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We Explore We Exhibit



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B-SMART

(**B**V**R**ITian **S**tudent **M**agazine on **A**dvanced
Research & **T**echnologies)



VISION

To emerge as the best among the institutes of technology and research in the country dedicated to the cause of promoting quality technical education.

MISSION

At BVRITH, we strive to

- Achieve academic excellence through innovative learning practices.
- Enhance intellectual ability and technical competency for a successful career.
- Encourage research and innovation.
- Nurture students towards holistic development with emphasis on leadership skills, life skills and human values.

B-SMART is here to keep the students and the faculty members informed with the latest development in the area of science, engineering & technology. It also inculcates the habit of reading among students about new trends in technology and emerging areas and to provide a platform to the student for sharing knowledge.

Principal's Message



**Dr. K. V. N. Sunitha,
Principal, BVRITH**

**‘Excellence is not a destination; it is a continuous journey that never ends’
- Brian Tracy**

At BVRIT HYDERABAD College of Engineering for Women, we strive relentlessly to set new benchmarks in education, innovation, and holistic development. The year 2024 has been an extraordinary one for us, filled with remarkable milestones and achievements that reflect the unwavering commitment of our faculty, staff, and students.

We are proud to share that our institution has been ranked **140** in *India Today Best Colleges of India* and **163** in *The Week Hansa Research Survey*. This national recognition motivates us to scale greater heights.

Our dedication to energy conservation and sustainability was acknowledged with a Silver Certificate of Appreciation from the *Energy Swaraj Foundation* for making over 500 individuals energy literate. Furthermore, we received a Certification of Appreciation from ITC Limited – Paper Boards and Specialty Papers Division for our responsible disposal of e-waste during the academic year 2024–25.

We take immense pride in our students' accomplishments. Eight of our students were selected for the prestigious WE Program, earning a stipend of ₹1 lakh each, a rare feat among 200 students across India.

These accomplishments symbolize the hard work and vision of our entire BVRITH community. As we continue to forge ahead, let us remember that success is achieved through perseverance, collaboration, and a shared commitment to excellence.

I warmly invite you to explore the Volume 9, Issue 2 of our technical magazine, BSMART. In each edition, we recognize one student article as the most promising contribution. From the previous issue, the article titled ‘AI to Find Aliens’ by Ms. K. Vyshnavi of IV CSE earned this distinction.

I appreciate the contributors of the articles and the dedicated faculty and student coordinators for their sincere efforts in bringing forth this edition of the magazine.

Warm Regards

Dr. K.V.N. Sunitha

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'Name to Fame'

BVRIT HYDERABAD proudly introduces its star of the year
and wishes her 'The Best in Life'



PLACEMENTS
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Department of CSE

"Congratulations"

Ch.Kavya

Btech-CSE(21WH1A0566)

Wishing you great success in this exciting new role !



51.03 Lakhs
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This is my journey, not of a genius, but of an ordinary student who dared to dream big and landed a dream internship and full time offer at Microsoft. Hi, I'm Kavya Chitipotu, and I'm excited to share my journey of receiving a full-time offer from Microsoft!

They say hard work pays off, but they don't always tell you about the self-doubt, the late nights, and the tears blurring your computer screen.

Growing up, I never considered myself exceptional, In school I often used to aim to be a class topper but often felt held back, believing I couldn't match the brilliance of my topper classmates (at present these people are IIT, NIT, IITians) and then I convinced myself that I can't match their success.

I used to blame GOD for not gifting that natural grasping power to me, instead of working on it. My parents always had concerns about whether I could achieve something in my life, and entering into Engineering became my turning point. I wanted to prove something, not just to everyone else, but to myself. I didn't want to be lazy and regret it in the future, as I believe the pain of regret is much greater than the pain of discipline. Of course, the road was not easy for me, a few DSA concepts were so difficult for me to grasp, and couldn't understand them even after spending 3-4 hours on a single problem. when I constantly failed the wrestle with dynamic programming problems, there were nights where I cried in silence, sitting alone in the room, this fueled a voice that whispered, "Maybe this isn't for you."

"Opportunities don't happen; you create them"

But there was another voice, that urged me to keep going. It reminded me of my parents, and their constant yet unspoken worry about my future. I held on to one simple mantra: “Never Give Up.” I realized that success isn’t just about natural talent; it’s about determination and hard work. While some may grasp concepts quickly, and I was willing to put in the extra time and effort to fully understand them.

There were tears of frustration and moments of despair where giving up seemed like the only option. But each time, I’d find that spark of determination flickering back to normal.

The turning point for me wasn’t some lucky break or a sudden burst of brilliance. It was the constant push to get better. I practiced, practiced, and practiced. it’s all about Consistency and Discipline. Nothing comes so easily without extra effort, getting out of your comfort zone, and going beyond your speed.

Though I very well practiced and completely focused. I faced a lot of rejections, and it will take more than 2000 words for me to address all those difficult and depressing days. so, don’t expect success so instinctively, GOD tests your patience and wants to know how determined you are.

In the end, you will deserve what u deserve !! but u need to have the patience to travel till the end to collect your presents hidden by GOD to gift you. Just Don’t Quit !!

And finally, I received my present that was sent through an email with the subject:

“ Congratulations!! Welcome to Microsoft”.

I would credit this achievement to Almighty GOD and to my previous self for not giving up.

My Message to Juniors/Others Based on My Journey So Far:

1. Discipline and consistency are the keys to achieving goals in life.
2. Even if your natural grasping ability is slower, it does not mean you are destined for an average or low career. With extra time, effort, and determination, you can achieve equal to or even more than highly intellectual individuals.

3. Trust the process and never give up until you achieve your goals. Remember, success may be delayed, but in the end, you will receive what you truly deserve for your efforts.



KAVYA CHITIPOTU
(CSE – 2021 Batch)

"Effort never goes unnoticed in the journey of success"

COVERSTORIES

COVER STORY – 1

1st prize winners at WinAI

Hackathon

Team Members:

Ms. Pavitraa. G

Ms. Vagdevi

4th year CSE(AIML)



In the recent WinAI hackathon organized by the Department of CSE(AI&ML) at BVRIT HYDERABAD College of Engineering for Women, my teammate Vagdevi and I were thrilled to secure the 1st position. Together, we developed an innovative AI-based application designed for YouTube transcript summarization. Our app provides users with concise and meaningful summaries of YouTube videos, enhancing accessibility and comprehension by supporting multiple languages, including English and Hindi. The concept aims to benefit a wide audience, from students to professionals, allowing for efficient information consumption without needing to watch the entire video. This project was incredibly fulfilling, as it allowed us to apply our knowledge in AI to solve real-world problems while delivering a solution that promotes inclusivity through multilingual support.

Our experience with the Vipas.ai platform was equally invaluable, as it offered a robust environment to deploy and test our application seamlessly. Vipas.ai's resources made it easier for us to focus on fine-tuning our AI model, gaining hands-on experience with real-time application performance and user interaction. We encountered and overcame various technical challenges, from language processing to ensuring accurate summarization, which not only strengthened our technical expertise but also deepened our problem-solving skills. This hackathon provided an excellent platform to learn, grow, and gain confidence in using advanced AI tools, marking a significant milestone in our journey as aspiring AI and ML professionals.

"Don't be afraid to give up the good to go for the great."

COVER STORY – 2

**Runner - up in DEMUX
Hacathon 2024 – BVRIT
Narsapur**

Title:

**To promote eco friendly
lifestyle**



TeamMembers:

Ms. K. Vishalakshi

Ms. C. Kavya

Ms. V. Varshini

Ms. M. Vijaya

(2nd year ECE)

Recently, our team had the incredible opportunity to participate Demux Hackathon in September 2024, held at BVRIT Narsapur. Our team participated with enthusiasm and focused on promoting eco-friendly lifestyles.

Competing against 120 teams from various institutions, we were thrilled to secure the second prize, reinforcing our belief in teamwork and creative problem-solving.

My team and I brainstormed innovative ways to present information on eco-friendly habits, from reducing waste to conserving energy. We designed an interactive platform that not only shares tips but also engages users through challenges and community initiatives. Our goal was to make sustainability accessible and appealing to everyone.

After countless hours of coding, designing, and refining our project, I was thrilled to learn that we placed second in the competition. This experience not only enhanced my technical skills but also deepened my commitment to environmental awareness.

I am grateful for the support of my peers and mentors throughout this journey. This hackathon reinforced my belief that technology can play a vital role in promoting a more sustainable future.

"Success is walking from failure to failure with no loss of enthusiasm."

COVER STORY – 3

Winners in PIVOT Hackathon 2024 - BVRIT HYDERABAD

Title:
ECO-LOOM



Team Members:

Ms. M. Thanusha
2nd year IT-B

Ms. P. Gayathri
2nd year CSE-B

Ms. A. Indhu
2nd year AIML

Ms. Ch. Rithika
3rd year ECE

Ms.M. Anoohya
2nd year CSE-C

We are thrilled to participate in this 24-hour makethon, an incredible opportunity for all of us to showcase our innovative ideas and celebrate creativity. We feel truly fortunate to be part of this event, where the energy and enthusiasm are contagious. Our innovation, Eco-Loom, focuses on creating sustainable and environmentally friendly fabrics, aiming to reduce the harmful chemicals that negatively impact both human health and the planet. The essence of our project lies in crafting fabrics that are gentle on the environment and safe for people, by utilizing natural resources such as lotus, hemp, banana, pineapple, and bamboo.

This experience has been nothing short of transformative. It has not only pushed us to innovate but also deepened our commitment to finding solutions that truly matter. We believe that Eco-Loom is more than just a project—it's a step towards a healthier future for both humanity and the planet. By combining creativity with sustainability, we hope to inspire others to rethink the way we interact with nature and to prove that innovation can drive real, lasting change.

In the end, the makethon has shown us that the possibilities are endless when passion and purpose come together. We're excited to take this journey forward and continue weaving a sustainable tomorrow.

"Hard work and patience build lasting success stories."

COVER STORY – 4

Winners in PIVOT

Hackathon 2024 - BVRIT

HYDERABAD



Title:

Space-Efficient Microgrids

Team Members:

Ms. Kalaga Sadhana
2nd year CSE

Ms. Kantayapalem Meghana
2nd year IT

Ms. Naga Sharmada
2nd year CSE

Ms. Abhigna Bandi
2nd year AIML

Ms. Mothe Sathwika
3rd year ECE

During pivot the 24hrs hackathon, our team focused on the issue of space inefficiency in urban solar panel installations. The excessive space occupied by traditional solar panels limits their scalability, especially in densely populated urban environments where land is scarce.

This hackathon ignited our curiosity and teamwork, driving us to propose microgrids with optimized, smaller solar panels as a space-efficient solution. Our microgrids integrate renewable energy sources like solar and wind, combined with energy storage systems to ensure a reliable and sustainable energy supply for urban areas.

Our project, Space-Efficient Microgrids, promises a solution that not only reduces the space consumption of solar panels but also integrates them with wind energy systems for better efficiency. These microgrids are scalable and can be implemented in various urban settings, such as rooftops and other underutilized spaces. Through innovation, we aim to create smarter, sustainable cities that balance energy needs and space utilization effectively.

Looking ahead, we are committed to refining the design of our microgrids by improving energy efficiency, optimizing space usage, and exploring further integration of renewable energy technologies. Our dedication to sustainability and urban innovation drives us to develop solutions that will shape the future of energy consumption in smart cities.

“The Best way to predict the future, is to create it.”

"Success is doing ordinary things with extraordinary focus."

COVER STORY – 5

Selected for the DESIS

Ascend Edu care Program



Ms. Gnanika Omkarini M

2nd Year CSE A

I'm incredibly excited to share that I've been selected for the ESIS Ascend Edu care Program, a prestigious six-month mentorship initiative by D.E. Shaw, specifically for women in tech. Out of more than 18,000 applicants across India, only 80 of us made it through, placing me in the top 0.4%! The selection process was quite intense, with four eliminatory stages—resume shortlisting, an online assessment on Hacker Rank, a technical interview, and finally, a behavioural interview.

This program is designed to foster holistic development, combining both technical and soft skills. I'll be diving deep into topics like data structures, algorithms, coding, programming languages, design thinking, and automation testing. Beyond that, there are sessions on professional presence, communication, and presentation skills, which I'm equally eager to enhance.

One of the highlights for me is the chance to connect with an incredible group of women from different colleges, all passionate about technology. We've been divided into study groups, each guided by a mentor from D.E. Shaw, who will support us throughout this journey.

The program comes with a ₹50,000 stipend, which is definitely a plus, and it all kicked off with an inspiring inauguration ceremony at D.E. Shaw's Hyderabad office on 18th October 2024. I'm truly looking forward to the growth and learning this experience promises, and I can't wait to see where this journey takes me!

"The only way to do great work is to love what you do."

COVER STORY – 6

Google Internship offer
with a package of 1 lakh.

Ms. B. PURNIMA

3rd year CSE - A

VISHNU | **BVRIT**
BVRIT HYDERABAD College of Engineering for Women (UCC-Autonomous)

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Department of CSE
"Congratulations"
B.Purnima
Btech-CSE(22WH1A0519)

Wishing you great success in this exciting new role as Software Engineering Intern at Google for Summer 2025!

Google
1.20 Lakhs Per Month Stipend

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As a 3rd-year Computer Science and Engineering student at BVRIT HYDERABAD College of Engineering for Women, securing a Software Engineering Internship at Google has been an incredible milestone. This achievement reflects not only my hard work but also the unwavering support from my college, placement coordinators, and mentors.

Preparing for Google was no easy feat. It required strong fundamentals in data structures, algorithms, and problem-solving. Thanks to the resources provided by my college—coding workshops, and mock interviews organized by the placement team - I could approach each interview confidently. The placement coordinators guided me through each step, from refining my technical skills to improving interview performance.

Each round of Google's interview process was rigorous, testing both technical and analytical skills. The experience taught me resilience and the importance of continuous learning. This success isn't mine alone; it's shared with everyone who supported me. To future aspirants, I'd say: **stay committed, use every resource, and keep pushing your limits.**

"If opportunity doesn't knock, build a door."

COVER STORY – 7

Got selected in NXP WOMEN IN TECH
– Batch III, as one of the Top 75
women engineering students in WIT
Programme

Ms. Ch. Bhanu Teja

2nd year EEE



I am Bhanu Teja from II EEE, and I am thrilled to share my journey of being selected for the prestigious NXP Women In Tech (WIT) Program – Batch III. This opportunity challenged me to put in my best effort and discover what I'm truly capable of. The selection process was highly competitive with over 15,000 registrations and involved multiple stages: academic shortlisting, an aptitude test, personal statement writing and a virtual interview. Each phase required commitment and with consistent effort and support from my college, I am fortunate to be among the Top 75 students selected in India.

The WIT Program offers a comprehensive one-year technical training in semiconductor design, focusing on industry-relevant practical sessions and innovation-driven learning. It includes individual projects, graded quizzes and insights from industry leaders, all delivered in a student-friendly online format. The program also provides a monetary reward of INR 50,000 and opens doors for internships and employment with NXP Semiconductors.

I am very grateful to my institute and well-wishers for their unwavering support. I am eager to begin this transformative journey and looking forward to unlock new opportunities in the dynamic field of semiconductors!

"It always seems impossible until it's done."

Articles selected as the Best 3, in the Competition held as part of National Space Week

Chandrayaan-3 and Beyond: How India's Space Program is Transforming Lives

India's Chandrayaan-3 mission, a significant milestone in its space exploration, successfully landed on the Moon on August 23, 2024. This achievement, building upon the successes of its predecessors, Chandrayaan-1 and Chandrayaan-2, solidified India's position as a global leader in space exploration.

Beyond the scientific breakthroughs, Chandrayaan-3 has inspired millions, especially young students, to pursue STEM fields. Its societal impact extends to various sectors, including agriculture, disaster management, and healthcare, through advancements in satellite technology and earth observation.

India's cost-effective space missions, often referred to as "Frugal Innovators," have garnered international recognition. This approach not only strengthens India's global standing but also encourages other developing nations to participate in space exploration.

Chandrayaan-3's success has also fostered international collaboration and diplomacy, strengthening India's position as a key player in the global space community. This journey into space marks a significant achievement for India, symbolizing scientific progress, national pride, and a relentless pursuit of knowledge



Ms. Yuvika Sai Simhadri
CSE 2nd year

Touching Lives while Touching the Moon: India's Space Saga

Chandrayaan-3's successful lunar landing marks a significant milestone in space exploration and inspires youth to pursue STEM careers. This achievement showcases India's rich history in space exploration and serves as a guide for the next generation.

Let's Walk through into a Glimpse of India's Space Exploration History:

India's space journey began in the 1960s with the establishment of ISRO. The launch of Aryabhata in 1975 marked India's entry into space technology. Subsequent developments like SLV and PSLV made significant progress.

The Chandrayaan missions are crucial chapters in India's space history. Chandrayaan discovered water molecules on the Moon. Chandrayaan-2's orbiter continues to provide valuable data despite challenges faced by the Vikram lander. Chandrayaan-3 achieved a successful landing on the Moon's south pole in 2023, marking a significant advancement in lunar exploration. These achievements foster national pride and demonstrate dedication and perseverance towards mission.

Chandrayaan-3's complexity involved multiple STEM disciplines. This diversity shows that STEM careers offer a range of opportunities. The mission's success highlights emerging fields like robotics, AI, and satellite technology. Robotics and AI were integral to the mission's success, providing exciting new career paths. Educational initiatives inspired by the mission provide hands-on learning experiences. Chandrayaan-3's success inspires youth to pursue STEM careers, highlighting national achievement, diverse career opportunities, and engaging educational initiatives. The story of Chandrayaan-3 sets a remarkable chapter of

India's space exploration history, showing the way for future advancements.

“The only way to discover the limits of the possible is to go beyond them into the impossible”

Ms. Battina Charitha
CSE 3rd year



Touching Lives while Touching the Moon: India's Space Saga

“With each space mission, we uncover the universe's magic and find new inspiration.”

From Humble Beginnings to Historic Triumphs

India's space journey began in the 1960s under the visionary leadership of Dr. Vikram Sarabhai. He founded ISRO, setting the stage for India's transformation from a space newcomer to a global leader. Despite challenges, India's determination and innovation led to significant achievements, starting with Aryabhata in 1975. Over the years, missions like INSAT and IRS showcased India's growing capabilities and dedication to using space technology for societal benefit.

Chandrayaan-3: A Historic Achievement

Chandrayaan-3's successful landing on the Moon's south pole in 2023 marked a significant milestone for India. This achievement, a testament to India's resilience and technological prowess, inspired millions.

The Ripple Effect of Space Technology

India's space missions have revolutionized daily life. ISRO's satellites have improved communication, environmental management, and disaster response.

A Global Partner in Space Exploration

India's achievements have earned global recognition and fostered collaborations. The Country's commitment to space exploration has

inspired young people and contributed to a shared vision of exploration.

Inspiring the Next Generation

India's space achievements inspire young people to pursue STEM careers. ISRO's outreach programs engage students with hands-on experiences in space science.

Embracing the Future

India's space program is poised for further achievements. Future missions like Gaganyaan and Aditya-L1 promise to push the boundaries of exploration and deepen our understanding of the universe.

Conclusion

India's space saga is a story of dreams realized and boundaries overcome. As we reflect on our achievements, we take immense pride in how far we have come and the impact we continue to make. From the Moon's south pole to the everyday benefits of space technology, our space missions highlight the limitless possibilities of human creativity and determination.

Looking up at the night sky, we see more than just stars; we see a reflection of our aspirations and potential. Touching lives while touching the Moon is not merely a goal; it is a living reality that unfolds with every new mission. As India continues to reach for the stars, we are united in our pride and inspired by the endless possibilities ahead.

Ms. Yalamanchili
Gunavarhini
ECE 3rd year



“Overconfidence will drown you in the sea of reality”



TECHNICAL TRENDS – From Faculty

YOLOv11: Advanced Object Detection for Autonomous Vehicles in Adverse Conditions

The latest evolution in real-time object detection, YOLOv11 (You Only Look Once version 11), has brought enhanced accuracy and resilience to autonomous vehicle systems. This model, a continuation of the YOLO series known for rapid object detection, not only detects objects like cars, pedestrians, and cyclists with high accuracy but also performs well under challenging conditions such as fog, snow, and sandstorms. Here, we explore the YOLOv11 model's capabilities, using visualization results and a confusion matrix to showcase its real-world effectiveness.

Understanding Model Performance

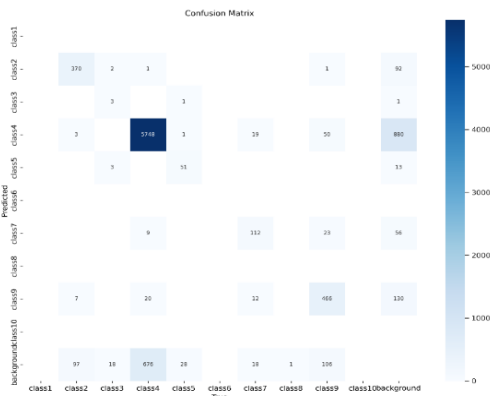


Figure 1: Confusion matrix of YOLOv11 for various classes

The confusion matrix (Figure 1) provides a quantitative analysis of YOLOv11's detection performance across different object classes. Each cell in the matrix represents the number of predictions for each class compared to the ground truth. High values along the diagonal indicate the model's accuracy in identifying specific objects correctly, while lower values off the diagonal show occasional misclassifications.

This matrix confirms YOLOv11's ability to achieve high detection accuracy, especially for essential classes like vehicles and pedestrians, which are critical for autonomous driving safety.

Studies have shown that improvements in object detection performance, such as those in YOLOv11, enhance the safety of autonomous systems in urban environments. Time Object Detection: Sample Outputs The model's capability in various environmental conditions is illustrated through a series of sample detection's:

Detection Results in Adverse Conditions



Figure 2: Detection Results in Adverse Conditions

Figure 2 shows detection results from a range of adverse weather conditions, including foggy, misty, and sandy environments. YOLOv11 accurately identifies vehicles with high confidence scores, as shown by the bounding boxes marked with classes and confidence levels (e.g., "class4 0.9" for cars). Even in low-visibility conditions, such as fog and sandstorms, the model demonstrates a robust capacity to detect vehicles, a crucial feature for safe autonomous navigation. Research highlights the importance of robust object detection in poor visibility for reducing collision risks in autonomous vehicles.

Detection Results in Complex Environments:



Figure 3: Detection Results in Complex Environments

In Figure 3, YOLOv11's detection is tested in scenarios with high object density and multiple vehicle types. The bounding boxes accurately cover each detected vehicle, indicating YOLOv11's precision in identifying overlapping objects. The model's high confidence scores in challenging lighting and weather conditions underscore its utility in dynamic and complex environments, maintaining reliability when multiple objects appear in close proximity.

Specific Additions: Detection Examples

Snowstorm Detection:



Figure.4: Detection of objects in Snow storm



Figure.5: Detection of persons, objects in Snow storm

Figures 4 and 5 showcase YOLOv11's performance during a snowstorm, where visibility is low, and environmental interference is high. The model correctly identifies cars (class4) and other relevant objects with confidence, underscoring its capability to handle snowy environments. This reliability is essential for autonomous vehicles operating in colder

regions, ensuring safety even in extreme weather conditions .

Dust Tornado



Figure.6: Detection of objects in Dust to tornado

Figure 6 displays a detection scenario during a dust tornado. Despite the reduced visibility, YOLOv11 maintains accurate vehicle detection with confidence scores above 0.8. This capability to detect objects under harsh conditions illustrates the model's robustness and adaptability, which are vital for real-world applications where such adverse weather is unavoidable .

Foggy Weather Detection



Figure.7: Detection of objects in Fog

In Figure 7, foggy conditions test the model's ability to discern objects in highly obstructed environments. YOLOv11 successfully detects multiple vehicles with high confidence scores, proving its efficiency in foggy conditions that typically challenge vision-based systems. This reliability enhances the potential for autonomous vehicles to operate safely in diverse weather scenarios.

Conclusion:

The YOLOv11 object detect stands out as a powerful tool for autonomous vehicles, demonstrating high accuracy and reliability even in the face of adverse environmental conditions. With its improved architecture, YOLOv11 offers fast and accurate detection's essential for safe navigation, making it a promising technology for the future of autonomous driving.

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2. Zhou, Y., et al. (2022). Improving Autonomous Vehicle Safety in Low Visibility. IEEE Transactions on Intelligent Vehicles.
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Dr. Pardhu Thottempudi,
Assistant Professor,
Department of ECE.

Underwater wireless optical communication systems

Most part of the earth is filled with water, and approximately 97% of this water is in oceans. People rely on the oceans for transportation, food, and communication. Humans have hardly explored 5% of the oceans, but with better communication systems, it is possible to learn much more. Underwater communication, like terrestrial communication, requires high speed and capacity in order to create communication links between sensor nodes, buoys, remotely operated vehicles (ROVs), and underwater wireless sensor networks (UWSNs). Acoustic, wired (Fiber optic), and optical wireless communication systems are appropriate technologies for underwater communication.

Underwater Optical Wireless Communication (UOWC) systems are innovative technologies that enable higher data transfer in aquatic environments, providing distinct benefits compared to conventional acoustic and radio frequency (RF) methods. Acoustic waves are often used for long-distance underwater communication, but they are limited by low data rates and high latency since sound travels slower in water. Similarly, RF signals are severely limited in range underwater due to high attenuation, making them unsuitable for deep-sea applications. In contrast, optical wireless communication systems use the visible light, usually in the wavelengths of blue-green, which has relatively low attenuation in water. This characteristic allows for greater bandwidth and quicker data transmission rates over the distances up to few hundreds of meters, making it well-suited for real-time, high-resolution data transfer across various underwater situations.

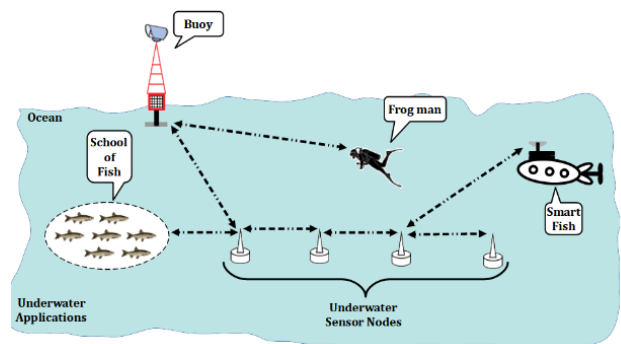


Figure: Applications of Underwater optical wireless communication system

The progress of UOWC systems has attracted considerable interest due to their promising applications in areas like environmental monitoring, maritime archaeology, port security, live video streaming, disaster preparedness, offshore oil field exploration, high-performance UWSNs, internet of underwater things (IoUT), and military operations. By facilitating high-speed data transmission, UOWC can enable video streaming, sensor data sharing, and even the operation of autonomous underwater vehicles (AUVs) with very little latency. Major

difficulties in the deployment of UOWC systems include addressing the turbulence due to the fluctuations in the water density, salinity, and temperature variations; absorption and scattering of light in aquatic environments due to depth, water clarity, and the presence of particles; transmitter-receiver misalignment. Innovative approaches, such as adaptive modulation techniques and cutting-edge laser sources, are being investigated to address these challenges and improve the dependability of UOWC. The relaying techniques are employed to improve the link range, and the use of simultaneous light information and power transfer (SLIPT) method is making the AUVs life longer in the underwater environment. With the help of underwater sensors and vehicles UOWC is more useful for the internet of underwater things, and underwater wireless sensor networks. UOWC is having more scope towards underwater navigation and positioning and needs more attention and significant research.

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Digital Twins in the Internet of Energy: Virtual Optimization for Grid

The Internet of Energy changes the entire industry at its core—including power plants,

transmission lines, and devices by interconnecting them within a digital network. This allows for the instant sharing of data with smart control and upgrade among different energy subsystems. One of the vital elements of the IoE system is the Digital Twin. It is a digital counterpart or representation of a real asset or system. Digital Twins which can be defined as development of a specific object which enables precise replication of an existing physical object in the digital world which can act, and function just as its real-world counterpart. These models are created using data gathered from sensors and models, predictive and historical information. This virtual model can be utilized to assess alternative courses of action, perform operation efficiencies, and forecast anticipated results.

Digital Twins in the Internet of Energy (IoE):

Digital Islands can inform you in regards to the status of the several items of the distribution grid that are in its composition. With monitoring voltage, current and temperature and those times through the people operating securing ever might find troubles in advance and act in attempts to fix what but these troubles. The twins utilize historical and current data collection methods to make failure predictions before equipment breakdowns happen. This aims at ensuring that headways to address breakdowns are on time which helps with efficiency and cost control. Digital Twins have capabilities that enable the modeling of different operating conditions and testing scenarios. Such capabilities enable grid operators to enhance power distribution, reduce peak loads and enhance the efficiency of the grid. In addition, Digital Twins can also allow the grid to incorporate renewable energy sources such as winds and solars. With these sources simulated, operators are able to come up with plans that would enable them to manage supply against demand.

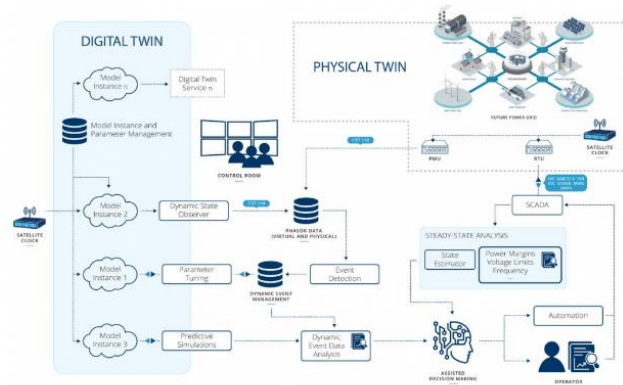


Figure: Interaction of a power system digital twin with its counterparts.

The image above is a comprehensive description of how a power system digital twin interacts with its physical counterpart through advanced analytics, dynamic and steady-state data management, automation, and the system operator function. According to the conducted research and practice, the perspective concerning the use of Digital Twins in the Internet of Energy (IoE) is very interesting, as it makes it possible to implement a number of transformations in grid operations. The first and by far the most important transformation is the increase in efficiency, caused by the provision of operational efficiency of the grid: digital twins allow reducing energy losses and increasing the efficiency in a comprehensive manner of the grid performance. They also reduce the frequency with which power loss occurs by enabling predictive maintenance and resolving faults early. In today's economy, another significant plus is the reduction in expenses: Digital Twins improve the energy use; lower the cost of maintenance, and increase the efficiency with which assets are utilized, and as a result, overhead costs. Digital Twins also make it possible to shorten time scales over which innovations in the energy industry are realized. This is because dependence on technology is not an objective, but a means of increasing efficiency of new technologies and business models that are developed, thereby speeding the pace of smart grids development.

However, there are still barriers to be overcome in the implementation of Digital Twins in the bandwidth of the Internet of Energy (IoE) rather than creating many benefits. The majority of concerns that are raised can be classified into functional categories, most of them are related to the area of permanently available data/information. It is one of the important tasks to ensure security of and accountability for the data used for creation and trying to improve the Digital Twins. In addition, the costs of hardware/software resources for the creation and maintenance of the Digital Twins are exceptionally high, and some companies may view these high expectations in terms of financial and technical obstacles. Interoperability is another major challenge, since seamless integration is only possible when there is existing compatibility across different Digital Twin platform or systems which will ensure optimal data integration and efficient realignment of operations. As the IoE continues to change, Digital Twins will only become more impactful. Grid operators can enhance and streamline operations by harnessing the potential of virtual models and accelerate progression towards a more environmentally sustainable energy future.

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Datafication : Transformation of raw information into structured digital data

Datafication refers to the process of transforming various aspects of life, activities, or processes into digital data. This term has become increasingly relevant with the rise of digital technologies and the proliferation of data collection methods. Essentially, datafication involves converting analog information into digital form, enabling it to be stored, analyzed, and utilized in various ways.



Datafication encompasses a series of algorithms and processes designed to transform raw information into structured digital data, primed for analysis and application. Initially, data is gathered from diverse sources including databases, sensors, and online platforms. Next, data cleaning algorithms rectify errors, remove duplicates, and fill in missing values to ensure data integrity. Subsequently, data transformation techniques convert unstructured data into a structured format, often utilizing natural language processing or computer vision. Feature extraction algorithms identify pertinent features for analysis, while data integration algorithms merge disparate datasets cohesively. Analysis algorithms then uncover patterns and relationships within the data, employing methods such as machine learning and statistical

modeling. Visual representations of the findings are crafted through data visualization techniques, aiding comprehension for stakeholders. Finally, the processed data is stored and managed efficiently, typically in relational databases, data warehouses, or cloud solutions, enabling seamless access and utilization. These integrated algorithms and processes underpin the datafication journey, empowering organizations to harness data for informed decision-making and innovation.

Datafication has the potential to revolutionize various aspects of society by providing insights, improving efficiency, and enabling innovation. However, it also raises concerns about privacy, security, and the ethical use of data.

These algorithms and processes work together to enable datafication across various domains, allowing organizations to leverage data for decision-making, innovation, and optimization.

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AlphaFold and Beyond - Assessing the AI Revolution in Protein Folding

Introduction:

The awarding of the 2024 Nobel Prize in Chemistry to John Jumper, Demis Hassabis, and David Baker marks a pivotal moment for artificial intelligence (AI) in science. The recipients were recognized for AlphaFold, a groundbreaking AI tool developed by Deep Mind, and complementary contributions to protein design by Baker's Rosetta lab. Together, these advances have revolutionized structural biology by solving a problem that has confounded scientists for over 70 years, predicting the three-dimensional structure of

proteins solely from their amino acid sequences. This article examines AlphaFold's accomplishments, its technical methodology, and the ongoing challenges and potential that remain in the field of protein folding.

Breaking Boundaries in Structure Prediction

AlphaFold made headlines worldwide for its unprecedented accuracy in predicting protein structures, beginning with the debut of Alpha Fold2 at the 2020 CASP14 competition, where it outperformed other methods with remarkable accuracy.

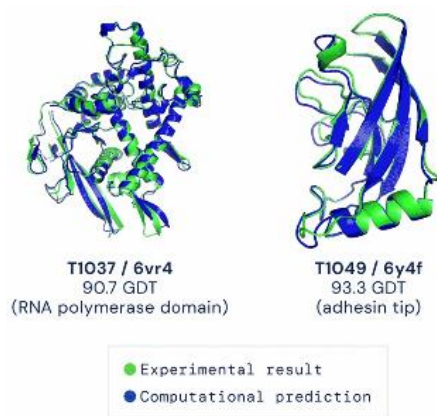


Figure 1: Predicted 3D protein Structure by AlphaFold and its comparison with experimentally determined structure (Source: Deep mind)

Unlike prior prediction techniques reliant on template-based modeling, AlphaFold uses deep learning, extracting and interpreting evolutionary data from multiple sequence alignments and structure databases, notably the Protein Data Bank (PDB). Through this integration, AlphaFold achieves a root-mean-square deviation (RMSD) of less than 1 Å for many predictions, rivaling experimental methods such as X-ray crystallography and cryo-electron microscopy (Jumper et al., 2021).

AlphaFold's Impact on Biology and Medicine

The impact of AlphaFold goes far beyond structural biology. By providing structural models for over 214 million proteins, including nearly all proteins from major genetic databases,

AlphaFold has democratized access to protein structures, previously available only through time-consuming experimental methods. This database has facilitated advancements in areas such as enzyme engineering, vaccine development, and drug discovery. Researchers have used AlphaFold models to locate cryptic binding pockets on proteins—transient structural features that can be targeted for drug design, unlocking new avenues for therapeutic interventions (Kuzmanic et al., 2020; Bowman, 2024).

Achievements and Methodology: How Alpha Fold Works

Alpha Fold's development was a cumulative journey of AI innovation and bio informatics, combining data-driven and physics-informed approaches to model protein structures. The Alpha Fold architecture is designed to predict protein structures from amino acid sequences by leveraging multiple stages of data processing and deep learning.

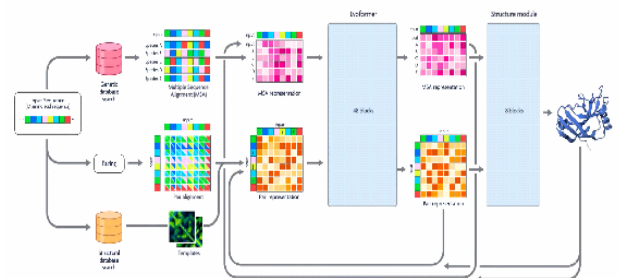


Figure 2: End to End Framework of Alpha Fold for Protein Structure Prediction

The process begins with an input sequence, which is used to search genetic databases, resulting in multiple sequence alignments (MSAs) and structural templates. The MSA captures evolutionary information across different species, while structural templates from a structural database provide potential structural clues. These inputs are transformed into two main representations: an MSA representation and a pair representation, which encode information about individual amino acids and their pairwise interactions,

respectively. These representations are then processed by the “EvoFormer”; component, a deep neural network consisting of 48 blocks that iteratively refines the MSA and pair representations to enhance the prediction accuracy. The Evoformer applies attention mechanisms to learn relationships within the MSA and between paired residues, capturing structural dependencies. Afterward, the outputs from the Evoformer feed into the “Structure Module” an 8-block network that translates the refined representations into precise 3D atomic coordinates, predicting the final protein structure. This iterative and multi-layered architecture allows AlphaFold to achieve high accuracy by progressively improving the structure prediction at each step, accounting for both evolutionary and structural data. Through a process called “recycling,” AlphaFold refines its predictions by iteratively adjusting its initial model to improve accuracy with each cycle. This technique produces highly accurate structures, comparable to experimental techniques in many cases (Senior et al., 2020).

Is the Protein Folding Mystery Finally Over?

While Alpha Fold has redefined protein structure prediction, the hypothesis remains that the complete “protein folding problem” is yet unresolved. Alpha Fold predicts static protein structures, which represent only the lowest energy states within a protein’s dynamic landscape. Proteins exist in numerous configurations, essential for their functions, which AlphaFold’s static models cannot fully capture (Bowman, 2024). Consequently, a significant challenge remains: to predict not only stable structures but also the entire range of conformations that a protein can adopt within a cellular context. The 2024 Annual Review of Biomedical Data Science emphasized the importance of protein dynamics, where proteins can shift among various conformational states, forming “conformational ensembles” necessary

for biological functions, such as enzyme activation or molecular binding. This complexity suggests that the landscape of protein folding is far from fully understood, pointing to ongoing needs in molecular modeling to accurately predict protein interactions and behavior in real-world conditions. AlphaFold does not model the folding process or intermediate states. It predicts final structures but lacks a mechanism to simulate how proteins attain these forms, which is essential for understanding diseases linked to protein misfolding. AlphaFold performs less reliably (5%) with intrinsically disordered regions, which lack a stable 3D structure. These regions are crucial in signaling and regulation, and AlphaFold’s inability to model them limits its utility in certain functional analyses. Although recent efforts have adapted AlphaFold for protein-protein interactions and complexes, its predictions for larger assemblies or systems that incorporate non-protein components remain challenging (Evans et al., 2021).

Future Directions and Complementary Approaches

AlphaFold’s limitations highlight directions for future research. Expanding structure prediction to incorporate conformational ensembles would improve our understanding of protein dynamics, providing critical insights for functional analysis and drug design. This endeavor requires integrating AlphaFold’s AI approach with physics-based molecular dynamics simulations. These simulations explore the diverse configurations that proteins can adopt, advancing towards a fuller understanding of protein behavior in biological systems. New AI models, like Pocket Miner (Meller et al., 2023), are being developed to predict cryptic pockets that emerge due to protein flexibility, presenting novel targets for drug design. Additionally, there are initiatives to create open-source tools based on AlphaFold, which could allow

researchers to innovate and tailor models for specialized applications, such as predicting complex protein interactions or the effect of mutations on protein structure.

Conclusion:

AlphaFold has achieved a remarkable milestone in computational biology, transforming protein structure prediction from a theoretical goal into an accessible reality. This tool, powered by sophisticated AI, has bridged a significant gap in biology, making it feasible for researchers worldwide to explore protein structure and function at unprecedented scales. However, the journey to fully understanding protein folding and dynamics is far from over. Future developments in machine learning and integrative structural biology hold the promise of mapping the entire conformational landscape of proteins, advancing our knowledge of life's molecular machinery. As Jumper noted, the real measure of AlphaFold's success will come not only from this Nobel-winning tool but from the discoveries it enables in laboratories worldwide. In the spirit of scientific progress, AlphaFold represents a beginning rather than an endpoint, inspiring continued exploration into the intricacies of protein folding and beyond.



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Predictive Analytics with NLP for Network Performance

Predictive analytics and Natural Language Processing (NLP) are revolutionizing how businesses track and improve network performance in a time when data drives decision-making. As a result, technological convergence not only improves operational effectiveness but also gives companies the

ability to proactively handle possible problems before they become more serious.

Comprehending Predictive Analytics

The term "predictive analytics" describes methods for predicting future events by analyzing past and present data. To find patterns and trends, it makes use of machine learning methods and statistical algorithms. Predictive analytics aids in the performance of networks by providing insight into user behavior, traffic patterns, and possible system problems.

The Role of NLP in Network Performance

A subfield of artificial intelligence called NLP gives computers the ability to comprehend, interpret, and produce human language. NLP can extract useful insights from unstructured data sources, including social media posts, user reviews, and logs, in relation to network performance.

Key Applications of NLP in Network Performance

1. **Log Analysis:** It might be difficult to manually assess the vast amounts of log data generated by network devices. NLP enables faster problem-solving by automating the processing of logs to find anomalies, error messages, and performance bottlenecks.
2. **Sentiment Analysis:** Organizations can measure customer satisfaction about network efficiency by using sentiment analysis on consumer feedback and support tickets. Gaining insight into sentiment can help improve and modify network management tactics.
3. **Automated Reporting:** Without delving further into technical reports, stakeholders can easily understand network efficiency measurements and trends because to NLP's ability to produce natural language summaries of complicated data.

Integrating Predictive Analytics and NLP

The integration of predictive analytics with NLP creates a powerful framework for proactive network management. Here's how this synergy unfolds:

Data Collection and Preparation

Organizations collect vast amounts of structured (e.g., network traffic data) and unstructured data (e.g., social media comments). NLP techniques can preprocess this unstructured data, making it easier to analyze alongside structured datasets.

Pattern Recognition and Anomaly Detection

Predictive models analyze historical data to recognize patterns in network usage. When NLP processes real-time user feedback, it can flag deviations from expected patterns, indicating potential performance issues. For instance, if users report slow internet speeds during peak hours, predictive models can correlate these reports with traffic data to forecast future congestion.

Real-Time Monitoring and Alerts

By continuously analyzing both structured and unstructured data, organizations can set up real-time monitoring systems. NLP can trigger alerts based on user sentiment or specific keywords related to performance issues, allowing network administrators to respond swiftly.

Predictive Maintenance

Using historical data, predictive analytics can identify when network components are likely to fail. NLP can augment this by analyzing user reports of problems, leading to targeted maintenance actions before failures occur. This not only minimizes downtime but also optimizes resource allocation.

Challenges and Considerations

While the integration of predictive analytics and NLP offers significant advantages, organizations must navigate several challenges:

1. **Data Quality:** The effectiveness of predictive models depends on the quality of input data. Ensuring that both structured

and unstructured data are accurate and relevant is crucial.

2. **Complexity of Implementation:** Developing robust predictive analytics and NLP solutions requires specialized skills and tools. Organizations may need to invest in training or hire experts to effectively leverage these technologies.
3. **Privacy and Security:** Analyzing user-generated content can raise privacy concerns. Organizations must implement robust data governance policies to protect user information while still extracting insights.

Future Directions

The future of predictive analytics with NLP in network performance is promising. As AI technologies advance, we can expect more sophisticated models that provide deeper insights and automation capabilities. Key trends include:

- **Enhanced Machine Learning Models:** Continued improvement in machine learning algorithms will lead to more accurate predictions and real-time analysis.
- **Integration with IoT:** As the Internet of Things (IoT) expands, the volume of data generated will increase. Predictive analytics and NLP will be crucial in managing this complexity and ensuring optimal network performance.
- **Greater Automation:** Organizations will increasingly adopt automation solutions powered by predictive analytics and NLP, reducing the burden on human operators and speeding up response times.

Conclusion

Predictive analytics combined with NLP is revolutionizing network performance management. By harnessing the power of both technologies, organizations can proactively address potential issues, optimize operations, and enhance user satisfaction. As the landscape evolves, those who embrace these innovations

will be well-positioned to lead in an increasingly data-driven world

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Unveiling Maven: Streamlining Java Development

Maven stands as a pillar in the landscape of Java development, offering a streamlined approach to project management, dependency resolution, and build automation. At its core, Maven simplifies the development process by providing a standardized structure and set of conventions, enabling developers to focus on writing code rather than managing project configurations. Central to Maven's functionality is the Project Object Model (POM), an XML file that defines the project's structure, dependencies, and build settings. This model fosters consistency across projects and facilitates collaboration among developers by providing a clear and standardized project structure.

One of Maven's key features is its dependency management system, which automates the process of resolving and downloading project dependencies from remote repositories. By declaring dependencies in the project's POM file, developers can easily include external libraries and frameworks without the need for manual downloading and configuration. Maven's central repository, known as the Maven Central Repository, hosts a vast collection of open-source artifacts, further simplifying the

dependency management process. This centralized repository ensures that developers have access to a wide range of libraries and can easily integrate them into their projects.

Maven's build lifecycle, consisting of phases such as compile, test, package, install, and deploy, guides the project's build process. Developers can execute predefined build goals using Maven commands, such as `mvn compile` or `mvn test`, to progress through the build lifecycle. Additionally, Maven's extensible nature allows developers to customize and extend its functionality through the use of plugins. A rich ecosystem of plugins is available to handle various tasks, including code generation, code analysis, and deployment, catering to diverse project requirements and workflows.

In conclusion, Maven serves as a cornerstone in Java development, empowering developers with tools and conventions to streamline project management, dependency resolution, and build automation. Its standardized project structure, dependency management system, and extensibility through plugins make it an indispensable tool for modern software development. By embracing Maven, developers can enhance productivity, foster collaboration, and ensure the scalability and maintainability of their Java projects.

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Artificial Intelligence Milestones –2000 to 2024

Understanding the evolution of AI is crucial for grasping its impact today. AI Milestone comprehensive journey through the history of artificial intelligence from 2000 to today. This table encapsulates the major milestones, breakthroughs, and events that have shaped the field of AI over the two decades. It gives insights of the technological advances that have defined AI, the key people and companies involved, and the impact these developments have had on society.

Notable early milestones include the introduction of the ASIMO humanoid robot in 2000 and the launch of the Roomba home cleaning robot in 2002, signaling the rise of practical robotics in everyday life. Autonomous vehicle research surged, with Stanford's "Stanley" winning the DARPA Grand Challenge in 2005 and Google launching its self-driving car initiative in 2009. AI also made waves in entertainment, with IBM's Watson competing in Jeopardy in 2009, highlighting the potential of AI to tackle complex cognitive challenges. The release of virtual assistants like Apple's Siri in 2011 and Microsoft's Cortana in 2014 further integrated AI into personal devices, making AI assistance more accessible to the general public

In the mid-2010s, AI's capabilities expanded significantly, with Google's DeepMind AlphaGo defeating the world Go champion in 2016, a major milestone in AI's ability to tackle sophisticated tasks. Virtual assistants such as Amazon's Alexa (2014) gained popularity, while neural networks and machine learning made significant strides. OpenAI launched GPT-2 in 2019 and GPT-3 in 2020, revolutionizing natural language processing and setting new standards for AI-generated text. AI also started making significant contributions in

creative industries, with AI-generated artwork being sold at auctions and AI applications emerging in agriculture, healthcare, and other fields. By 2020, AI had become a crucial component of tech innovations, including NVIDIA's advances in AI-driven hardware and Google's contributions to language translation and self-driving technology. In recent years, the development of advanced AI models has accelerated, with OpenAI's GPT-4 release in 2023, Meta's introduction of Llama 3, and Google's unveiling of the Gemini model in 2023 marking key milestones in AI research. These models have transformed areas such as language generation and image processing, with AI now capable of producing human-like text and imagery with unprecedented accuracy. In 2024, global attention to AI governance grew as the US, UK, and the EU signed an international AI treaty, reflecting the increasing influence of AI on global policy. Swift AI drones demonstrated the physical capabilities of AI by outperforming humans in sports, while Meta's release of AI-powered glasses and other wearables signaled .

References:

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“Key to success is action, and the essential in action is perseverance.”

TECHNICAL TRENDS – From Students

Bharatgen: An Inclusive Innovation by Indian Intelligence

BharatGen is an initiative by the Indian government, specifically, Principal Scientific Advisor A K Sood, to promote generative AI that people of all shapes, sizes, and colors can access. It is a very recent project developed by the hard-headed and ever-so-hardworking minds of IIT Bombay along with other academic minds like IIT Madras, IIIT Hyderabad, IIT Hyderabad, IIT Kanpur, IIT Mandi, IIM Indore.



Now, what is BharatGen? It is a foundation model that uses generative AI to generate high-quality content in various Indian languages. This in turn helps in the collaboration of various Indian developers and researchers to make innovative solutions.

The key features of BharatGen include the multilingual and multimodal nature of models, an open-source platform for the development of generative AI, and Bhartiya data set building.

This project is one of its kind as it is the largest language model initiative. The developers also stated that they are planning to add dialects nuances, and cultural contexts and make sure that they are accurately represented.

Some of the main advantages of the project include the lessening of dependency and/or co-dependency on other countries for technologies, and tech, and hence helps in the economic growth of the country's home ground startups, industries, and government agencies.

The project outlines are set as far as July 2026. These include model training and development, extensive experimentation, and modifications.

Reference:

<https://www.thehindu.com/education/india-launches-bharatgen-project-for-generative-ai-in-local-languages/article68704970.ece>



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Smart Grids: A New Era of Electrical Efficiency

Distribution of electricity must be both efficient and dependable in the quickly changing energy landscape of today. Smart grids are a groundbreaking development in electrical systems that maximize energy generation, distribution, and consumption by fusing contemporary communication technology. Smart grids open the door to a more sustainable energy future by converting conventional one-way electrical flows into a dynamic, interactive network.

Traditional electricity networks are improved by smart grids because they allow utilities and customers to communicate in both directions. This technology enables for real-time data sharing, optimizing energy utilization and enhancing reliability. One notable feature is the integration of renewable energy sources, such solar and wind power Because they are sporadic,

smart grids manage supply and demand by transferring extra energy that is stored during periods of high output. This feature uses self-healing technology to automatically detect and fix issues, reducing the risk of outages while also supporting greener energy.



Smart grids provide users more control over how much energy they use, which further empowers them. Smart meters allow users to track how much electricity they use and modify their usage to reduce costs, particularly during peak usage hours. As electric cars (EVs) gain popularity, smart networks enable charging and allow EVs to send unused energy back to the grid, boosting efficiency.

In conclusion, smart grids are essential to building an energy environment that is robust, efficient, and sustainable. Accepting this technology is crucial to solving the growing energy demands and climate change.”

Reference:

[https://www.mdpi.com/ps/\(All About Circuits\) All About Circuits](https://www.mdpi.com/ps/(All About Circuits) All About Circuits).

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Robotic Dogs: The Future of Warfare or a Step Too Far?

The battlefield is evolving, and robotic dogs are leading the charge into this new era of warfare. These incredible machines are stepping into roles that were once deemed too risky for human soldiers. Take Ukraine’s BAD-2 robotic dog, for example. With AI-powered navigation, it can maneuver through complex environments, all while remaining undetected thanks to high-definition cameras and anti-thermal camouflage. This agile dog can even transport up to 7 kg of supplies, such as ammunition or medical kits, directly to where they’re needed most.

In the United States, the ‘Lone Wolf’ robotic dog is being developed to tackle a new threat: enemy drones. Armed with machine learning algorithms and sophisticated sensors, it can autonomously detect and neutralize aerial threats, adapting to challenges in real time.



Meanwhile, India’s Multi-Utility Legged Equipment (MULE) combines advanced AI with sensor fusion technology, enabling it to navigate rugged terrains while carrying essential tools like thermal cameras and weapon systems. Yet, as we embrace these innovations, ethical questions loom large. The United Nations emphasizes the necessity of keeping human oversight in the loop to avoid unintended

consequences of autonomous decision-making in warfare.

Robotic dogs promise to revolutionize military operations, but as we advance, we must also consider how to integrate this technology responsibly into future combat scenarios.

Reference: <https://tinyurl.com/2t28zmfv>



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The Ultimate Getaway: An Epic Adventure in Game Development

Game development is an exciting and challenging field, especially with powerful tools like Unity and C#. In my second year, I dived into game development and created an action-packed game that brought me valuable experience and tons of fun.

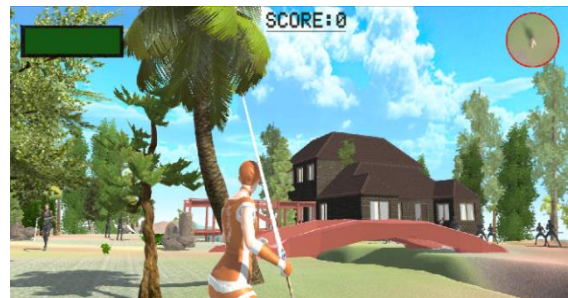
Why Unity and C#? Unity is a popular game development platform that lets you create stunning and interactive games. It's user-friendly and packed with features for both beginners and experienced developers. Combined with C#, a flexible and efficient programming language. Unity offers a smooth game creation experience.

My Game Development Journey: I started by brainstorming game ideas and outlining core mechanics and features. Unity's intuitive interface helped me bring these ideas to life, from designing the game world to implementing visuals.

One of the best parts of Unity is the ease of integrating various assets like 3D models, animations, sound effects, and user interfaces. This meant I could focus more on refining the gameplay and less on technical issues.

C# is a robust programming language for creating game logic and mechanics. Its object-oriented nature and extensive library of functions made it easier to create interactive gameplay elements, handle user inputs, and manage game states.

Unity's builtin tools for testing and debugging helped me identify and fix issues quickly, ensuring a stable and enjoyable game. Plus, Unity's support for cross platform development allowed me to reach a wider audience by deploying the game on multiple platforms.



The Power of Community: I also explored Unity's vast community and resources. Engaging with other developers, accessing tutorials, and using Unity's documentation enriched my understanding of game development principles and best practices. This collaborative ecosystem provided invaluable insights and inspired me to push the boundaries of my skills.

Visual Showcase: Here are a few pictures of the game I created in Unity, as well as a glimpse of

the Unity game engine in action. These visuals highlight the game's environment, characters and gameplay elements, demonstrating the power and versatility of Unity and C# in game development.

Conclusion: My journey with Unity and C# was enriching and fulfilling. It let me unleash my creativity, expand my technical skills, and immerse myself in the captivating world of game development. I encourage everyone to learn game development. It's so much fun! I want to inspire and encourage people to dive into game development because it's an incredibly rewarding experience.

Reference:

<https://ieeexplore.ieee.org/document/10007155>

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Genomics Technology

Genomics is the study of the complete set of DNA (the genome) in organisms, encompassing its structure, function, and elaboration. In 2024, genomics technology has made significant advancements, profoundly impacting healthcare and exploration.

Next-Generation Sequencing (NGS) remains a foundation, offering enhanced output and reduced costs, making genomic analysis accessible in clinical settings. Portable sequencers enable real-time analysis, indeed in remote locales. Single-cell genomics has advanced, allowing experimenters to study cellular diversity within tissues, which is pivotal

for understanding complex conditions like cancer.



CRISPR and other gene-editing technologies have progressed, furnishing bettered perfection and effectiveness. These tools are being explored for remedial operations, including the treatment of inheritable diseases and advancements in agrarian genomics. The integration of artificial intelligence (AI) and machine literacy into genomics is revolutionizing data analysis, enabling the identification of inheritable variants linked to conditions and easing individualized drug approaches.

As genomics becomes more routine in patient care, ethical considerations regarding data sequestration, concurrence, and inheritable demarcation have gained elevation. Regulatory fabrics are evolving to address these enterprises, icing responsible use of inheritable data.

In summary, 2024 marks a vital time for genomics, characterized by technological inventions that enhance our understanding of genetics and its counteraccusations for mortal health, eventually driving the shift towards perfection drug and perfecting patient issues across colorful fields.

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<https://tinyurl.com/39bhx67v>

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“ The two most powerful warriors are patience and time”

6G Wireless Technology

The 6G wireless technology would be the step beyond 5G, hundred times fast, and ultra-low latency. It further achieves to improve how people communicate with devices and use a kind of real-time communication and processing. The bandwidth of 6G will be able to go at least upto 1 Tbps and will make available applications such as holographic communication and 8K video streaming. Ultimately, latency, or the time to respond, will decrease to near-instant levels under 1 millisecond, which should be enough to support real-time VR/AR applications and autonomous vehicles among others.

Key applications include smart cities and connected infrastructure, immersive virtual worlds and medical advancements. 6G: Power for the Hyper-connected Environment of Sensor, AI System, and Autonomous Systems Interaction. 6G latency will be one of the key enablers of remote surgeries and precision healthcare through robotic systems.



Technological innovations include operation in terahertz (THz) frequencies, which enable higher data rates. It will be able to enable the fully AI-managed networks to automatically optimize and troubleshoot the systems, keeping ultra-fast

connections even if millions of devices are connected to it.

This new wave of wireless connectivity, cognition, sensing, and imaging will expand the scope of capabilities that will support a new generation of innovative and new applications. With 6G, users can expect instant data transfers without any buffering, lags, or disconnections.

Reference:

<https://www.techtarget.com/searchnetworking/definition/6G>



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Unveil of "Apple Intelligence", Apple's Highly Anticipated AI Integration

Apple has finally unveiled "Apple Intelligence," which is an ambitious initiative in integrating high-level artificial intelligence across its entire product ecosystem. This would bring into being a completely new user experience in the form of intelligent personal assistants, predictive analytics, and real-time contextual awareness.

It lies at the heart, where the refined machine learning, based on the knowledge of user behavior, is utilized. Thus, Apple Intellection enables one to easily develop their tendencies into technology. This certainly means optimized performance at each given device, streamlined security processes, and intelligently automatized daily applications.

Apple has been steadfast in upholding its commitment to privacy. In this light, Apple Intelligence ensures the protection of user data

from external exposure by limiting that exposure, which it does through on-device processing. This, in turn, gives the user the opportunity to enjoy AI without compromising their control over information.

Apple Intelligence is the next step in innovation by Apple, marking a new step toward a more interconnected and intuitive digital experience. The technology promises to redefine how users interact with their devices, making everyday tasks more efficient and enjoyable.

References:

<https://www.apple.com/newsroom/>



They are driver less vehicles that operate without the intervention of human beings through sensors such as cameras, LIDAR, RADAR, and ultrasonic sensors used for scanning their environment. AI microchips onboard will continuously calculate a 3D map of surroundings for routing and navigation. They use connected technology to communicate with each other and infrastructure to better manage traffic, safety, energy efficiency and cut down on pollution. Therefore, they can be viewed as a further step on the road to the future of mobility.

The goal is to enhance safety and ensure that the vehicle meets industry standards. In addition, these startups are incorporating connected technology that allows the SUV to communicate with other vehicles and share real-time data. This can improve traffic management and increase safety on the roads.

This initiative showcases India's commitment to smart mobility solutions, blending traditional vehicles with modern technology. The self-driving Bolero could serve as a model for more efficient and safe transportation options, aligning with global trends toward autonomous vehicles and sustainable mobility solutions.

References:

<https://tinyurl.com/8k79hsv>

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‘Autonomous vehicles’-Indian Startup Converts Mahindra Bolero into Self-Driving SUV

Bhopal-based startup Swaayatt Robots demonstrated autonomous driving technology using a Mahindra Bolero converted into a driverless SUV. A video of an SUV navigating crowded streets in Bhopal using autonomous driving technology is being widely shared on the internet, impressing social media users.

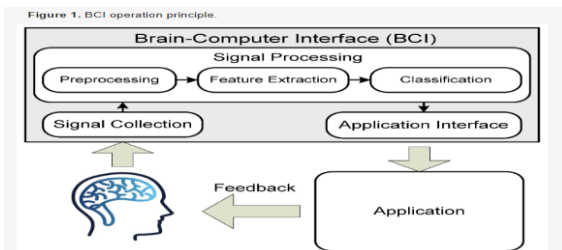
Indian startups are working to convert the Mahindra Bolero into a self-driving SUV. This involves integrating advanced technologies such as artificial intelligence (AI), machine learning, and various sensors like cameras, LiDAR, and RADAR. These technologies help the vehicle navigate on its own and understand its surroundings accurately.

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Human Augmentation and Brain-Computer Interfaces (BCIs):

BCIs have, in 2024, advanced human augmentation and directly communicate between the human brain and devices externally with direct channels of translation into action. The device helps enable individuals to control technology via cognitive commands and allows very highly benefited people who face neurological impairments with this tool to be better independently autonomous. The current successes in non-invasive BCI have been largely accelerated by breakthroughs in neuroimaging and machine learning. Better signal processing interpretation has increased the accuracy as well as responsiveness of different BCI applications. Neurological leaders like Neuralink and CTRL-Labs strive to merge human cognition digitally without any hitch.



Currently, the consumer electronics world welcomes this technology, seeking new kinds of experience in gaming, communication, and accessibility, particularly through people with disabilities. Applications like these, as they grow,

require urgent attention to the ethical aspects of them, specifically privacy and consent. BCIs offer the promise for richer cognitive abilities, whereby the quality of life will improve. Healthcare, accessibility, and much more may see a pretty transformative change. In the coming future, innovation will need to be carefully balanced with ethical safeguards, ensuring the safe introduction of BCIs into our technological sphere.

In conclusion, BCIs promise enhanced cognitive abilities and quality of life, but ethical safeguards and interdisciplinary collaboration are essential for their safe and responsible integration.

References:

[Neuralink: Innovations in BCIs](#)
[CTRL-Labs and Human Augmentation](#)



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India's path to semiconductor leadership

With its sights firmly set on the semiconductor sector, India seems to be on the verge of a technological shift, one that can potentially allow it to dominate the industry as a global leader. The changing of this course can be attributed to 2 things – the rise in the demand for chips (which are the core elements of electronics) and the government's active steps towards promoting local production.

Already, the government's PLI (production linked incentive) program and design linked incentive schemes under the ministry of Electronics and Information technology has led to significant investment by international

constructors who are now able to set up production plants in India and provide employment whilst enhancing the local supply chain in the process. For example, have been enticing semiconductor companies to invest in India-including design, manufacturing, and testing capabilities within India. The buoyant ecosystem and a growing pool of skilled talent in India are nurturing innovation in semiconductor design and manufacturing.

Of course, there are challenges as well. Rising to the top 5 economies comes at a price: a country like India – for example – must invest massive amounts of capital in R&D to catch up with the existing technology leaders. Creating an innovative ecosystem as well as a talented workforce remains one of the most important components.



If enhanced further, India surely can be positioned as a formidable competitor to several countries within this arena, in turn boosting economic activity as well as technological innovation within the country.

Reference:

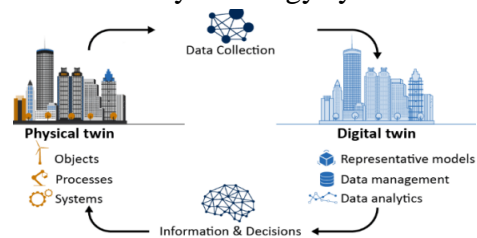
<https://community.nasscom.in/communities/engineering-research-design/indias-path-semiconductor-leadership>

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Digital Twins: The Key to Smarter, Greener Business Operations

Digital twin technology refers to a digital representation of a physical object or environment that operates in real time. It is a growing technology and the market for digital twins is expected to grow by 28.5% each year over the next five years. Its applications can be as vast as from spacecrafts to smart cities and from automobile industry to energy systems.



When combined with IOT and cloud technology, digital twins help businesses analyse data better. In manufacturing, they let companies monitor and adjust production in real time, reducing waste and downtime. Augmented Reality and Virtual Reality use digital twins to create 3D experiences, helping industries like healthcare to improve the services.



Digital twins also support sustainability by simulating energy use and its consequent environmental impact. They are used in areas like transport and smart cities to build ecofriendly infrastructure. Its main use is to make energy grids more efficient.

In asset management, digital twins help companies to test new assets like wind turbines, digitally before using them in the real world, thus saving a lot of time, money and resources.

In conclusion, digital twins are becoming important tools for industries to work efficiently and in environmentally friendly manner. Companies using this technology are better prepared to stay ahead and meet their goals.

Reference:

<https://www.hcltech.com/trends-and-insights/digital-twin-trends-2024>

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Cybersecurity Innovations

The recent cybersecurity innovations are Artificial Intelligence (AI) and Machine Learning (ML), Zero Trust Security Model, Behavioral Biometrics, Quantum-Resistant Cryptography, Extended Detection and Response (XDR). Zero Trust Security Model and Artificial Intelligence and Machine Learning are currently most trending Cybersecurity innovations due to cloud adoption and Sophisticated accounts.

Why Cybersecurity Innovations?

These innovations are crucial in our day-to-day life because of rapidly evolving cyber threats, The rapid increase in devices (smartphones, wearables, smart home systems, etc.) has created vast new opportunities for cyberattacks, as many of these devices are not properly secured. The financial impact of cyberattacks is staggering. So to protect valuable data and to maintain trust in

these world where digital transformation is central to any operations and day to day life.

Zero Trust Security Model:

It is the modern cybersecurity approach that works on the principle “never trust, always verify”. The Zero Trust Security model assumes that the threats can come from both outside and inside the network. It enforces strict identity verification, and also uses network segmentation to limit potential breaches. With the rise in cloud computing and sophisticated cyber threats, this model has become more essential for securing information and also for reducing cyber attacks.

Artificial Intelligence(AI) :

Artificial intelligence (AI) is transformative technology reshaping industries worldwide. AI refers to the development of computer systems that can perform tasks typically requiring human intelligence, such as speech recognition, decision-making etc. AI algorithms can analyze large datasets of phishing emails, URLs, and websites to differentiate between legitimate and fraudulent communications.

Machine Learning (ML) :

A subset of AI, involves training algorithms to learn from data and improve their performance over time without explicit programming. These technologies are applied in various fields, including healthcare, finance, and transportation, enhancing efficiency and decision-making.

As AI and ML continue to evolve, they offer immense potential for innovation, while raising important ethical considerations about their impact on society.

References:

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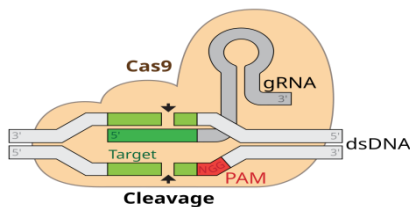
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CRISPR-Cas9: The Future of Gene Editing

CRISPR-Cas9 (Clustered Regularly Interspaced Short Palindromic Repeats) is a gene-editing tool with great potential for treating genetic diseases, enhancing agriculture, and advancing research. Adapted from a bacterial defense system, it allows precise DNA targeting and modification.



How CRISPR-Cas9 Works

1. CRISPR-Cas9 introduces a guide RNA into a cell to locate a specific DNA sequence. Once the target is found, the Cas9 enzyme cuts the DNA at that precise spot.
2. The cell's natural repair mechanisms then take over.
3. Scientists use this process to insert, delete, or modify genes. CRISPR enables scientists to "rewrite" the genetic code in living organisms.

4. This allows the correction of genetic defects like cancer, cystic fibrosis, and sickle cell anemia.

A Scientific Breakthrough

CRISPR's origins stem from early research into bacterial immune systems. Scientists Jennifer Doudna and Emmanuelle Charpentier played a key role in simplifying CRISPR-Cas9, making it more accessible for widespread use. This was done by combining two RNAs into a single guide RNA, streamlining its use. They also developed "dead" Cas9, which alters gene activity without cutting DNA, expanding research in gene regulation and therapy.

While CRISPR offers incredible promise, it is not without risks. One of the primary concerns is off-target effects, where unintended parts of the genome might be edited, leading to potentially harmful mutations. Additionally, there are ethical concerns, particularly when it comes to editing germline cells, which can pass genetic changes to future generations. This raises questions about the long-term impacts on human evolution and the ethical boundaries of genetic manipulation. As the technology develops, CRISPR-Cas9 is expected to have a transformative impact on medicine, agriculture, and beyond. However, its potential must be weighed against ethical considerations and the need for safe, responsible use.

Reference:

<https://tinyurl.com/yu64mp3t>

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Li-fi: Lightning the path to future of Wireless Communication

“Imagine downloading an entire HD movie in seconds—just by switching on a light bulb. This isn’t a futuristic fantasy, but the potential reality of Li-fi technology.”

Li-fi (Light Fidelity) is a wireless communication technology that uses visible light to transmit data, providing a high-speed alternative to Wi-Fi. Instead of using radio waves like Wi-Fi, Li-Fi operates by modulating light from light emitting diodes (LEDs) to transmit data. This technology enables data transfer by switching the LED light on and off at extremely fast speeds, imperceptible to the human eye.

The existing Wi-Fi technology has many drawbacks. The radio frequency spectrum used by Wi-Fi is becoming increasingly congested due to large number of devices relying on it. Wi-Fi signals can penetrate walls, which makes them vulnerable to eavesdropping and hacking. These networks require routers, access points, and repeaters to maintain signal coverage, all of which consume electricity. Some individuals express concerns about the long-term exposure to electromagnetic radiation emitted by Wi-Fi devices.



Case Study: Li-Fi in Underground Mines (France)

Objective: Improve communication and safety in mining environments.

Implementation: Li-Fi technology was tested in French underground mining sites where radio-frequency communication (Wi-fi) was unreliable due to the density of the rocks. Miners used headlamps equipped with Li-Fi transmitters to send and receive data.

Outcome: The tests demonstrated that Li-Fi could offer high-speed data transmission in challenging environments where radio-frequency signals don’t work well. It also allowed for real-time monitoring of equipment and miner safety, even in remote parts of the mine.

“Li-Fi may well be the key to overcoming the growing challenges of bandwidth demand and security in our increasingly connected world. The future is bright-quite literally.”

Reference: <https://en.wikipedia.org/wiki/Li-Fi>

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The Rise of Smart Rings: A Sleeker, More Versatile Alternative to Smartwatches.

This year at CES, smart rings have emerged as a highlight, shifting attention from functionality-

focused smartwatches to sleeker, inconspicuous wearables. While early adopters of devices like the Oura Ring have already embraced the technology for sleep and activity tracking, 2024 marks a significant expansion in both features and brand variety within the smart ring market.

Among the standout models at CES 2024 were the Amazfit Helio Ring and the Evie ring. The Amazfit Helio Ring, a new entrant, attracted attention with advanced health-tracking features like heart rate monitoring, sleep analysis, and activity tracking—all in a minimalist ring design. Meanwhile, the Evie ring, which launched last year, returned with updates, positioning itself as an alternative health-monitoring device for those seeking options beyond traditional wrist-based wearables.

Interestingly, not all smart rings are focused solely on health metrics.



For instance, the Lotus ring, while incorporating some health-tracking features, functions primarily as a smart home controller within its own ecosystem. This allows users to control compatible devices directly from their finger, positioning the Lotus ring more as a smart home accessory than as a fitness tracker. It showcases the versatility of smart rings and the potential for expanded applications in wearable technology.



With the potential entry of the Samsung Galaxy Ring, competition is set to intensify, pushing smart rings closer to mainstream popularity, similar to that enjoyed by smartwatches. As consumer interest grows, smart rings could soon become as common as traditional wearables, offering a new level of convenience and style.

Reference: <https://tinyurl.com/26fwhn2j>

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