig 8 : Anti UAV Defence System

(b) Repellent.

Probably the first classical counter swarm system is the Repellent-1 developed by Russia as a mobile anti-drone warfare complex. It is designed to suppress and destroy miniaturized enemy drones. The system is capable of auto detecting and neutralizing enemy drones at distance of over 30 km, suppressing their control sensor via powerful jamming or through directed interference to the drones satellite navigation system. It has unique supersensitive electronic in station which uses enemy drones control signals to detect them across long distance at any time of day or night and under any weather conditions. It has electronic intelligence and jamming equipment, together with a panoramic camera.

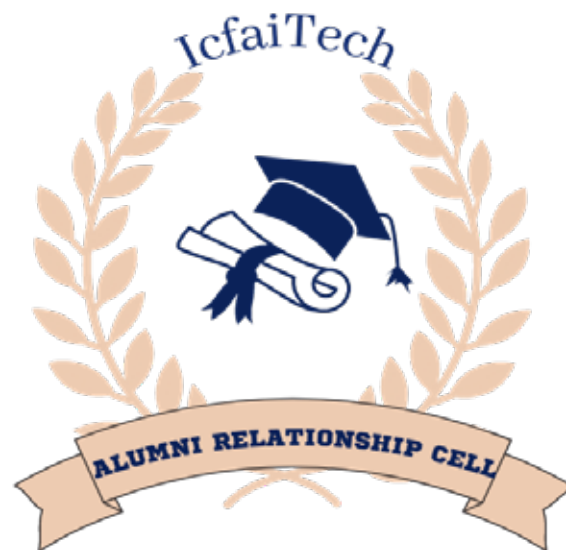


Fig 9 : Repellent

Conclusion

Affordability, software domination, reduction in mission costs and risk reduction are some of the consummate advantages that swarm technology promises in military campaigns. Drone swarms could be engineered out of COTS components and are software dominated. These aspects would probably lead to their quick proliferation even among not -so- affluent militaries and even terrorists. Though employment of swarms technology is still a nascent phase, its future dominance is inevitable. It would be prudent to be prepared to both harness the technology is that it must be capable of adapting to changes which too are inevitable after fielding of the same. While initially, the focus would be developing technology to harness the prowess of mass, all development must be guided by well thought out document of likely employment. Moreover, the armed forces must be open to the idea of employment of robotic swarms in all dimensions and facets of warfare. To be ahead of our adversaries in military capabilities we need to think ahead and commence research to meet futuristic military challenges.

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Alumni Achievements

Awards n Recognitions

Sainath Volam

Alumnus (2011-15)

Sainath Volam on behalf of Microsoft at DGFC Conference Cambodia, International Digital Government and Digital Technology Expo organized by Ministry of Post and Telecommunications and Digital Government Committee!



Incorporating Microsoft Copilot into his demonstrations, Sainath exemplified a proactive approach to AI security, leveraging cutting-edge tools to safeguard sensitive data and mitigate potential risks. By showcasing the capabilities of Copilot in enhancing code quality and security, Sainath underscored commitment to not only pushing the boundaries of AI innovation but also ensuring its responsible and ethical implementation. In an era where the intersection of AI and security is of paramount importance, Sainath Volam leads the charge towards a future where innovation thrives in harmony with safety and integrity. We applaud his unwavering dedication to shaping a more secure and resilient AI landscape and eagerly anticipate the continued impact of his pioneering efforts

Aatif Ibrahimi

Alumnus (2011-15)

Aatif was awarded ESR of the Year for 2023 at special ceremony in Washington USA. By Mathworks Inc. Aatif's dedication and contributions have been recognized, and it's heartwarming to see alumni making a positive impact in their respective fields



Alumni Relations Cell

Faculty Team	<ul style="list-style-type: none"> ▶ Dr Digvijay V Nair (Faculty Incharge) ▶ Dr Hashmi S ▶ Dr Vivekananda. K ▶ Dr Divya ▶ Dr H Sudheer
Student Team	<ul style="list-style-type: none"> ▶ YASASVI (Secretary) ▶ SAISRI ▶ SANTHOSH ▶ ANUHYA ▶ MEGHANA ▶ SIDHARTH ▶ BHAVITHA ▶ DHEERAJ ▶ YASHASRI ▶ MADHURA ▶ VAISHNAVI ▶ SRAVANI ▶ TANISHA ▶ SABER ▶ KEERTHANA





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