

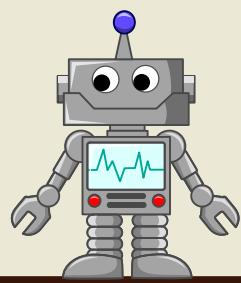


# REDUX GREENOVA



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# Editorial



In recent years, the urgency of addressing climate change and environmental degradation has become increasingly apparent. As temperatures rise, sea levels swell, and natural disasters become more frequent, the need for sustainable solutions has never been more pressing. We must harness the power of technology and innovation to mitigate the effects of climate change and create a more resilient and sustainable future.

There are groundbreaking advancements that are happening in the field of Green Technology which are revolutionizing industries and driving positive change across the globe. From solar panels and wind turbines to electric vehicles and green building materials, the possibilities for innovation are endless.

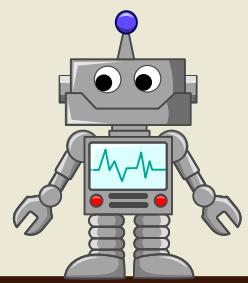
One such area of innovation is the integration of Internet of Things (IoT) devices and machine learning (ML) algorithms into renewable energy systems. IoT devices, equipped with sensors and connectivity capabilities, are deployed across renewable energy infrastructure to monitor and optimize performance in real time.

ML algorithms further enhance the effectiveness of IoT devices by analyzing vast amounts of data collected, enabling predictive maintenance and fault detection in renewable energy systems. By continuously learning from operational data, ML algorithms can identify patterns indicative of potential faults or inefficiencies, allowing for timely intervention to prevent downtime and maximize energy output.

For instance, in solar energy systems, IoT sensors can monitor individual solar panels for factors such as temperature, voltage, and current output.



# Editorial



ML algorithms can then analyze this data to detect deviations from expected performance and identify potential issues such as shading, soiling, or panel degradation. By proactively addressing these issues, operators can optimize energy production and extend the lifespan of solar installations.

In addition to enhancing the performance and reliability of renewable energy systems, these technological innovations also contribute to the overall sustainability of our energy infrastructure. By reducing downtime, optimizing energy production, and minimizing waste, IoT devices and ML algorithms enable us to achieve greater energy sustainability while driving economic growth and job creation in the burgeoning green technology sector. Additionally, developing biodegradable plastics and packaging materials offers sustainable alternatives to traditional petroleum-based products, reducing plastic pollution and environmental degradation.

Innovative startups like Climeworks, specializing in direct air capture technology, also significantly contribute to Green Technology. Their solutions remove carbon dioxide from the atmosphere, offering a pathway to carbon-neutral fuel production and mitigating the impacts of climate change.

We at CSI-VESIT are thrilled to unveil this year's edition of REDUX magazine, titled REDUX: GREENOVA. This magazine offers insights into the latest advancements in green technology, showcases ongoing startups, and highlights the importance of Greentech for our future. As we embrace Greentech and its transformative potential, we pave the way for a brighter and more sustainable future. Let us continue to support and invest in these innovative solutions, driving positive change for generations to come.



# Faculty's Desk

Dear Reader,

In today's world, with climate change's growing impact, adopting green technologies is crucial. Using renewable energy sources and sustainable practices is essential for preserving the environment and ensuring a sustainable future. Green technologies, like solar and wind power, offer cleaner alternatives, reducing our reliance on polluting resources. They don't just focus on energy; they also improve various industries such as transportation and agriculture.



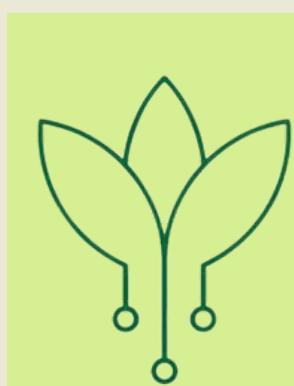
Sustainable practices, such as recycling and energy-efficient design, help reduce our ecological footprint and promote a circular economy.

CSI-VESIT acknowledges the urgent need for greener technologies and sustainable practices. By organizing workshops, seminars, and conferences, CSI-VESIT facilitates knowledge sharing and networking among professionals in sustainable technology. Through events like the Symposium - Greenova '24, CSI-VESIT takes steps to provide a platform for young minds. This platform allows them to discuss, share, and network, while also learning new skills for engaging in debates and refining their ideas.

I extend my best wishes to CSI-VESIT for the years ahead. I'm confident that the newly elected Council members will continue CSI-VESIT's legacy by introducing new events to educate future generations. Together, we can use technology to create a greener, more resilient planet for our descendants.

Mrs. Lifna C S  
Staff In-charge,  
CSI-VESIT

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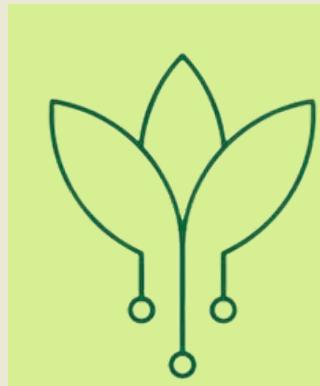
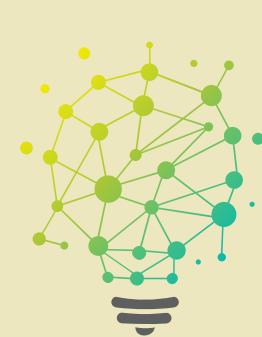
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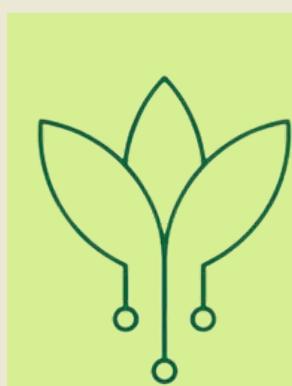
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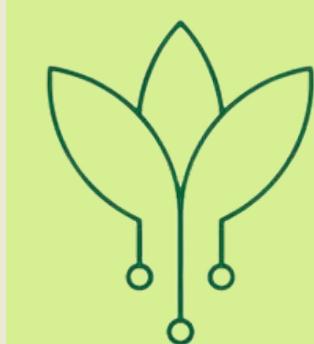
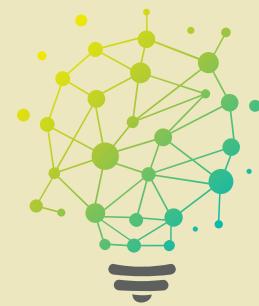
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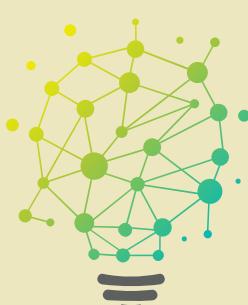
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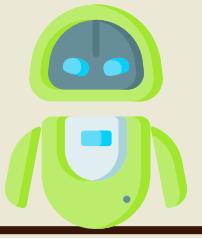
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# Events Organised

## Firescript

Participants delved into a workshop hosted by CSI Vesit, exploring JavaScript and Firebase. They honed their skills on day one, mastering JavaScript's intricacies. Day two saw them building personalized diaries, incorporating authentication and utilizing Firebase's robust databases. Through hands-on exercises and guided tutorials, attendees gained practical experience in leveraging Firebase's database functionality to create dynamic and secure web applications. The workshop provided participants with the tools and knowledge needed to excel in JavaScript and Firebase.

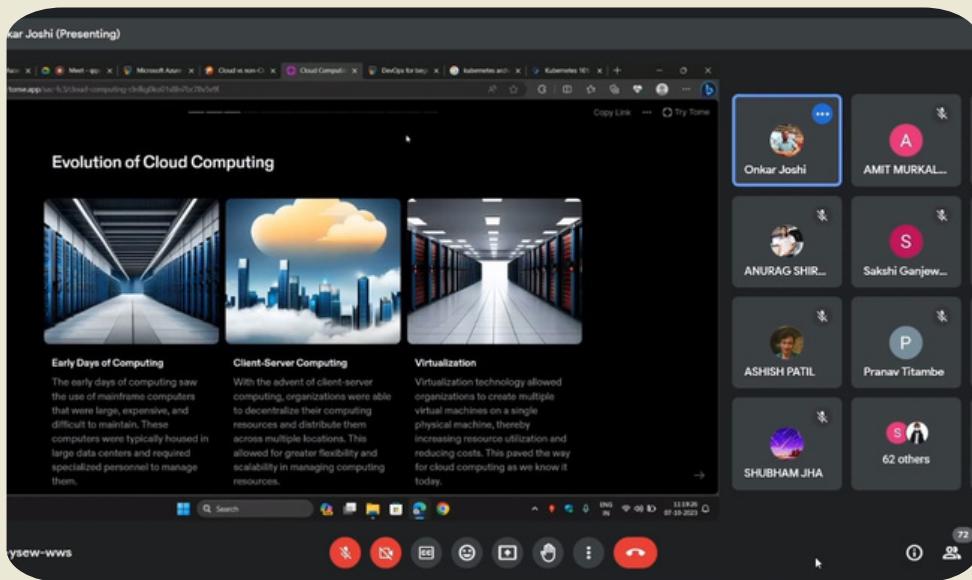
## Webathon 2.0

CSI-VESIT's Webathon 2.0 attracted participants with a mix of engaging games and a spirit of competition. Teams of three to four players fought for a handsome Rs. 1000 in cash prizes. The activities included tests of coordination, memory, and problem-solving abilities. The Computer Department's TEs demonstrated excellent teamwork by winning the final coding round. Everyone enjoyed working together and spending time with friends. Webathon 2.0 was a welcome diversion from the usual and made a lasting impact, indicating that CSI-VESIT will host more interesting activities in the future.



# Ascending the Cloud

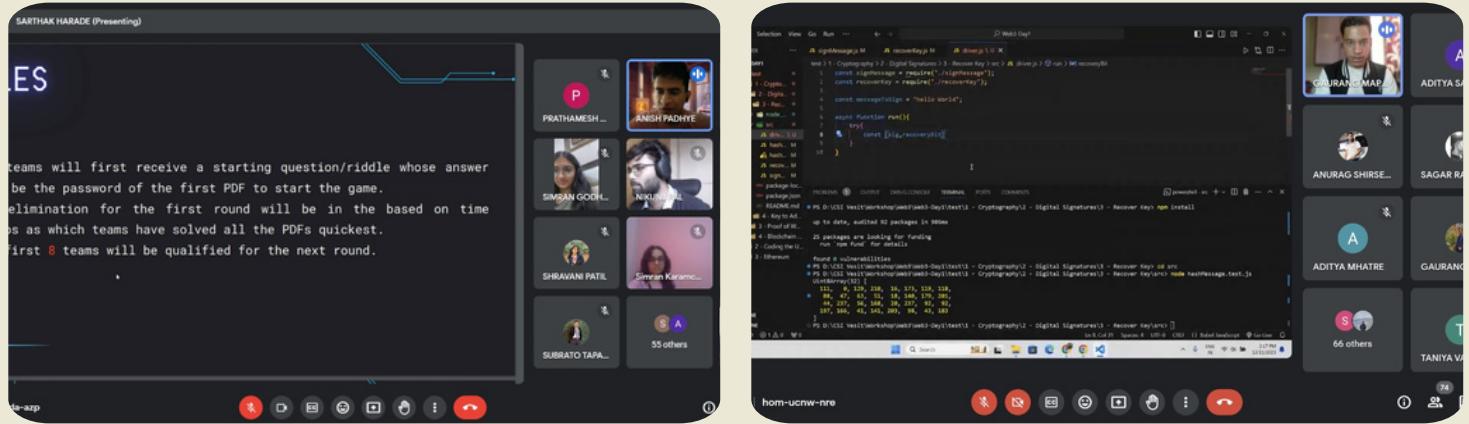
The "Ascending on Cloud" session, led by Onkar Joshi, a Microsoft Azure Architect, provided a comprehensive introduction to cloud computing and Microsoft Azure services. Joshi covered topics such as virtualization, Azure service types, and essential concepts like virtual networks and backups. He shared his career journey, emphasizing the importance of Azure certifications and continuous learning. Attendees were encouraged to explore Azure for its user-friendly interface and were introduced to advanced topics like Kubernetes and DevOps. The session left participants equipped with knowledge and confidence to begin their cloud computing journey effectively.



# Mumbai Move Workshop

In partnership with Move Developers, students were immersed in an enlightening online workshop powered by Aptos technology, led by an industry expert. The focus of the session was to introduce students to the revolutionary potential of Aptos in the context of Web 3. Through interactive sessions and practical demonstrations, participants gained insights into how Aptos technology is reshaping decentralized systems, paving the way for a more secure, scalable, and user-centric web experience. By the workshop's conclusion, attendees were equipped with a deeper understanding of Aptos and its pivotal role in shaping the future of decentralized applications and digital ecosystems.





# Hidden Cipher

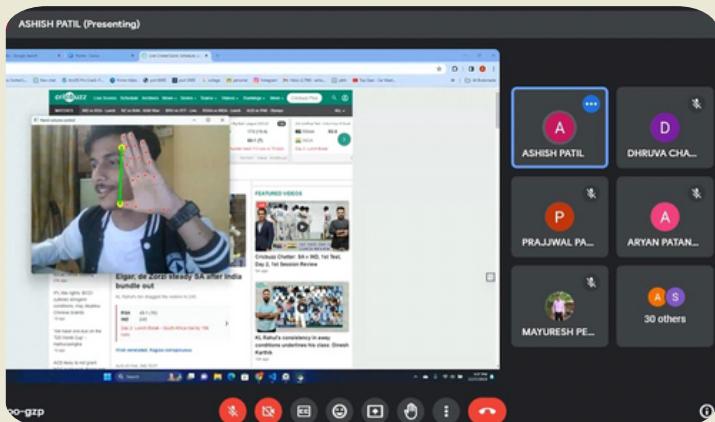
The Hidden Cipher event, orchestrated by the Junior Council of CSI VESIT during the winter hiatus of 2023-24, offered a diverse array of challenges spanning technical and non-technical domains. Teams engaged in deciphering password-protected PDFs in the inaugural round, Tech Trek, followed by decoding interrogative sentences in CodeBreakerChase. The culmination, Cipher Rush, demanded adeptness in programming, web development, and command-line proficiency. Time penalties were incurred for soliciting hints, while bonuses were conferred for completing auxiliary tasks. The triumphant team, boasting the swiftest completion time, claimed the coveted prize of an Amazon Gift Card. This event exemplified collaborative problem-solving, innovation, and strategic acumen, making it a compelling showcase of intellectual prowess.

# Decentralised 101

Inquisitive minds eagerly immersed themselves in a foundational workshop on Ethereum and Solidity, the bedrock of decentralized applications (dApps). Throughout the sessions, participants were introduced to the core concepts of blockchain technology, Ethereum's role as a decentralized platform, and Solidity's significance in smart contract development. The workshop provided hands-on experience in creating simple smart contracts, deploying them on the Ethereum blockchain, and interacting with them using web3.js. By the workshop's culmination, attendees departed with a solid understanding of Ethereum and Solidity, poised to explore the exciting realms of decentralized applications.

# Code Capture

CSI-VESIT organized a workshop titled "CODE CAPTURE: OPENCV AND FACES" on December 26th and 27th, from 3 pm to 5 pm. The workshop aimed to introduce OpenCV and foster face recognition and gesture control projects. Speakers included Ashish Patil, Aditya Sampathkumar, Sami Thakur, and Karan Bhatia. Day 1 covered Python basics, OpenCV features such as image manipulation and video processing, and building a face recognition project. Day 2 delved into MediaPipe framework and gesture recognition projects, concluding with an interactive Rock Paper Scissors game. Attendees actively participated, guided by speakers, and gained valuable insights. The workshop received positive feedback, offering an enriching learning experience.



# Cricomania

CSI VESIT's flagship event, Cricomania, hosted 35 teams for two days of cricket-themed challenges. Day 1 featured engaging mini-games testing participants' cricket knowledge and judgment. Twelve teams advanced to Day 2 for auction rounds, strategically bidding to assemble their squads. Virat Kohli's acquisition for 990 lakhs marked a highlight. Only five teams reached the final round, where Team 1 clinched victory based on ODI points, earning 2500, with runner-ups receiving 1500. Cricomania fostered camaraderie and sportsmanship, celebrating cricket while creating lasting memories for all involved.



# Mern Marvel

Passionate learners eagerly embraced a hands-on workshop dedicated to exploring the robust capabilities of the MERN (MongoDB, Express.js, React, Node.js) stack. Throughout the sessions, they delved into the stack's versatility and extensive functionalities, discovering its seamless integration and ease of use. The workshop's focal point was the creation of a dynamic landing page for a pizzeria website using React and its components. Additionally, participants were guided in implementing essential features such as an 'add to cart' functionality, leveraging MongoDB for CRUD operations. By the workshop's conclusion, attendees departed equipped with invaluable skills to effectively harness the power of the MERN stack in their own projects.



# Sherlock & Watson

CSI-VESIT hosted "Sherlock and Watson," a coding challenge for third and second-year duos. After an elimination round, pairs tackled coding questions. The twist? Midway, partners swapped roles, losing sight of the question. Relying on their partner's work, they deciphered the problem and solved it. Time penalties loomed for hints, and errors incurred during execution. The challenge demanded seamless teamwork, communication, and adaptability. Participants navigated through hurdles, forging bonds and honing skills. "Sherlock and Watson" wasn't just about coding; it tested problem-solving under pressure and trust. As duos conquered each obstacle, they emerged as resilient problem solvers, embodying teamwork and innovation.



# Amazing Race

The "Amazing Race," hosted on March 3, 2023, by CSI-VESIT in collaboration with Praxis '23, was a thrilling treasure hunt-style competition for college students. Spanning seven rounds, teams of four navigated challenges ranging from locating council members in plain clothes to solving aptitude questions and programming errors. The event culminated in an Interstellar-themed treasure hunt, where participants embarked on a cosmic journey to secure Earth's survival. With immersive challenges and strategic gameplay, teams raced against the clock and each other for victory. The event showcased teamwork, problem-solving, and ingenuity, providing an unforgettable experience for all participants.



# Green Tech:

Highlighting Innovations in Renewable Energy,

Sustainable Practices and Eco-friendly Technology

-Vemburaj Konar



The world is currently experiencing the detrimental effects of climate change, leading to significant losses in several countries worldwide. Based on the UN Environment Programme's analysis, between 2000 and 2019, climate change has cost the world at least \$2.8 trillion in loss and damage, equivalent to approximately \$16 million per hour. In recent years, there has been a significant increase in awareness about sustainability and the crucial role that technology can play in addressing the world's pressing environmental challenges.

The Pavegen Systems, a UK-based technology company, has introduced an innovative solution that harnesses the energy generated by human footsteps to produce electricity known as Pavegen Tiles, these interactive floor tiles have the remarkable capability of converting the kinetic energy from walking into usable electrical power. On average, these tiles can generate approximately 5 watts of power per step, making them a promising addition to the renewable energy landscape.



Over the last decade, there has been a remarkable economic transformation in the realm of renewable energy. The cost of solar photovoltaic (PV) power, a key driver for green hydrogen production, has seen an almost 90% drop. Similarly, onshore and offshore wind generation costs have decreased significantly.

These cost reductions have made renewable energy sources like solar and wind the most economical choices in many parts of the world. This shift is pivotal for green hydrogen production, as it primarily relies on electricity derived from these renewable sources.

Despite the current higher production costs of green hydrogen compared to its fossil-based counterpart, there's optimism for a more economically viable future. The plummeting costs of renewable electricity and technological advancements in electrolysis are driving factors. As renewable energy becomes cheaper and electrolyze technology evolves, the overall cost of green hydrogen production is expected to decrease, making it competitively priced with fossil-based hydrogen in the near future.

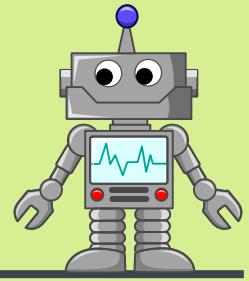
A hybrid car is a vehicle that combines a conventional internal combustion engine with an electric propulsion system, utilizing both power sources to drive the wheels. Unlike fully electric vehicles (EVs), which rely solely on electric power, hybrid cars seamlessly switch between the gasoline engine and electric motor, optimizing fuel efficiency and reducing emissions. The hybrid car is more sustainable than the conventional EV's but to tackle the lithium mining problem the only alternative is hydrogen vehicles.



These innovations not only offer promising solutions to mitigate climate change and reduce our carbon footprint but also present economic opportunities and job creation in the burgeoning green economy. As governments, industries, and individuals increasingly recognize the importance of transitioning to sustainable practices, the momentum towards a renewable energy future continues to grow.

# AGI-Exploring Tomorrow's Tech Revolution

-Karan Bhatia



In the continuously changing landscape of technology, one concept often sparks both excitement and worry: Artificial General Intelligence (AGI). AGI represents the peak of artificial intelligence, promising human-like cognitive abilities in machines. As discussions around AGI intensify, questions about its proximity and societal impact become increasingly relevant. In this article, we'll dive into the journey towards AGI, discuss if we should be worried, and look at how we can handle this big change.

## Possibilities and Predictions:

Artificial intelligence has made significant progress, from narrow AI systems designed for specific tasks to more complex algorithms capable of learning and adaptation. AGI, however, remains an inaccessible goal. Predicting the timeline for AGI's emergence is challenging. Some experts believe it could be achieved within decades, while others argue that significant obstacles still exist. Despite rapid advancements in AI, achieving human-level intelligence involves complexities beyond mere computational power. It's not just about better computers; we also need to understand things like how humans think and feel.

## Fear vs. Reality:

When we talk about AGI, it's natural for some people to feel worried. They're concerned about what might happen if machines become as smart as humans. One big fear is that AGI could take over jobs, leaving many people unemployed. Others worry about losing control over machines that are too smart. But it's essential to look at these fears realistically. While there are genuine concerns, not everything we hear about AGI is cause for panic. In fact, AGI has the potential to do a lot of good. It could help us solve complex problems, like finding cures for diseases or managing our resources more efficiently.

## Navigating the Future:

As society grapples with the implications of AGI, proactive measures can help mitigate risks and maximize benefits. Education and upskilling initiatives are vital to prepare the workforce for an AI-driven economy. Additionally, ethical frameworks and regulations must be established to ensure responsible development and deployment of AGI.

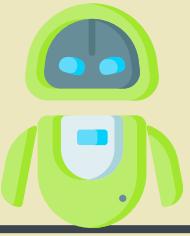
## Conclusion:

The journey to Artificial General Intelligence shows how creative and curious humans can be. While there's still a lot we don't know, one thing is clear: AGI will change how we see technology and work. Instead of being afraid, let's face this new era with curiosity and strength. With the right approach, AGI could make our lives better and push society forward.



# The Future of Food: Exploring Vertical Farming's Potential

-Simran Karamchandani



Our growing population and unsustainable agricultural practices are creating a looming food crisis. With the global population rising by 1% annually (and even faster in some regions), traditional farming methods are struggling to keep up. These practices are also harming the environment, contributing to climate change, deforestation, and a significant loss of arable land (a third in just 40 years!). Thankfully, innovative solutions like vertical farming offer a promising way to address these challenges and ensure food security for future generations.

Vertical farming takes a revolutionary approach to food production, ditching sprawling fields for vertically stacked layers. Imagine skyscrapers or even shipping containers transformed into productive growing environments! This method maximizes space, allowing farmers to cultivate significantly more food on a smaller footprint.

Unlike traditional farms that rely on soil, vertical farming often utilizes hydroponics, a method where plants grow in a nutrient-rich water solution instead of soil. This eliminates the need for vast tracts of arable land and minimizes water usage. These vertical farms can be housed in various locations, from repurposed warehouses to greenhouses, even utilizing spaces otherwise deemed unsuitable for agriculture (like unused shipping containers).

However, vertical farming is more than just stacking plants and hoping for the best. These controlled environments require meticulous management of factors like temperature, light, water, and humidity. Maintaining this delicate balance is crucial—any disruption can be as devastating to crops as a drought or flood in traditional farming.

Vertical farming offers numerous environmental and social benefits. This innovative approach slashes water usage by a staggering 98% and land requirements by a mind-blowing 99%. This translates to a massive boost in productivity, with yields reaching up to 240 times that of traditional farms!

Furthermore, these farms rely on the power of the sun, eliminating dependence on fossil fuels or less eco-friendly energy sources for lighting, making them a truly sustainable option.

Moreover, Controlled Environment Agriculture (CEA) safeguards both farmers and communities. By controlling the environment, it minimizes exposure to hazards like chemicals and diseases for farmers, while also preventing harmful runoff that can impact nearby areas.

Not only is vertical farming pesticide-free, it reduces emissions since crops are cultivated in urban areas and need not be exported from farms. This approach also addresses a major challenge in India: desertification. Desertification is a major challenge in India, with a staggering one-third of the landmass classified as such.

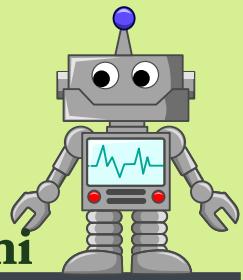
Despite its potential, vertical farming faces some challenges. A major hurdle is the cost of initial setup. The cost of vertical farming in India varies depending on location, project size, technology choices, and automation levels. A rough estimate suggests infrastructure costs range from ₹10 lakh to ₹1 crore, technology and equipment costs range from ₹5 lakh to ₹50 lakh, and annual operational costs range from ₹2 lakh to ₹5 lakh. This innovative approach could be particularly beneficial for India, where a staggering one-third of the landmass is classified as desertified, posing a significant threat to agriculture and food security.

Another limitation is the type of crops suitable for vertical farming. While leafy greens, herbs, and microgreens thrive in these controlled environments, larger crops like corn and soybeans pose a challenge. The economics of growing these crops vertically may not be viable at present.

Furthermore, while automation and advanced systems are key to its efficiency, they are also potential weak points. Unlike traditional soil-based

# Robots to the Rescue: How AI is Revolutionizing C&D Waste Sorting

-Simran Karamchandani



Rapid urbanization, industrialization, population growth, and increased consumerism have all contributed to an ever-increasing volume of solid waste that must be managed in countries worldwide, particularly in emerging nations. This article first introduces the current state of the field and then discusses the major challenges, such as the lack of publicly available data on Construction and Demolition (C&D) waste for training AI systems. Construction and demolition (C&D) waste is made up of wood, steel, concrete, gypsum, masonry, plaster, metal, and asphalt. It also briefly highlights the techniques to improve data quality and enhance AI system accuracy. Due to the complexity of this task, its application in waste sorting remains limited. Waste from construction and demolition (C&D) is a big environmental problem. However, we can reuse and recycle C&D waste, but direct sorting, that is, sorting it all by hand is too slow and expensive.

This is where AI and robots come in. Sensors learn more about the waste and its chemical makeup. Then, computers (AI) figure out what kind of waste it is and robots pick it up and sort it. This is undoubtedly more accurate and efficient, however as mentioned earlier it is highly complicated. The major questions are: How can AI use cameras to identify C&D waste? What sensors can help AI do this better? How can AI learn to identify even more types of waste? How can robots work with AI to sort the waste? What challenges do we need to solve to make this technology work even better?

The process of sorting of waste starts with different sensors that can help identify various different types of waste and capture its features. Cameras (RGB), depth sensors (RGB-D), and special cameras that can see heat (thermal) to name a few. However, the data from the sensors needs to be processed in a specific way depending on what the AI is trying to do.

There are three main things AI can do with images:

- Classification: Figure out what type of waste it is (e.g., wood, concrete).
- Object detection: Find the waste and figure out what type it is.
- For C&D waste, segmentation is most important: This is because robots need to know the exact shape and size of the waste to pick it up. However, right now most research focuses on classification.

Then depending on the investment and operational costs and size of enterprises. It's important to pick the right AI tool to sort waste according to the requirements. Image processing, Machine learning or Deep Learning are a few options. Image processing is good for basic tasks like smoothing images or finding edges. It's fast and simple but not great for complex shapes. Machine learning is more advanced and needs training data to work. It's good for analyzing data from special cameras that can see heat or chemical makeup (hyperspectral cameras). Deep learning is the most advanced option and uses complex models like convolutional neural networks (CNNs). It's very good for complex tasks like identifying and outlining different types of C&D waste. However, it requires a lot of computing power to run. The major challenge being encountered is that We need a lot of data to train the AI, and labeling that data is expensive and time-consuming. There also aren't many publicly available datasets for C&D waste specifically. Even with good data, AI models can struggle with complex tasks like identifying overlapping pieces of waste. To improve AI training for C&D waste We can use techniques like data augmentation to create more training data from a smaller dataset. We can use transfer learning to take advantage of knowledge gained from training AI models on other tasks.

Lastly, to use robots to sort the waste there are two main approaches: sorting on-site (at the demolition location) or off-site (at a separate facility). On-site sorting is more complex because robots need to navigate a dynamic environment. Off-site sorting is simpler but requires transporting the waste and has challenges like high conveyor belt speeds and dense waste piles. While waste management and AI together offer a lot of potential, its challenges like data scarcity and complex environments need to be addressed for complete implementation and adoption of this technology which will further facilitate SDG and positively impact the environment.

# Perovskite Solar Cells: Promising but Not Quite Ready for Prime Time

-Simran Karamchandani



**T**he Good News:

Perovskites are highly efficient and have achieved record competence in lab settings, even surpassing some existing solar technologies. This means they can convert more sunlight into electricity, leading to greater power generation. Interestingly, perovskite's composition can be adjusted to capture different parts of the sunlight spectrum. This flexibility allows for potentially even higher efficiency and the creation of tandem cells that combine perovskite with other materials for even greater energy output. And unlike traditional silicon panels, perovskites can be lightweight and flexible. This makes them ideal for portable applications like solar backpacks or powering devices in remote locations. Fortunately, existing manufacturing techniques from other industries might be adaptable for large-scale perovskite production, potentially leading to cost-effective mass production.

Perovskite solar cells display great potential and show remarkable progress at converting sunlight into electricity(3% in 2009 to over 25% today) Widespread adoption of this technology could lead to a significant decrease in our reliance on fossil fuels for electricity generation. This would result in a reduction of greenhouse gas emissions and air pollution associated with burning fossil fuels.

Perovskite cells are thin-film devices and some manufacturing techniques explored involve printing or coating from liquid inks. Compared to traditional silicon solar panels, which require more energy-intensive production processes, perovskites could potentially have a lower environmental impact during manufacturing.

**The Challenge:**

The biggest hurdle is their limited lifespan. Perovskite cells degrade quickly

when exposed to moisture, heat, light, or voltage. Existing solar panels need to last over 20 years, and perovskites currently fall far short of this benchmark. Researchers are working on improving material composition and fabrication processes to enhance stability. Lack of standardization proves to be another challenge as testing methods for perovskite cells lack consistency across labs. This makes it difficult to compare results and predict real-world performance. Establishing standardized testing protocols is crucial for building investor confidence in the technology.

Lead is often used in perovskite materials, raising environmental concerns. Researchers are exploring lead-free alternatives and mitigation strategies to address this issue. Due to the above mentioned factors of concerns about long-term performance and the lack of a proven track record, financial institutions are hesitant to invest in large-scale perovskite production. Emphasis on standardized testing and field data demonstrating stability are needed to attract investment and bring perovskite solar cells to market.

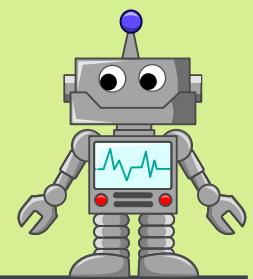
A comprehensive life cycle analysis is needed to fully understand the environmental impact of perovskite solar cells. This would involve analyzing the environmental costs of material extraction, manufacturing, transportation, operation, and disposal of perovskite cells.

#### Conclusion:

While the potential for a positive environmental impact exists, further research and development are needed to minimize the environmental footprint of perovskite solar cells and ensure responsible use of materials throughout their life cycle. Perovskite solar cells have the potential to be a game-changer in the solar industry, but they need to overcome these hurdles first.

# Carbon Capture and Storage: The New Frontier in Green Technology

- Anish Padhye



**A**s greenhouse gas emissions blanket the Earth, they trap the sun's heat. This leads to global warming and climate change. The world is now warming faster than at any point in recorded history. Warmer temperatures over time are changing weather patterns and disrupting the usual balance of nature. Carbon capture and storage (CCS) has emerged as a promising solution to mitigate greenhouse gas emissions and combat climate change. As the world grapples with the urgent need to reduce carbon dioxide (CO<sub>2</sub>) emissions, CCS presents a viable strategy to capture CO<sub>2</sub> emissions from industrial processes and power generation facilities, preventing them from entering the atmosphere. CCS involves capturing CO<sub>2</sub> emissions from industrial sources such as power plants, cement factories, and steel mills. Various methods of carbon capture exist, including pre-combustion capture, post-combustion capture, and oxy-fuel combustion. Captured CO<sub>2</sub> is then stored underground in geological formations such as depleted oil and gas reservoirs, saline aquifers, and deep coal seams. Carbon Capture and Storage also enables the continued use of fossil fuels in a carbon-constrained world while curbing emissions. Additionally, CCS supports industrial decarbonization efforts by facilitating the adoption of cleaner technologies without substantial disruption.

Innovative approaches such as direct air capture and carbon utilization have emerged as promising avenues in CCS technology. Several successful CCS projects worldwide demonstrate its feasibility, including power plants, industrial facilities, and research initiatives. Government support through policies, incentives, and funding mechanisms plays a pivotal role in accelerating CCS deployment and scaling up infrastructure. Despite its promise, CCS faces several challenges. High upfront costs associated with implementation, including capture technology, transport, and storage infrastructure, pose a significant barrier. Additionally, ongoing research and development are necessary to enhance efficiency, reduce costs, and establish reliable storage methods.

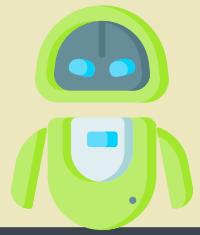
Moreover, addressing public concerns regarding safety, environmental impact, and long-term liability is crucial for widespread adoption. Also implementing CCS all over the world can be a challenge due to the differences in policies and regulations of governments over the world. Even if a government adopts a new policy regarding carbon emissions, after a few years if the government changes then again we will have a lot of problems due to an altogether different ideology. So to continue CCS we would need a collective effect from all countries which work towards the betterment of society and communities all over the world.

So rather than crying over small and bitter problems, solving a big problem like rising carbon emissions would be beneficial for us all. Integrating CCS with renewable energy sources could provide a reliable, low-carbon baseload power supply. Collaborative efforts among governments, industry stakeholders, and research institutions are essential to scale up CCS deployment effectively. Moreover, ensuring the sustainability of CCS projects by addressing environmental and social concerns is paramount to achieving long-term climate goals.

In the urgent battle against climate change, carbon capture and storage (CCS) stand as beacons of hope, promising to reshape our energy landscape and secure a sustainable future. While hurdles remain, the allure of CCS lies in its potential to not just mitigate emissions, but to revolutionize how we approach industrial processes and energy production. As we navigate the complexities of implementation, let us remember that the journey towards a low-carbon world is not just a technical endeavor but a shared commitment to safeguarding our planet for generations to come. With perseverance, innovation, and collective action, CCS can catalyze a transformative shift towards a greener, more resilient tomorrow.

# Harnessing the Power of Wind

- Anish Padhye



We all know about the popular choices of Green Energy such as Solar and Hydro energy. But the one area we often neglect when discussing Green Technology is the power of Wind as a fuel to our appliances and tech. Wind is a powerful source of energy which when used properly can have many benefits to human society. In the pursuit of sustainable energy solutions, wind power has emerged as a leading contender, offering clean, renewable energy with the potential to reshape our global energy landscape.

From ancient windmills to modern wind turbines, humanity's relationship with wind energy has evolved over millennia. Early civilizations harnessed wind power for milling grain and pumping water, laying the foundation for the development of wind turbines in the late 19th century. Since then, advancements in turbine design, materials, and engineering have propelled wind energy into the forefront of renewable energy technologies. Among the most notable developments of the modern world is the rapid expansion of offshore wind farms, tapping into the vast potential of wind resources found in coastal regions. These offshore installations benefit from stronger and more consistent wind speeds, unlocking new frontiers for wind energy deployment and enabling the development of larger, more efficient turbines.

Additionally, the integration of digital technologies and artificial intelligence is revolutionizing wind farm operations, optimizing turbine performance, predictive maintenance, and grid integration. The environmental benefits of wind energy are really great and healthy. Wind Energy produces no greenhouse gas effects or air pollutants unlike fossil fuels and also the land and water footprint of wind farms is quite minimal compared to traditional sources of energy. These two main reasons mitigate the air quality change or pollution, contributing to the benefits of

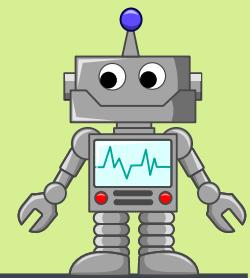
wind energy. As the world grapples with the urgent need to reduce carbon emissions and transition to a sustainable energy future, wind energy stands as a beacon of hope. Its abundance, scalability, and affordability make it a cornerstone of efforts to decarbonize electricity generation and achieve carbon neutrality. Moreover, wind energy creates jobs, drives economic growth, and enhances energy security, benefiting communities around the globe.

Also the role of engineers is important in promoting wind energy in today's world. The design of windmills can be an important factor in its growth towards a prominent energy source in the fast paced world. Today's wind turbines are marvels of engineering, towering structures adorned with sleek blades that capture the kinetic energy of the wind and convert it into electricity. Innovations in turbine design, such as variable-speed generators, aerodynamic enhancements, and smart grid integration, have significantly increased efficiency and reliability, making wind energy an increasingly competitive and viable alternative to conventional fossil fuels.

Despite its many benefits, wind energy faces challenges such as intermittency, grid integration, and public acceptance. Addressing these challenges requires continued innovation, investment in infrastructure, and supportive policies. It's our duty as a responsible society to embrace and adopt Wind Energy as an important source of energy. Nothing will happen if we do not treat wind energy as a prominent factor in fuel generation as we are the ones who are going to use it for our needs. It will not take place in a few days or years but surely after a decade or so we will see its benefits. In the age of climate change and environmental stewardship, wind energy offers a sustainable path forward, harnessing the power of nature to meet our energy needs without compromising the planet. The winds of change are blowing, and it's time to seize the opportunity to embrace a renewable energy future powered by the limitless potential of wind.

# Beyond 9 to 5: Remote Job, Rise of AI and more

- Sami Thakur



**W**orking from Home: No More Office Cubicles. You might have noticed more people working from home lately. This trend got a big boost during the COVID-19 pandemic.

working from home means you can do your job without going to an office every day. It's great because you can have a more flexible schedule, save time on commuting, and maybe even work in your pajamas! But it's not all easy. Sometimes, it can be hard to stay connected with your team when you're not all in the same place. Plus, not everyone has the same access to good internet or a quiet space to work.

## AI: Changing the Job Landscape

Artificial Intelligence (AI) is another big change in how we work. AI can analyze data, make predictions, and even learn from experience. This means it can do tasks that used to require human intelligence, like diagnosing medical conditions or writing news articles. Some people worry that AI will take away jobs. And it's true that AI can automate some tasks that humans used to do. But it's also creating new jobs. For example, someone needs to design and teach the AI systems. Plus, AI can help us be more productive, freeing up time for us to focus on more interesting or important work.

## Technology: The Rise of Smart Machines

Have you ever heard of robots doing people's jobs? It's happening more and more. Machines can now do tasks like sorting packages in a warehouse or answering customer service questions. This is called automation. Automation is cool because it can make things faster and safer. But some people worry that it might take away jobs. The good news is that machines can't do everything.

There are still lots of things that only humans can do, like coming up with creative ideas or understanding how others feel. So, instead of worrying, we should focus on learning new skills that can help us work alongside smart machines.

### Freelancing: Working on Your Own Term

Have you ever thought about being your own boss? That's what freelancing is all about. Instead of having a full-time job with one company, freelancers work for themselves and take on different projects for different clients. You might have heard of platforms like Uber or Fiverr, where people can offer their skills or services to anyone who needs them.

Freelancing can be great because you get to choose when and where you work. But it can also be uncertain because you're not guaranteed a steady income or benefits like health insurance. We need to find ways to support freelancers and make sure they have the protections they need.

### Looking Ahead: Adapting to Change

The way we work is changing, and that's okay! We just need to be ready to adapt. Whether we're working from home, collaborating with smart machines, or freelancing our skills, there are always new opportunities to learn and grow.

It's important to make sure everyone has access to these opportunities and that nobody gets left behind. By working together and supporting each other, we can create a future where everyone has the chance to succeed, no matter how they choose to work.



# Carbon Capture And Utilisation (CCU)

-Vedika Walhe



**T**he need for CCU:

Today, we are all subjected to a lot of urgent challenges of climate change including global warming, extreme weather events, rising sea levels, loss of biodiversity and more. It is predicted that by 2030, the chemical industry will become the greatest global oil consumer. One of the major factors in driving this is the ever increasing need of fossil resources that contribute to greenhouse gas emissions. However, there's still a glimmer of hope for us in the form of Carbon Capture and Utilization (CCU) technologies.

What is CCU?

Essentially, CCU involves capturing carbon dioxide (CO<sub>2</sub>) - a major greenhouse gas - from industrial processes or even directly from the air and putting it to work as a raw material for chemical production. Instead of allowing CO<sub>2</sub> to be released into the atmosphere where it contributes to climate change, CCU seeks to harness it for beneficial purposes. Thus, we are not only reducing the CO<sub>2</sub> emissions but also creating new opportunities for the development of industries and economic growth.

How does CCU work?

Carbon Capture and Utilization generally works in 4 steps: Capture, Purification, Conversion and Utilization. First, CO<sub>2</sub> emissions are captured using various technologies which include post combustion capture, pre combustion capture and direct air capture. Then the purification process is carried out by separating CO<sub>2</sub> from other gases such as oxygen, nitrogen etc. After purification, the captured CO<sub>2</sub> is then converted into usable products or materials through chemical, biological, or electrochemical processes. The final step in CCU is the utilization of the converted CO<sub>2</sub> products. These products can range from fuels and chemicals to building materials, plastics, and consumer goods.

## Environmental Benefits:

In addition to reducing greenhouse gas emissions, Carbon Capture and Utilization (CCU) offers a range of environmental benefits. By capturing and repurposing carbon dioxide (CO<sub>2</sub>), CCU helps reduce air pollution and improve air quality, particularly in areas heavily reliant on fossil fuel combustion. By diverting CO<sub>2</sub> from being released into the atmosphere, CCU contributes to reducing smog, acid rain, and other pollutants associated with conventional industrial processes. This dual impact on climate change and air quality underscores the significant environmental potential of CCU technologies.

## Challenges and Opportunities:

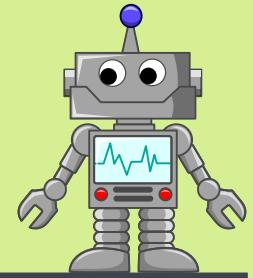
While CCU holds great promise for addressing climate change and promoting sustainable development, it also faces several challenges. One major challenge is the high cost of capturing and processing CO<sub>2</sub>, which can make CCU technologies economically unfeasible without government incentives or carbon pricing mechanisms. However, despite these challenges, CCU presents numerous opportunities for innovation and collaboration across industries and sectors. Research and development efforts are underway to improve the efficiency and affordability of CCU technologies, as well as to explore new applications and markets for CO<sub>2</sub>-derived products.

## Looking Ahead:

As we confront the urgent challenges of climate change, CCU offers a promising pathway towards a more sustainable and resilient future. By harnessing the power of CO<sub>2</sub> as a valuable resource, we can reduce emissions, promote economic development, and build a cleaner, greener world for future generations. With continued innovation and investment, CCU has the potential to play a vital role in mitigating climate change and shaping a brighter tomorrow.

# The Role of AI in Green Technology

- Anish Padhye



**A**rtificial intelligence (AI) refers to computer systems capable of performing complex tasks that historically only a human could do, such as reasoning, making decisions, or solving problems.

But can we use AI in green technology and harness its power appropriately for our own and the planet's benefit. Surely we can do it! Artificial Intelligence (AI) has emerged as a game-changer in the realm of green technology, offering novel solutions to address pressing environmental challenges. This article delves into the multifaceted role of AI in advancing sustainability efforts, exploring its applications, potential benefits, challenges, and the transformative opportunities it presents for building a greener future. As we use AI and its benefits for our own progress in simple tasks, it can surely do wonders in Green Tech. Also it can reduce human effort in these issues so that we can utilize human power in some other useful fields.

A very simple application would be: By analyzing data from smart grids, transportation systems, and industrial processes, AI can identify patterns and recommend strategies for reducing energy consumption, improving waste management, and promoting renewable energy sources. Other major uses include using AI driven sensors or drones to monitor the air and water quality of the planet, measuring the rate of global warming, deforestation, biodiversity thereby facilitating the proactive efforts towards a green and healthy future. AI based agriculture practices improve the crop yield, promoting smart work of the farmers rather than the strenuous hard work they do anyways. AI algorithms showcase better route planning, traffic flow, fostering the transition to electric and autonomous vehicles in the near future. Furthermore, AI serves as a catalyst for innovation, fostering the development of novel technologies and solutions to address environmental challenges. From advanced materials and renewable energy systems to precision agriculture and smart transportation, AI-driven innovations are driving a paradigm shift towards more sustainable practices across sectors.

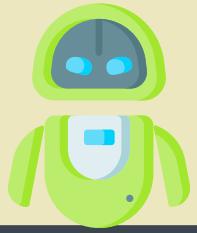
Artificial Intelligence (AI) into green technology offers transformative potential but is not without challenges and ethical considerations. Ensuring data quality and integrity, addressing biases, and safeguarding privacy are paramount. Moreover, the energy-intensive nature of AI poses environmental concerns, necessitating the development of energy-efficient algorithms and infrastructure. Ethical dilemmas surrounding decision-making processes, accountability, and fairness require transparency, accountability mechanisms, and diversity in AI development.

Additionally, the potential for AI to exacerbate socio-economic inequalities underscores the importance of equitable access and inclusive development frameworks. Collaboration among stakeholders is crucial in establishing regulatory frameworks, promoting ethical standards, and investing in AI education to maximize its benefits while mitigating risks and ensuring equitable outcomes. Lastly it's our duty to AI for a greener and healthier technology. We will have our fair share of problems adopting this policy into the real world but which new idea doesn't have issues and difficulties in its application. So here we are in this modern world promoting green technology with the help of AI, the new trendy topic of the world solving age old problems of humans.



# Green Technology

-Sagar Rajak



**E**nergy:

**E**nergy, the word itself resonates that we are talking about something big... something enormous... something that is indestructible, something which is present everywhere, either in the form of matter or antimatter, either in an occupied stance or void space. Whether it's in fundamental particles or in massive galaxies, it is everywhere. The flow, the vibrations, and the frequencies of it remain the same everywhere, and it flows continuously.

As we all know from the second law of thermodynamics, "Energy can not be created nor destroyed". So where is it? Why are we not using it all? Why are we facing an energy crisis? Why are we searching for alternate resources for it? Legitimate questions, right? Okay, so let's dive a little deeper into it. It all started 13.6 billion years ago when the Big Bang happened, and since then, we have been using that created energy in different forms. And one form of it is ourselves, yes, we... me, you, and all these people and living organisms. Now, you all might have a question: how and when did it happen? The answer is, we are all made up of hydrocarbon components, and the cluster of it which is basically the fundamental components of what we refer to as carbon fuel or crude petroleum. And since past ages, we have been using it. It is easily available, produces mass energy, easy to carry, easy to burn, and makes our life smooth, right? But here's the catch. As we all know, everything comes with some cost, and here the cost is very expensive.

Yes, it is very much expensive because it is costing us our environment, our home, our Mother Nature, in the form of the greenhouse effect, ozone depletion, and global warming. So what are the solutions for it? What should we do now? What should be our next step? So let's find a solution for it.

## 2. Green Energy:

"The green energy"... Ah, the name itself explains that we are talking about something which is related to our environment, our surroundings, our Mother Nature. Green energy is any energy type often comes from renewable energy sources such as solar energy, wind power, geothermal energy, biomass, and hydroelectric power. Green energy is important for the environment as it replaces the negative effects of fossil fuels with more environmentally friendly alternatives. Green energy is also often renewable and clean, meaning that they emit no or few greenhouse gases and are often readily available. Even when the full life cycle of a green energy source is taken into consideration, they release far fewer greenhouse gases than fossil fuels.

In a similar manner, the next big thing in green energy is "Hydrogen Fuel" or "The Green Hydrogen"... the alternative of all energy sources and an on-stock solution of major energy and environment- related crises. Depending on production methods, hydrogen can be of different form. However, green hydrogen is the only type produced in a carbon-neutral manner, making it critical to reach net-zero emission product. Now, if we move one step further, then "Hydrogen fuel cells" are the ultimate application of hydrogen fuel. A fuel cell uses the chemical energy of hydrogen or other fuels to cleanly and efficiently produce electricity. If hydrogen is the fuel, the only byproducts are electricity and water, which makes it the most efficient solution to the energy crisis until now.

Now, let's dive a little into how it works. In the cell, the anode catalyst, usually fine platinum powder, breaks down the fuel into electrons and ions. The cathode catalyst, often nickel, converts ions into waste chemicals, with water being the most common type of waste. Gas diffusion layers are designed to resist oxidization. Now, the question comes, how are we going to change the world with hydrogen fuel cell? How can we apply it in our day-to-day life? So, if we study till now, it has its application mainly in the electricity and transportation industry. It is very much useful in making home electricity cheap and easily available, but its major potential lies in

the vehicle and transport industry since 24% of all pollution comes from the transport and vehicle industry, so fuel cells have the potential to replace all petroleum and electrical vehicles from the industry and can revolutionize the energy crisis like never before. Now, you will be having a question, how? And what are the flaws in EV vehicles? They too do not emit anything? So, what is the problem?

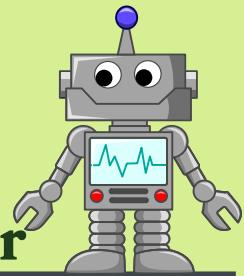
### 3. Application of Fuel Cell Car as the Future:

The problem of EV vehicles is their lithium-ion batteries on which they operate. If EV batteries continue to be made of lithium-ion, the primary concerns are: labor practices for mining cobalt, environmental impacts of extracting lithium, sufficient supply of materials for EV batteries, carbon emissions from battery manufacture, and toxic waste from disposal of used batteries. These batteries have a lifespan of 6-7 years, but after that, they are not useful at all, and the solid waste generated is really horrendous that it can't be destroyed, causing soil pollution and environmental problems. That's why fuel cell cars are the future, which are going to revolutionize the transport industry. The only concern is that the energy efficiency of a fuel cell until now is 48%, whereas EVs have an efficiency of 82%, which makes them the obvious choice of the industry, but it is costing us our environment and clean lifestyle, which makes a great hurdle in making a green future and a zero-carbon environment completely.

The steps and research are still ongoing on how we can improve the efficiency of fuel cells, and big brands like Toyota and Honda are doing their best to make fuel cell vehicles our future. So let's see what comes next. It's going to be wonderful if we live in a place where our Mother Nature and all our ecosystems are conserved and are in great shape, and green technology has the potential to do it.

# Smart Energy Solutions: Energy Optimization using IoT devices

- Mayuresh Pednekar



In the realm of green technology, the integration of Internet of Things (IoT) devices is revolutionizing how we manage and optimize energy usage. From homes to industries, IoT-enabled sensors and devices are playing a pivotal role in enhancing energy efficiency and sustainability. One of the key IoT devices transforming energy management is the smart thermostat. These devices utilize IoT technology to monitor temperature settings and occupancy patterns in homes and buildings. By analyzing data in real-time, smart thermostats can adjust heating and cooling systems to optimize energy usage while ensuring occupant comfort. In industrial settings, IoT sensors are deployed throughout facilities to monitor energy consumption and identify opportunities for optimization.

These sensors collect data on equipment performance, energy usage, and environmental conditions, allowing businesses to pinpoint inefficiencies and implement energy-saving measures. Additionally, IoT-enabled smart meters provide granular insights into energy usage, allowing utilities and consumers to track consumption patterns and identify areas for improvement. By leveraging real-time data analytics, smart meters enable more accurate billing, reduce energy waste, and empower consumers to make informed decisions about their energy usage.

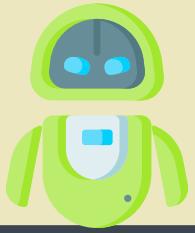
The impact of IoT devices in energy optimization extends beyond individual buildings and industries. At a broader level, IoT technology enables demand response programs, where energy consumption is adjusted in response to grid conditions or pricing signals. By participating in these programs, businesses and consumers can reduce their energy costs and contribute to the stability of the grid.

Furthermore, IoT devices are driving innovation in renewable energy integration and management. For example, IoT-enabled solar inverters can optimize the performance of solar photovoltaic systems by adjusting output based on weather conditions and energy demand. Similarly, IoT sensors in wind turbines can monitor wind speeds and turbine performance to maximize energy generation. Overall, IoT devices are transforming energy management by providing real-time insights, optimizing energy usage, and facilitating more sustainable practices. As technology continues to evolve, the role of IoT in energy optimization is expected to expand, ushering in a future where energy efficiency and sustainability go hand in hand.



# The Potential of Hydrogen Fuel Cells in Green Transportation

-Sagar Rajak



In the quest for sustainable transportation solutions, hydrogen fuel has emerged as a promising contender, offering a clean and efficient alternative to traditional fossil fuels. With advancements in hydrogen fuel cell technology and hydrogen fuel engine technology, the potential for hydrogen-powered vehicles to revolutionize green transportation is becoming increasingly evident.

## Overview of Green Energy Transportation Systems:

- Battery Electric Vehicles (BEVs): BEVs are powered by electricity stored in rechargeable battery packs. These vehicles use an electric motor for propulsion, with energy provided by plugging into the electric grid.
- Fuel Cell Electric Vehicles (FCEVs): FCEVs utilize hydrogen fuel cell technology to generate electricity on-board. Hydrogen gas is stored in tanks and combined with oxygen from the air in the fuel cell stack to produce electricity, powering the vehicle's electric motor.
- Hydrogen Internal Combustion Engine (ICE) Vehicles: These vehicles use hydrogen gas as a direct fuel in an internal combustion engine. The hydrogen is ignited, producing mechanical power to drive the vehicle, and the only emission at the tailpipe is water vapor.

At the heart of hydrogen-powered vehicles lies fuel cell technology, which converts hydrogen gas into electricity through an electrochemical process. Unlike conventional internal combustion engines, fuel cells produce electricity without combustion, emitting only water vapor and heat as byproducts. This makes hydrogen fuel cell vehicles (FCVs) zero-emission vehicles, offering a compelling solution to reduce greenhouse gas emissions and combat air pollution.

Furthermore, hydrogen fuel cell technology offers several advantages over traditional battery electric vehicles (BEVs).

FCVs boast longer driving ranges and faster refueling times, addressing two significant barriers to widespread EV adoption: range anxiety and charging infrastructure. With refueling times comparable to conventional gasoline vehicles, hydrogen fuel cell vehicles offer a familiar and convenient driving experience for consumers.

## Hydrogen Fuel Engine Technology: Another Path to Sustainability

In addition to fuel cell technology, hydrogen can also be used as a direct fuel in internal combustion engines, offering another pathway to green transportation.

Hydrogen-powered internal combustion engines (ICEs) produce zero emissions at the point of use, making them environmentally friendly alternatives to gasoline and diesel engines. While not as efficient as fuel cell technology, hydrogen ICE vehicles can still play a role in reducing emissions and transitioning away from fossil fuels.

Both hydrogen fuel cell vehicles and electric vehicles offer environmental benefits compared to conventional gasoline and diesel vehicles. However, the environmental impact of each technology depends on factors such as the source of electricity or hydrogen production. In regions with renewable energy sources, such as wind or solar power, both hydrogen fuel cell vehicles and electric vehicles can achieve near-zero emissions.

## Environmental Friendliness: Which is Better?

While hydrogen fuel cell vehicles offer zero emissions at the tailpipe, producing hydrogen can involve energy-intensive processes, such as steam methane reforming or electrolysis. On the other hand, electric vehicles produce zero emissions during operation but may rely on electricity generated from fossil fuels, resulting in indirect emissions.

Ultimately, the environmental friendliness of hydrogen fuel and electric vehicles depends on factors such as the energy source used for

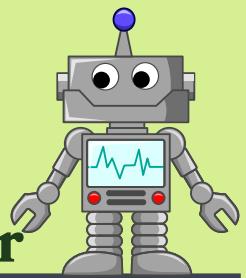
production, the efficiency of the vehicle technology, and the infrastructure required for deployment. As renewable energy sources become more prevalent and production processes become more efficient, both hydrogen fuel cell vehicles and electric vehicles have the potential to play significant.

Hydrogen fuel holds immense potential in advancing green transportation and reducing greenhouse gas emissions in the automotive sector. Hydrogen ICE vehicles represent an evolving area of research and development. These vehicles offer the advantage of utilizing existing infrastructure for refueling while providing zero emissions at the point of use. Continued advancements in hydrogen production methods and engine efficiency could further enhance their environmental credentials. While challenges remain, such as the need for infrastructure development and cost reduction, the promise of hydrogen fuel in achieving a sustainable future on the roads is undeniable.



# The Role of AI in Energy Optimization and conservation

- Mayuresh Pednekar



In an era marked by growing environmental concerns and the pressing need to address climate change, the transportation sector finds itself at a crossroads. Traditional internal combustion engine (ICE) vehicles, long backbone of our mobility systems, are increasingly viewed as contributors to air pollution and carbon emissions. In response, a wave of innovation has swept through the automotive industry, giving rise to a new generation of vehicles designed to mitigate these environmental impacts: green vehicles. At the forefront of this revolution are electric vehicles (EVs), which have gained widespread attention for their promise of zero tailpipe emissions. These vehicles, powered by electric motors and rechargeable batteries, offer a cleaner alternative to conventional gasoline-powered cars.

From compact city cars to sleek luxury sedans, EVs come in a variety of shapes and sizes, appealing to a broad spectrum of consumers. Hybrid vehicles, another prominent category of green vehicles, combine the benefits of electric propulsion with the range and flexibility of traditional gasoline engines. By seamlessly switching between electric and gasoline power, hybrids deliver improved fuel efficiency and reduced emissions, making them an attractive option for drivers seeking to minimize their environmental footprint without sacrificing convenience.

Fuel cell vehicles (FCVs), powered by hydrogen fuel cells that produce electricity through a chemical reaction with oxygen, represent yet another frontier in green transportation. Although still in the early stages of commercialization, FCVs offer the potential for long-range driving and rapid refueling, addressing some of the limitations of battery electric vehicles. The journey towards greener transportation began decades ago, with early experiments in electric propulsion dating back to the 19th century. However, it wasn't until the late 20th and early 21st centuries that significant strides were made in developing commercially viable green vehicle technologies.

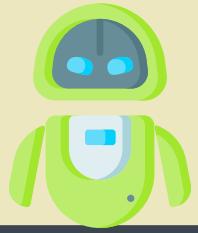
The introduction of the Toyota Prius in the early 2000s marked a turning point in the automotive industry, demonstrating the potential of hybrid technology to deliver improved fuel economy and reduced emissions. This paved the way for further innovation, leading to the emergence of electric vehicles and fuel cell vehicles as viable alternatives to traditional ICE vehicles.

The advantages of green vehicles extend beyond their environmental benefits. From lower operating costs to enhanced performance and driving experience, these vehicles offer a host of advantages that appeal to consumers and businesses alike. By producing fewer emissions and reducing reliance on fossil fuels, green vehicles contribute to cleaner air and a healthier environment for future generations. Electric and hybrid vehicles are inherently more energy-efficient than ICE vehicles, translating into lower fuel consumption and reduced operating costs over the vehicle's lifetime. Green vehicles are at the forefront of automotive innovation, driving advancements in battery technology, electric drivetrains, and autonomous driving systems.



# Green Technology

-Garv Chawla



**S**tuck on environmental problems? Look to nature! Biomimicry is a clever idea that studies how amazing creatures and plants have adapted and thrived for millions of years. By mimicking these natural designs and processes, we can create innovative solutions to our problems in a sustainable way.

Did you know the self-cleaning lotus leaf inspired scientists to create stain-resistant fabrics? Or that the aerodynamic shape of a bird's wing helps engineers design airplanes that use less fuel? Biomimicry helps us translate these wonders of nature into inventions that are good for the planet.

For example, scientists are working on materials that can heal themselves, just like some amazing creatures like starfish can regenerate lost limbs! Imagine buildings that fix cracks by themselves or surfaces that repel dirt naturally, reducing the need for cleaning products.

But biomimicry goes beyond cool ideas. In nature, there's almost no waste – everything gets used for something else. Biomimicry encourages us to design products and technologies that minimize environmental impact and resource use. Imagine packaging materials that decompose like leaves or manufacturing processes that generate minimal waste, unlike many of our current practices.

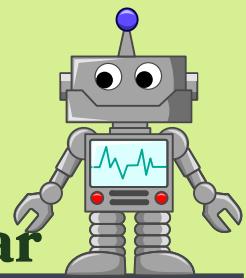
The future of biomimicry is brimming with possibilities! Imagine super strong, lightweight materials inspired by spider silk, which is stronger than steel at a fraction of the weight. Or buildings that cool themselves down naturally, mimicking the way termite mounds maintain a constant temperature. Biomimicry can even help us create better ways to get and store energy, by mimicking how plants capture sunlight for photosynthesis or how some creatures store energy for long periods, like a bear preparing for hibernation.

By learning from nature's genius, biomimicry holds the key to creating a cleaner world that works better for everyone. It's a powerful tool that can help us address some of the most pressing challenges facing our planet. As research and understanding of natural systems advance, the possibilities for biomimicry are truly limitless. This approach to innovation can lead us towards a more sustainable and harmonious future for all.



# Revolutionizing Transportation: The Rise of Green Vehicles

- Mayuresh Pednekar



In the global pursuit of sustainability, the intersection of artificial intelligence (AI) and green technology has emerged as a powerful catalyst for change. AI, with its ability to analyze vast amounts of data, identify patterns, and make autonomous decisions, is revolutionizing how we address environmental challenges. From optimizing energy usage to enhancing conservation efforts, AI is playing a crucial role in minimizing our ecological footprint and preserving the planet for future generations. In a complex network of building equipment and automation systems, machine learning is invaluable for improving operations. In particular, it can be a powerful tool for reducing energy use and improving overall energy management.

Key ways machine learning can optimize building energy efficiency are:

## 1. Forecasting Energy Consumption:

Machine learning can be used on the data of energy consumption gathered through various IoT sensors and devices and then a model can be trained to predict the future energy consumption of the building and even help in reducing or managing the energy consumption.

## 2. Detecting and Predicting Faults:

A building's interconnected network of equipment, sensors, and devices can generate an unwieldy volume of data and trigger multiple alarms when equipment malfunctions. Advanced analytics organizes, analyzes, and prioritizes this data to produce meaningful insights and isolate points of vulnerability and failure. Predictive analysis is particularly valuable for high-consumption targets like HVAC equipment, which accounts for approximately 40% of commercial facility. One of the primary applications of AI in green tech is optimizing energy efficiency across various sectors. AI algorithms can analyze real-time data from smart meters, sensors, and other sources to identify opportunities for energy savings and reduce wastage.

For example, in buildings, AI-powered systems can dynamically adjust heating, cooling, and lighting based on occupancy patterns and external conditions, thereby minimizing energy consumption while maintaining comfort levels. In industrial settings, AI-driven predictive maintenance systems can detect equipment failures before they occur, enabling proactive maintenance and preventing costly downtime. By optimizing equipment performance and reducing energy-intensive AI helps industries minimize their environmental impact and achieve greater operational efficiency. AI is also driving innovation in renewable energy technologies, making them more efficient and reliable.

For instance, AI algorithms can optimize the placement and operation of solar panels and wind turbines based on factors such as weather patterns, solar radiation, and wind speeds. By maximizing energy generation and minimizing downtime, AI enhances the viability of renewable energy sources as alternatives to fossil fuels. Furthermore, AI-enabled energy storage systems improve the integration of renewable energy into the grid by addressing intermittency challenges. These systems can predict energy demand and optimize storage capacity, ensuring a stable and reliable supply of clean energy even during periods of low renewable generation. In addition to energy optimization, AI is transforming environmental monitoring and conservation efforts. AI algorithms can analyze satellite imagery, sensor data, and other sources to detect environmental changes such as deforestation, habitat loss, and pollution in real time. Moreover, AI-powered predictive models can forecast the impacts of climate change and human activities on ecosystems, helping to prioritize conservation efforts and allocate resources effectively.

By leveraging AI's capabilities, we can develop proactive strategies to mitigate environmental degradation. AI is a powerful enabler of green technology, offering unprecedented opportunities to optimize energy usage, advance renewable energy solutions, and enhance environmental monitoring and conservation efforts. By harnessing AI's capabilities, we can develop innovative solutions to mitigate climate change, protect biodiversity, and build a more sustainable world for current and future generations.

# Russia VS Ukraine : How Cyber Warfare and Misinformation Won the War.

-Amit Murkalmath



The world watches with bated breath as two former Warsaw Pact-allies continue their bitter feud. What began as a territorial dispute has now escalated into a full-blown conflict, with both sides accusing the other of aggression and treachery. But it's not just the armies that are fighting – in this war, the battle is fought in cyberspace and through propaganda. Ukraine claims Russia is spreading false information and cyber-attacking their infrastructure, while Russia claims the opposite. It's a shadowy war with no clear victor, but its impact is felt on the ground. In this battle of disinformation and technology, who will come out on top?

Since 2014, when Russia annexed Crimea and pro-Russian rebels started a rebellion in Eastern Ukraine, there has been tension between Ukraine and Russia. Although the battles have largely taken place on the ground, the result of the fight has been significantly impacted by the amount of disinformation and cyber warfare that both sides have participated in.

Campaigns of misinformation have been a major aspect of the confrontation between Russia and Ukraine. The Ukrainian government has frequently been characterised by Russian media as a fascist, anti-Russian administration that wants to persecute ethnic Russians in Ukraine. This has made it harder for the Ukrainian government to win the confidence of its people and has encouraged pro-Russian sentiment in both Russia and Ukraine.

Cyber warfare has been a major factor in the confrontation between Russia and Ukraine. The Ukrainian electricity infrastructure was the target of a cyberattack in 2015 by a gang of hackers going by the name of "Sandworm," which resulted in severe outages. Malware was used in the extremely sophisticated attempt to seize control of vital infrastructure.

Although there were no fatalities as a result of the assault, it showed how vulnerable vital infrastructure is to them and underlined the possibility of using cyberwarfare as a weapon of aggression.

In addition, Russia has repeatedly disputed having any participation in the conflict in Eastern Ukraine and has charged the Ukrainian government with being the one who instigated it. Russia contends that it has only been supplying humanitarian aid to pro-Russian rebels in Eastern Ukraine who are battling an oppressive Ukrainian government for their freedom.

Both parties have used these strategies in online conflict. While Russia has disputed these allegations and charged Ukraine with initiating cyberattacks against Russian targets, the West has accused Russia of hacking into Ukrainian government organisations and crucial infrastructure. Additionally, both parties have been charged with using social media to disseminate misinformation and false information.



It is difficult to quantify how these strategies have affected how the conflict has turned out, but it is evident that both parties have been employing them as instruments to further their strategic goals. While cyberattacks have revealed the vulnerability of vital infrastructure and highlighted the need for stronger cyber security measures, misinformation has been used to sway public opinion and excuse actions.

Despite these challenges, there have been efforts to resolve the conflict through diplomatic means. The Minsk II agreement, signed in February 2015, was an attempt to bring about a ceasefire and a peaceful resolution to the conflict. However, the agreement has not been fully implemented and fighting continues in Eastern Ukraine.

As a result, combating the use of disinformation and cyberwarfare in the conflict between Ukraine and Russia necessitates a multifaceted strategy that includes fostering media literacy, enhancing cyber security measures, fostering international cooperation, encouraging responsible social media use, and assisting independent journalism. Governments, non-governmental groups, and the business sector can cooperate to stop the dissemination of false information and advance an informed and peaceful society.

In conclusion, the use of misinformation and cyber warfare has been a significant factor in the conflict between Ukraine and Russia. Both sides have used these tactics to achieve their strategic objectives and shape public opinion. It is important to recognize that other countries have also been involved in these activities. Ultimately, a peaceful resolution to the conflict can only be achieved through diplomatic negotiations and a commitment to finding common ground.

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