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Matoshri College of Engineering & Research Centre, Nashik

Eklahareshivar, Near Odhagaon, Opposite to Nashik-Aurangabad Highway, Nashik, Maharashtra 422105Contact: 0253-2406600/1/2/3

Website: engg.matoshri.edu.in/Email: matoshricoe.hr@gmail.com

Toll free No.:1800 233 6602

Vision

"To Establish Omnipotent Learning Centre Meeting the Standards to Evolve as a Lighthouse for the Society."

Mission

- Setting up state-of-the-art infrastructure
- Instilling strong ethical practices and values
- Empowering through quality technical education
- Tuning the faculty to modern technology and establishing strong liaison with industry
- Developing the institute as a prominent center for Research and Development
- Establishing the institute to serve a Lighthouse for the society

Quality Statement

"We, Matoshri College of Engineering & Research Center are committed to practice a system of Quality Assurance that inculcates quality culture, aiming at quality initiation, sustenance and enhancement of quality comprehensively ultimately leading the institute as Center of Excellence."

River Flood Forecast: Predicting the Reach of Inundation - Gauri Walve (BE IT)

Flooding is a severe natural disaster that threatens communities, infrastructure, and ecosystems. This project presents a real-time flood forecasting system using AI and computer vision to enhance disaster preparedness. The system captures live video streams from river cameras and processes them using advanced machine learning techniques to detect water flow speed, wave intensity, and rising water levels. By integrating AI-based analysis, it generates early warnings, enabling authorities to take preventive measures. The system utilizes Optical Flow analysis to calculate water speed, YOLOv8 for detecting and classifying wave intensity, and Edge Detection to monitor water levels. When predefined thresholds are exceeded, it triggers an alert system, providing real-time notifications through a user-friendly dashboard. The implementation requires cameras for video capture, a GPU for AI model processing, and stable network connectivity for real-time data transmission. It is developed using Python, OpenCV for image processing, TensorFlow/PyTorch for deep learning, and YOLOv8 for object detection. Despite its efficiency, the system faces challenges such as ensuring data accuracy, optimizing real-time processing, and maintaining scalability for multiple locations. Future enhancements may include integrating advanced AI models for improved accuracy, expanding geographic coverage, and incorporating weather data for more comprehensive flood predictions. This AI-driven system is a significant step toward minimizing flood risks and improving emergency response strategies.

Flood forecasting: https://en.wikipedia.org/wiki/Flood_forecasting

How AI is Redefining Creativity – Shinde Sejal (TE IT)

In the past, creativity was considered a uniquely human trait—inborn, emotional, and abstract. It was one of the last pillars of human capability that machines couldn't replicate. However, as artificial intelligence (AI) evolves, it's becoming clear that creativity is no longer solely the domain of humans. AI is not just a tool, but an active collaborator in the creative process. From AI-generated art and music to algorithmically written novels and even film production, AI is reshaping how we approach creative work. Initially, AI was used as a tool to enhance human creativity. Software like Photoshop or MIDI sequencers allowed artists to expand their craft digitally. But with generative AI models like OpenAI's GPT-4, DALL·E 3, and Sora, AI has evolved from assistance to creation. Writers can co-author works with AI, designers can quickly generate multiple concepts, and musicians can compose soundtracks using AI that mimics their style. AI is augmenting human creativity in ways that were once unimaginable, offering both speed and inspiration.

One of the most striking developments is how AI has shifted from being a passive tool to becoming an active creative partner. In industries like advertising and film, AI is now being used to brainstorm storyboards, draft scripts, and design visual aesthetics. In the literary world, AI models help authors break through writer's block or experiment with entirely new genres and styles. Even in fashion and architecture, AI-generated designs are introducing novel patterns and forms that challenge conventional thinking. These collaborations show that AI doesn't just assist—it inspires.

Perhaps one of the most transformative aspects of AI in the creative world is its ability to democratize access. Traditionally, creating high-quality content required years of training, expensive software, or access to professional studios. Now, platforms like Canva's Magic Design, Adobe Firefly, and Runway are empowering people with little to no formal background to produce professional-grade visuals, music, videos, and more. Educators can design engaging learning materials, small business owners can generate brand assets, and hobbyists can bring personal projects to life—all with just a few clicks.

This accessibility is changing who gets to be creative. It breaks down the barriers that once confined creative expression to professionals or those with specialized skills. At the same time, AI is drastically speeding up the creative process. Artists and designers can now produce dozens of concepts in the time it once took to create one. Writers can generate outlines, drafts, and revisions in minutes. This rapid iteration process allows for greater experimentation and refinement, leading to more polished final products and shorter production timelines.

AI does not—and likely cannot—replace the uniquely human elements of creativity. Emotional depth, intuition, lived experience, and cultural awareness remains central to meaningful artistic expression. Human creators are still needed to guide AI with vision, emotion, and ethical judgment, ensuring that creative work retains its authenticity and impact. As AI becomes a more prominent presence in creative industries, it also brings new challenges and questions. Who owns the rights to AI-generated content? Should creators disclose when they use AI? How do we maintain originality when many people rely on the same models or tools? Moreover, there are ethical concerns around deepfakes, misinformation, and plagiarism. Navigating these challenges will require new norms, updated laws, and a shared understanding of what responsible creative AI use looks like. Ultimately, the future of creativity is not about AI versus humans—it's about collaboration. Co-creation is becoming the new norm, where humans provide the inspiration and emotional core, and AI contributes speed, variety, and innovation. As technology continues to evolve, those who embrace this partnership will unlock unprecedented opportunities for expression and storytelling. The creative world is expanding—not replacing what came before, but redefining what's possible.

Computational creativity: https://en.wikipedia.org/wiki/Computational_creativity

Telangana's 400 Acre Green Oasis - Gaikwad Kalyani B. SE IT

Biodiversity is essential for the processes that support all life on Earth, including humans. Without a wide range of animals, plants and microorganisms, we cannot have the healthy ecosystems that we rely on to provide us with the air we breathe and the food we eat. Biodiversity is crucial for sustaining life on Earth, including human life. It supports essential ecosystem functions like clean air, food production, and climate regulation. In a world where biodiversity is increasingly under threat, local efforts to preserve and restore natural ecosystems have never been more vital. One shining example of this is Telangana's ambitious 400-acre green oasis a transformative project that reflects how regional initiatives can play a powerful role in protecting biodiversity and enhancing human well-being. In early 2025 , the telangana government initiated a plan to auction 400 acres of land in the Kancha Gachibowli area of hydrerabad's seritingampally mandal. This prime land ,valued at approximately Rs. 80 crore is strategically locted near key IT and residential hubs, including Hitec city and the financial hubs district. In biodiversity zone home to spotted deer, wild beears , peacocks, and many bird species. Kancha Gachibowli is one of Hyderabad's last remaining urban forests. It is rich in biodiversity, home to numerous bird, mammal and reptile species, and beautiful rock formations. Protests against the government's decision to auction the land off stem from the need to preserve existing carbon sinks in the city. Urban forests such as Kancha Gachibowli help regulate local climates by providing shade, reducing temperatures, and increasing humidity.

In April 2025, the Telangana government's plan to clear 400 acres of forested land near the University of Hyderabad (UoH) for an IT park sparked massive protests and legal action, with the Supreme Court intervening to halt the destruction. Telangana's 400-acre green oasis is more than a regional achievement—it's a powerful reminder that environmental change can begin at the local level. In a time when the planet faces mounting ecological challenges, such initiatives serve as beacons of hope. By restoring ecosystems, enhancing biodiversity, and involving communities, Telangana has created a model that balances development with sustainability. If more regions follow this path, the collective impact could help secure a greener, healthier future for generations to come.

Telangana: https://en.wikipedia.org/wiki/Telangana

Synthetic Realities: Building Worlds with AR, VR & the Metaverse

-Sakshi Shivaji Bhalerao. (SE IT)

Introduction –

The 21st century is witnessing the rise of a new dimension of reality—one not bound by physical laws or tangible limitations. Synthetic realities, powered by technologies like Augmented Reality (AR), Virtual Reality (VR), and the Metaverse, are enabling people to design, enter, and interact with immersive digital environments. This isn't just a technological upgrade—it's a complete reinvention of human perception, communication, and creativity. In synthetic spaces, anything imaginable can become real. For college students stepping into the future of work and innovation, understanding these realities is not just relevant— it's revolutionary.

AR allows digital content to overlay the real world—enhancing it without replacing it. Whether it's navigation directions appearing on your car windshield, or anatomy lessons that project organs in 3D on your desk, AR bridges the digital and physical. VR, on the other hand, creates entirely new environments—fully immersive, interactive digital worlds where users can work, play, learn, or create without physical limitations. The Metaverse connects all these experiences into shared, persistent digital spaces that support identity, economy, and interaction. This blend of realities offers not just new tools—but a new way of existing.

The defining feature of synthetic realities is immersion. Through headsets, glasses, haptic gloves, and spatial sound, users are enveloped in environments that feel alive and responsive. These systems are interactive—responding in real-time to gestures, gaze, voice, and motion. Many platforms now support multi-user experiences, allowing people to socialize, collaborate, and co-create inside virtual worlds. These realities are also dynamic, evolving with AI input, user interaction, and integrated sensors that pull in real-world data.

The Metaverse takes these capabilities further by offering persistence—a shared virtual world that continues to evolve even when users log out. It includes avatars, digital economies, and customizable environments that reflect the personalities and ambitions of their creators. In short, synthetic realities are no longer limited simulations—they are dynamic, living systems where human creativity can flourish with few constraints.

The significance of synthetic realities goes beyond entertainment. In education, students can now explore historical battles from the frontlines, walk through DNA strands in 3D, or simulate chemical reactions without risk. Medical professionals can perform virtual surgeries before operating on real patients. Engineers can prototype products in immersive environments, reducing errors and accelerating design cycles.

These realities also break geographical and physical barriers, allowing people from across the globe to work together in shared virtual spaces. In a world still adjusting to remote learning and remote work, synthetic realities offer a much-needed upgrade—replacing flat video calls with spatial, natural interaction. They also open doors for people with physical disabilities to engage in experiences that were previously inaccessible. Simply put, they democratize possibility.

Synthetic realities are defined by a few core properties:

Immersion – They provide a deep sense of presence, making users feel like they're “inside” the experience.

Interactivity – Users can manipulate and affect the environment in real time using gestures, controllers, or even voice.

Spatial Awareness – The systems track real-world movement and adjust the virtual world accordingly. **Persistence** – In metaverse platforms, the digital environment continues to evolve whether or not users are present.

Multi-Sensory Integration *– Visuals, audio, and increasingly, touch and smell are combined to create lifelike sensations.*

Cross-Platform Access – Experiences are becoming accessible via headsets, smartphones, desktops, and smart glasses.

These properties combine to form environments that are not just visually impressive, but psychologically convincing—able to train, entertain, and transform behavior.

The future of synthetic realities is limitless. With advancements in brain-computer interfaces, users may one day navigate virtual spaces using thought alone. Hyper-realistic avatars will mimic facial expressions in real time, powered by AI and biometric data. As 5G and cloud computing evolve, latency will disappear, enabling real-time interaction at a planetary scale.In education, universities may offer fully virtual campuses with AI-powered tutors. In business, companies may operate entirely in virtual HQs, hiring employees from any location without physical offices. Even cultural events—weddings, concerts, elections—could be hosted in immersive digital spaces that transcend physical borders.

With power comes vulnerability. Synthetic realities pose new challenges in cybersecurity, privacy, and mental well-being. Avatar impersonation, virtual harassment, and biometric data theft are real threats. Users often share sensitive data through gaze tracking, motion analysis, and voice commands—making it crucial to secure platforms with encryption, decentralized identity systems, and transparent governance. Mental health is another concern. Excessive immersion can blur the line between real and virtual, leading to addiction, social detachment, or psychological distress. Designers and developers must build with ethical intent, incorporating boundaries, safety zones, and age-appropriate environments. Ensuring synthetic spaces are as safe as they are exciting is the next major challenge.

The advantages of synthetic realities are wide-ranging and transformative: Education becomes more engaging and effective through experiential learning. Healthcare benefits from risk-free training and mental health applications.

Design & Engineering evolve with instant 3D prototyping and collaboration. Remote Work becomes immersive, collaborative, and location-independent. Social Interaction becomes inclusive and creative with limitless avatars.

Entertainment transforms into participation rather than observation.

These benefits not only improve current systems—they unlock entirely new modes of living and learning that were never possible before.

Google ARCore & Apple ARKit: Power thousands of AR apps from furniture placement to stargazing.

Meta's Horizon Worlds: A VR social space where users can meet, build, and host events.

Snapchat Lenses: Popular AR filters that add playful and useful layers to daily life.

Roblox Education: A gaming platform teaching kids to code while building their own virtual worlds.

Each of these examples reflects a growing trend: the blending of the digital with the physical to enhance how we interact, learn, and express ourselves.

Synthetic realities are not a passing trend—they are the next paradigm. They offer us the freedom to explore, to create, and to connect in ways the real world often restricts. But they also demand responsibility. As the architects of tomorrow's realities, we must ask hard questions, build with empathy, and ensure that these digital worlds serve humanity—not escape from it.

For college students and emerging innovators, the message is cle it's yours to shape. ar: Don't just witness the rise of synthetic realities. **Be the one who builds them.** The future is immersive, interactive, and infinite—and it's yours to shape.

Virtual reality: https://en.wikipedia.org/wiki/Virtual_reality

The Role of APIs in Modern Software Architecture --Nandini Dipak Marathe (SE IT)

Application Programming Interfaces (APIs) play a critical role in modern software development, enabling seamless communication between disparate systems and enhancing the scalability, modularity, and security of applications. This research investigates the impact of APIs on software architecture, focusing on their use in facilitating interoperability across distributed environments. Using a mixed-methods approach, the study combines a literature review, a survey of 50 software developers, and case studies from industry leaders such as Amazon Web Services (AWS), Google, and Facebook. The findings reveal that REST APIs are the most widely used (75%), while Graph QL is gaining popularity for its ability to optimize data retrieval in complex systems. Security challenges, particularly vulnerabilities in REST APIs, were highlighted by 35% of developers, underscoring the need for stronger authentication and encryption methods like OAuth. This study also explores how APIs foster innovation by enabling third-party integrations, driving ecosystem growth in cloud computing and other sectors. The research concludes that while APIs are vital for the future of software development, addressing security risks and improving API management practices will be essential for maximizing their

Why are they important?

APIs facilitate communication and data sharing between various systems, allowing developers to leverage existing functionalities and build upon them, rather than starting from scratch.Benefits of API-Driven Architecture:

Interoperability: APIs enable different systems to work together seamlessly, regardless of their underlying technologies.

Reusability: APIs allow developers to reuse existing functionalities and components, saving time and resources.

Scalability: API-driven architectures are inherently more scalable, as different components can be scaled independently.

Innovation: APIs foster innovation by allowing developers to create new and innovative applications and services by combining.

Examples of API Usage

Embedding maps in a mobile app: APIs allow developers to integrate map services from providers like Google Maps or Mapbox. Integrating chatbots for customer support: APIs enable developers to connect their applications with chatbot platforms like Dialog flow or Rasa. Providing personalized recommendations: APIs allow developers to access data and algorithms from Amazon.

Popular API Architectures and Protocols

REST (Representational State Transfer): REST is a popular architectural style for designing APIs, known for its simplicity and ease of use.

GraphQL: GraphQL is a query language for APIs that allows clients to request only the data they need, improving performance and efficiency.

gRPC: gRPC is a high-performance, open-source framework for building APIs, particularly well-suited for microservices architectures.

SOAP (Simple Object Access Protocol): SOAP is a protocol for exchanging structured data between applications, often used in enterprise environments.

WebSockets: WebSockets provide a way for bi-directional, real-time communication between a client and a server, ideal for applications requiring constant updates.

Challenges and Considerations

Security:

Protecting APIs from unauthorized access and malicious attacks is crucial.

Documentation:

Clear and comprehensive API documentation is essential for developers to understand and use APIs effectively.

Version Control:

Managing API versions and ensuring backward compatibility is important to avoid breaking existing applications.

Performance:

Optimizing APIs for performance is crucial, especially for applications that handle large amounts of data.

API Design:

Designing APIs that are easy to use, understand, and maintain is essential for long-term success.

The Future of APIs

API-First Development:

The trend towards API-first development, where APIs are designed before the underlying application, is gaining traction.

API Gateways:

API gateways are becoming increasingly important for managing and securing APIs, providing a single point of entry for API requests.

API Management Platforms:

API management platforms offer tools for designing, publishing, securing, and monitoring APIs.

Microservices Architecture:

APIs play a crucial role in microservices architectures, enabling the communication between different microservices.

AI-Powered APIs:

AI-powered APIs are emerging, enabling developers to integrate AI functionalities into their applications.

IoT APIs: APIs are essential for connecting and managing IoT devices and data.

GraphQL, while less widespread, is growing in popularity because of its flexibility in querying specific data. Banks (2020) points out that GraphQL's ability to avoid over-fetching data makes it more efficient for systems with complex, nested data structures, such as Facebook's platform. This trend is evident from the 20% of GitHub repositories using GraphQL. Security remains a major concern in API development, with 35% of survey respondents citing it as their biggest challenge. REST APIs, though simple to implement, are often vulnerable to injection attacks and other security threats due to insufficient encryption and weak authentication mechanisms. Richardson and Amundsen (2013) explain that developers are increasingly adopting OAuth and token-based authentication to mitigate these vulnerabilities.

SOAP APIs, while providing stronger security measures like WS-Security and SSL/TLS, have seen a decline in adoption due to their complexity. However, they remain in use in industries that prioritize robust security over simplicity, suchas financial services and healthcare.

APIs also drive innovation by enabling third-party integrations. Owens and Marr (2021) discuss how public APIs from platforms like Google and AWS empower developers to build new services that extend the core functionality of these platforms. For example, AWS APIs allow developers to manage cloud infrastructure without dealing with the complexities of the underlying hardware, leading to scalable and efficient cloud-based solutions.

Benefits and challenges of implementing APIs

APIs accelerate development by providing pre-built functionalities, enhancing efficiency. Developers can leverage existing services, reducing the need to build everything from scratch. This promotes code reuse and consistency across applications.

However, security is a major challenge when implementing APIs. They can be vulnerable to attacks due to exposed data and functionalities. Robust measures like encryption, authentication, and authorization are essential to protect API integrations.

Ensuring proper documentation and developer support is also critical. Poor documentation can hinder integration and adoption. Comprehensive guides, examples, and SDKs are crucial for smooth integration and fostering a thriving developer community.

Performance optimization is crucial when implementing APIs. High usage can strain servers, leading to delays and outages. Efficient API design, caching mechanisms, and scalable infrastructure are necessary to maintain optimal performance.

Despite these challenges, the benefits of APIs far outweigh the drawbacks. They enable interoperability, modularity, and scalability in modern software architecture. By investing in robust API strategies, organizations can unlock new opportunities for innovation and growth.

Emerging trends and best practices in API development

GraphQL is gaining traction for its flexibility in data querying. It allows clients to request specific data, reducing over-fetching and under-fetching. This approach optimizes performance and bandwidth usage.

API-first development prioritizes API design before application development. By focusing on the API contract first, developers ensure scalability, consistency, and seamless integration across multiple platforms and services. API-first strategies promote reusability and faster development cycles.

Automating API security is becoming increasingly important as APIs become more prevalent. Automated security testing and monitoring help identify vulnerabilities and protect against evolving threats. Implementing robust authentication, authorization, and encryption mechanisms is crucial for safeguarding sensitive data.

Serverless APIs are on the rise, allowing developers to build and deploy APIs without managing server infrastructure. Serverless platforms handle scalability, availability, and resource management, enabling developers to focus on writing business logic. This approach reduces operational overhead and increases agility.

API monetization is emerging as a viable business model. Many companies are exposing their APIs as products, offering them through pay-per-use or subscription-based models. This trend opens up new revenue streams and fosters innovation by enabling third-party developers to build applications on top of existing services.

Metaverse: https://en.wikipedia.org/wiki/Metaverse

Blockchain Technology -Chaitanya Marathe(SEIT)

The blockchain technology was described in 1991 by the research scientist Stuart Haber and W. Scott Stornetta.

In 2009 Satoshi Nakamoto made bitcoin with the help of blockchain a blockchain is a peer-to-peer distributed database that maintained a continuously growing list of order records called blocks.

Blockchain is the Decentralized technology.

2009 - Launch of Bitcoin: In January 2009, the Bitcoin network was launched with the release of the first Bitcoin software and the mining of the first block, known as the "genesis block." This marked the beginning of the practical implementation of blockchain technology.

2013 - Ethereum and Smart Contracts: Ethereum, proposed by Vitalik Buterin, went beyond Bitcoin's capabilities by introducing a blockchain platform supporting smart contracts. This allowed developers to build decentralized applications (Dapps) on the Ethereum blockchain, expanding the use cases for blockchain technology.

Subsequent Developments: Numerous blockchain projects and cryptocurrencies emerged, each with its variations in consensus mechanisms, governance models, and use cases. These include Ripple, Litecoin, and more recently, platforms like Polkadot, Cardano, and Solana.

BLOCKCHAIN TECHNOLOGY

Blockchain is a set to radically change our way of life in coming decades. That is why many authors like Marc Andreessen, consider it consider it ”one of the most important technology since the advent of the internet Based on a peer to peer(P2P)topology blockchain is a distributed ledger technology that always data to be stored globally on thousands of servers -while letting any one on the network see everyone else entries in real time.

In other words blockchain can be describe as a global online database, that anyone, everywhere in the world, with an internet connection, can use. As a consequence, a blockchain dos not belong to anyone, and it stores information permanently across a network of personal computers.

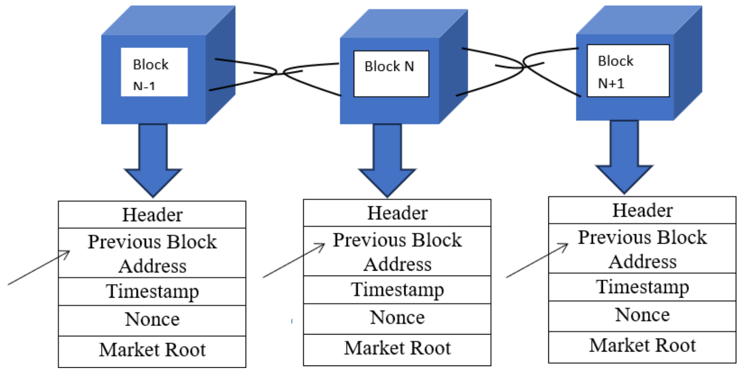


Fig.1.Blockchain

A typical blockchain system consists of several layers that work together to ensure the integrity and efficiency of transactions. These layers include:

1. Hardware Layer:

   This layer includes the physical devices, such as computers and servers, that support the blockchain network. It includes the hardware infrastructure, such as mining equipment, that is used to validate transactions and add them to the blockchain. Blockchain technology typically uses a Peer-to-Peer (P2P) network of computers to calculate, validate, and record transactions in an ordered format in a shared ledger.

2. Data Layer:

A blockchain's data structure is expressed as a linked list of blocks in which transactions are ordered. The data structure of the blockchain consists of two fundamental elements: pointers and a linked list. A linked list is a list of chained blocks with data and pointers to the previous block. In order to guarantee the security and integrity of the data stored there, transactions are digitally signed on the blockchain. Anybody with the public key can validate the signer of a transaction that has been signed using a private key. Because the encrypted data is also signed, the digital signature ensures data integrity and verifies information tampering. Data encryption prevents the detection of the information.

The sender's or owner's identity is also protected by a digital signature. The structure of a block on a blockchain is determined by the data layer.

3. Network Layer:

The network layer, commonly referred to as the P2P layer, is responsible for inter-node communication. Discovery, transactions and block propagation are all handled by the network layer. Propagation layer is another name for this layer. This P2P layer ensures that nodes can find one other and interact, disseminate and synchronize to keep the blockchain network in a legitimate state. A P2P network is a computer network in which nodes are distributed and share the workload of the network to achieve a common purpose. The blockchain's transactions are carried out by nodes.

4. Consensus Layer:

The consensus layer is essential for blockchain platforms to exist. The consensus layer is the most necessary and critical layer in any blockchain, whether it is Ethereum, Hyperledger or another. The consensus layer is in charge of validating the blocks, ordering them and guaranteeing that everyone agrees.

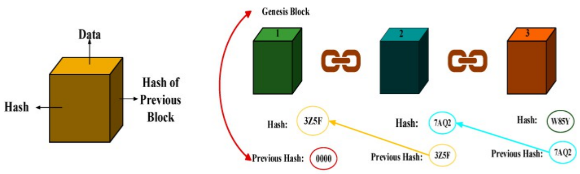
5. Application Layer:

Smart contracts, chain code and decentralized applications (Dapps) make up the application layer. The application layer protocols are further subdivided into the application and the execution layers. The application layer comprises the programs that end-users utilize to communicate with the blockchain network. Scripts, application programming interfaces (APIs), user interfaces and frameworks are all part of it. The blockchain network serves as the back-end technology for these applications, and they communicate with it via APIs. Smart contracts, underlying rules and chain code are all part of the execution layer.

Hashing

Hashing in blockchain implies the transformation of input data into a fixed size output through a specific algorithm. It establishes data integrity and averts fraudulent transactions. At the core of this process are hash functions, which create unique digital fingerprints for data. The output, known as a hash value, is unique to the input data, even if the input data is altered slightly, the hash value will be drastically different. This property of hash functions makes them an indispensable component of various data structures, including blockchain technology, where each block contains the hash of the previous block.

Different hashing algorithms like SHA-256 for Bitcoin and Script for Litecoin are available, each boasting unique properties and applications. A good hash function is essential for maintaining the security and integrity of the blockchain, as it



(a) (b)

guarantees that unique hashes are generated for different inputs, ensuring the authenticity of transactions and preventing tampering.

Blockchain: https://en.wikipedia.org/wiki/Blockchain

1. Soft Robotics in Biomedical Applications-Bhangale J.H

Soft robotics are transforming healthcare with flexible, muscle-like components. These devices mimic natural movements using elastomers and hydrogels. 2025 has seen their use in prosthetics and internal surgeries. Hospitals now deploy robotic grippers that adapt to tissue textures. Research focuses on AI-integrated control systems. Materials such as liquid crystal elastomers provide adaptive stiffness. Startups are developing glove-like exosuits for stroke patients. Testing is underway for robotic catheters. These robots reduce tissue damage and speed up recovery. Japan and Germany lead in clinical adoption. FDA approval processes have also evolved. Students are exploring low-cost 3D-printed prototypes. Sensors integrated into actuators help with precision. This technology promises safer, human-friendly robots. The future includes brain-controlled soft limbs. Partnerships between hospitals and labs are increasing. 3D printing simplifies customization. Ethical concerns about robotic autonomy remain. Sustainability in soft material production is also being addressed.

Ref **Nature Reviews Materials - Biomedical Applications of Soft Robotics** URL:https://www.nature.com/articles/s41578-018-0022-y

2. Hydrogen-Powered Engines- *KADVE PRATIK BALASHAEB*

Hydrogen engines are gaining attention as clean alternatives to fossil fuels. Unlike fuel cells, these engines combust hydrogen directly. Major automakers released models in 2025 with dual-fuel systems. Hydrogen emits only water vapor, reducing pollution. Safety protocols include advanced flame sensors and leak detectors. Cylinder design modifications address hydrogen’s low ignition energy. Fuel storage remains a key challenge. New carbon fiber tanks improve containment. Combustion stability has improved via real-time ECU mapping. Engine efficiency reaches 45% in recent trials. India launched a bus fleet using this tech. Refueling infrastructure is still in early stages.

Hydrogen can be generated from renewables. Turbulent mixing techniques enhance power output. Automotive suppliers are investing in hydrogen R&D. Emissions regulations are pushing hydrogen innovation. Educational institutes are offering specialized courses. Standardization of components is underway. Public awareness remains low but growing. Hydrogen combustion may complement electric mobility.

Toyota Global – Hydrogen Fuel Cell Vehicles
https://global.toyota/en/mobility/mirai/

3. Additive Manufacturing in Aerospace- *Bodake Ranjit Valiba*

3D printing has revolutionized aerospace manufacturing. Titanium and carbon composites are now printed with precision. Weight savings improve fuel efficiency in aircraft. Topology optimization customizes internal geometries. Jet engine parts are being 3D printed and tested. Companies like Boeing are using this at scale. Certification processes are evolving to match innovation. On-site printing reduces lead times significantly. This supports defense applications during field deployment. Printed parts are now flight-certified. AI aids in defect detection during printing. Layer-by-layer quality control ensures reliability. Additive manufacturing supports complex heat exchanger designs. New alloys improve durability and fatigue resistance. Design freedom allows multi-functional parts. Future space missions plan to 3D print on Mars. Recycling powder materials makes it sustainable. Student teams are building drone frames via 3D printing. Education is incorporating CAD and slicing software. Costs are dropping as printers become more accessible.

Additive Manufacturing – Wikipedia
General overview of 3D printing technologies, including applications in aerospace.
https://en.wikipedia.org/wiki/Additive_manufacturing

Applications of 3D Printing – Wikipedia
Covers how different industries (including aerospace) utilize 3D printing.
https://en.wikipedia.org/wiki/Applications_of_3D_printing

4. AI-Based Predictive Maintenance- ***Chaure aniket bapurao***

Predictive maintenance uses AI to forecast machinery failures. Sensors collect vibration, temperature, and noise data. Algorithms detect patterns before breakdowns occur. It reduces downtime and extends equipment life. Mining and energy sectors are adopting it widely. Machine learning models refine predictions with real data. Real-time dashboards support remote monitoring. Fault diagnosis algorithms identify component-level issues. Cloud integration enables centralized analysis. Condition-based alerts improve safety. Predictive maintenance is more cost-effective than preventive. Training datasets are growing through IoT devices. Edge computing enables local data processing. Technicians receive automated maintenance schedules. Integration with ERP systems streamlines operations. Research includes adaptive learning for rare failures. Drone inspections feed data into models. Student projects use Arduino for small-scale setups. ROI improves with accurate fault forecasting. Companies report 30% maintenance cost savings. Cybersecurity of data channels is a concern.

Predictive Maintenance – Wikipedia

https://en.wikipedia.org/wiki/Predictive_maintenance

5. Smart Materials for Vibration Control-Sham Ghuge

Smart materials actively control vibrations in structures. Piezoelectric materials convert stress into electric signals. Magnetorheological fluids change viscosity with magnetic fields. These materials are used in automotive suspension systems. Tall buildings use them to absorb wind loads. Bridges apply them in active damping systems. Military aircraft use adaptive wings with embedded sensors. 2025 saw new polymers with tunable stiffness. Research shows 40% reduction in resonance amplitudes. Real-time control systems adjust damping coefficients. Piezo patches are embedded in rail tracks. Machine tools use smart mounts for precision. Simulation software models dynamic response behavior. Space telescopes use these for vibration isolation. Smart composites reduce noise in passenger vehicles. Industrial robots use vibration control for accuracy. Thermal stability remains a challenge for long-term use. Student kits demonstrate vibration absorption in cantilever beams. Costs are reducing with mass production. Industry-academia collaboration is key to innovation.

REF :Smart Materials in Active Vibration Control | SpringerLink
URL: https://link.springer.com/chapter/10.1007/978-3-642-27791-7_5

CIVIL ENGINEERING ARTICLES

1. 3D Printed Structures Using Recycled Materials-Vrushali Bodke

3D printing in civil engineering is transforming sustainable construction. Recycled plastic, fly ash, and industrial waste are being converted into printable building materials. 2025 saw the completion of India's first 3D printed housing colony using 70% recycled content. Layer-by-layer construction reduces material waste and labor costs. Structures are printed directly on site, reducing transportation emissions. Startups are exploring mobile printers for rural deployment. Reinforcement using basalt or glass fiber rods ensures structural integrity. Smart sensors are embedded during printing for real-time monitoring. Engineers perform strength tests for vertical and lateral loads. The technology allows rapid shelter construction post-disaster. Regulatory bodies are drafting 3D construction guidelines. Challenges remain in waterproofing and insulation. Urban projects incorporate artistic facades directly into printed walls. Countries like UAE and China are racing toward 3D smart cities. Universities offer specialized courses in construction robotics. Startups partner with waste management firms for raw materials. Environmental audits show 30% lower carbon footprint. Thermal imaging and drones assist in quality assurance. 3D concrete mixes are tailored for local climate needs. This approach democratizes home ownership and lowers urban housing costs.

3D Printing and Recycled Materials Dassault Systèmes:
https://www.3ds.com/make/solutions/blog/3d-printing-and-recycled-materials

2. Smart Cities and Digital Twins-Rahul Kshatriya

Smart cities use technology to enhance quality of life, infrastructure, and governance. Digital twins are real-time 3D models of urban environments. These twins mirror city utilities, transport, and environmental data. In 2025, Pune implemented digital twins for traffic and water systems. IoT sensors on roads, pipes, and buildings feed live data. Urban planners simulate traffic flow and drainage models instantly. AI optimizes energy usage across city zones. Citizens can interact with city models via apps. AR interfaces allow planners to visualize underground networks. Digital twins improve disaster response by predicting failure points. Maintenance schedules are automated using AI predictions. Smart lampposts adjust brightness based on human presence. Waste collection routes are optimized using fill-level sensors. Telecom towers monitor air pollution and sound levels. Drone surveillance maps illegal construction in real-time. Smart meters track electricity and water usage. Cities are offering open-data platforms to researchers. 5G networks enable seamless data exchange. Public-private partnerships fund most initiatives. Local governments upskill staff in smart tech. Standards are evolving for inter-platform compatibility.

How digital twins can make smart cities better. Retrieved from https://www.pwc.com/gx/en/issues/data-and-analytics/industrial-internet-of-things/digital-twin-smart-cities.html

3. Earthquake Resistant Materials and Designs-Pramod Sathe

New seismic technologies aim to make cities disaster-resilient. 2025 saw the adoption of shape-memory alloys in high-rise joints. These materials revert to original form after deformation. Base isolation systems use flexible pads between buildings and foundations. High-performance fiber-reinforced concrete withstands large cyclic stresses. Retrofitting old buildings with carbon-fiber wraps is increasing. Damping systems using magnetic fluids reduce oscillations. Research focuses on hybrid energy-dissipating frames. Modular construction allows faster quake-resistant assembly. India updated seismic zoning maps based on new data. Low-cost bamboo-reinforced houses are promoted in rural zones. Japan uses AI to simulate aftershock impact on infrastructure. Smart sensors alert when ground motion exceeds safe limits. Tilt sensors in bridges offer early damage warnings. Public education campaigns train citizens in response drills. Universities are building shake tables for experimental tests. Innovative footings float structures on granular layers. Urban policy mandates compliance with BIS 2025 quake codes. Mobile apps guide quick evacuation via AR routes. Insurance firms offer discounts for certified structures. Earthquake resilience is now part of building valuation.

Earthquake-resistant structures. (2025, March 17). In Wikipedia. https://en.wikipedia.org/wiki/Earthquake-resistant_structures[](https://en.wikipedia.org/wiki/Earthquake_engineering_structures)

4. Green Roofs and Vertical Farming in Urban Buildings- Hiralal Pawar

As urban land shrinks, buildings grow vertically and greener. Green roofs reduce heat islands and purify air. 2025 designs integrate hydroponic systems into building exteriors. Rooftop vegetable gardens feed residents and reduce food miles. Water from AC condensate is reused for irrigation. Lightweight soil substitutes like coir and perlite prevent overloading. Modular planters are attached to building facades. Vertical farming uses LED grow lights and nutrient mist. Smart irrigation uses moisture sensors and weather data. Urban farms grow lettuce, herbs, and strawberries efficiently. Universities monitor plant health using AI imaging. Rooftop composters close the nutrient loop sustainably. India's Green Building Code now includes rooftop farming guidelines. Corporates grow food for staff in canteen towers. Green roofs reduce cooling load by 20-30%. Bees and butterflies return to cities via rooftop gardens. Rainwater harvesting tanks feed vertical green walls. Façade-integrated farms are tested in SEZ buildings. Construction uses anti-root waterproof membranes. Schools include vertical farming in environmental curricula. Urban food policies support building-scale agriculture.

Green roof: https://en.wikipedia.org/wiki/Green_roof

5. AI for Structural Health Monitoring ***Mahadik Pooja Babasaheb***

Structural Health Monitoring (SHM) uses sensors and AI to detect infrastructure damage. In 2025, SHM is mandatory for critical bridges and public buildings. Strain gauges, accelerometers, and tiltmeters track behavior under loads. Data is transmitted wirelessly to cloud platforms. AI analyzes this data to predict cracks or fatigue failures. Machine learning improves model accuracy with each event. Drones scan surfaces for corrosion and misalignment. Fiber optic sensors embedded in concrete offer continuous monitoring. Early warning systems shut down bridges before catastrophic failure. Civil engineers access dashboards for real-time assessment. India's railways deploy SHM on aging overpasses. 3D scanners track deformation in tunnels and dams. AI models differentiate normal wear from early damage. Public-private consortia maintain national infrastructure health databases. Students learn SHM with simulation software and sensors. Mobile apps notify engineers of anomalies instantly. SHM data informs smart city maintenance planning. AI recommends retrofit solutions before inspections. Remote locations benefit from satellite data integration. Costs are dropping with sensor mass production. SHM extends life of assets and enhances safety.

Vertical farming: https://en.wikipedia.org/wiki/Vertical_farming

ELECTRICAL ENGINEERING ARTICLES

1. Smart Grids and AI-Based Load Balancing - Pekhale Jay Anil

Smart grids in 2025 are powered by artificial intelligence for load optimization. They integrate solar, wind, and conventional energy sources in real-time. AI forecasts energy demands using weather and consumption patterns. Load shifting reduces peak hour strain on transmission lines. Smart meters provide consumption feedback to both users and suppliers. Decentralized control centers enhance system resilience. Microgrids offer localized power autonomy in remote areas. AI algorithms reroute power during faults instantly. Smart transformers maintain voltage and frequency stability. Demand response programs reward energy-efficient behavior. Blockchain is tested for peer-to-peer energy trading. Urban areas use EVs as temporary energy reservoirs. Grid digital twins simulate future faults and test responses. Renewable fluctuations are mitigated via AI-driven battery storage. Smart home appliances adjust behavior based on grid signals. Cybersecurity tools are upgraded to prevent grid hacking. Education institutes use simulation tools for smart grid training. Rural electrification benefits from modular smart microgrids. Machine learning enhances predictive maintenance in grid components. Policy frameworks now support AI in energy governance.

Smart Grids: https://en.wikipedia.org/wiki/Smart_grid

2. Wireless Power Transfer and EV Charging- *Akshay sharad shelke*

2025 marks breakthroughs in wireless EV charging. Inductive coils embedded in roads charge vehicles in motion. Static pads charge EVs in parking lots without cables. Magnetic resonance improves efficiency up to 92%. Automakers include inbuilt wireless receivers in EVs. Urban buses use charging lanes at stops. Charging time reduces significantly with smart load management. Standardized coil architecture supports interoperability. Power levels range from 3 kW to 350 kW. Public trials show lower maintenance costs than plug-in systems. Smart billing integrates charging into traffic apps. AI predicts optimal charging schedules and routes. Research explores high-frequency power transmission safety. Wireless charging is now available for drones and scooters. Retail malls and hotels offer premium wireless spots. Dynamic charging supports uninterrupted logistics transport. Universities simulate charging in moving convoy systems. EMC shielding ensures no interference with medical devices. Solar-powered pads reduce dependence on fossil grids. Government incentives boost wireless EV station installations. The future aims for seamless, contactless vehicle charging everywhere.

Wireless Power Transfer: https://en.wikipedia.org/wiki/Wireless_power_transfer

3. Supercapacitors in Energy Storage- ***Khelukar Mansi Madhukar***

Supercapacitors are bridging the gap between batteries and traditional capacitors. They offer high power density and rapid charging. 2025 applications include regenerative braking in electric buses. Graphene-based electrodes enhance storage capacity and lifespan. Hybrid supercapacitors now store over 100 Wh/kg. Used in energy-harvesting wearable devices and medical implants. Factories use them for high-speed actuator control. Electric trains benefit from rapid charge-discharge cycles. Supercapacitor banks support solar farms during fluctuations. Their lifespan exceeds 1 million charge cycles. Universities develop AI to monitor charge cycles and failure prediction. Supercapacitors reduce dependency on rare-earth battery materials. Aviation industries use them for emergency power. Startups offer modular supercapacitor packs for home systems. Temperature-resistant designs extend usability in extreme climates. Charging times are under 5 minutes for small EVs. Sustainable production methods use coconut shell carbon. R&D focuses on flexible and printable forms. Integration with IoT devices enhances autonomous operations. India promotes local manufacturing via energy missions.

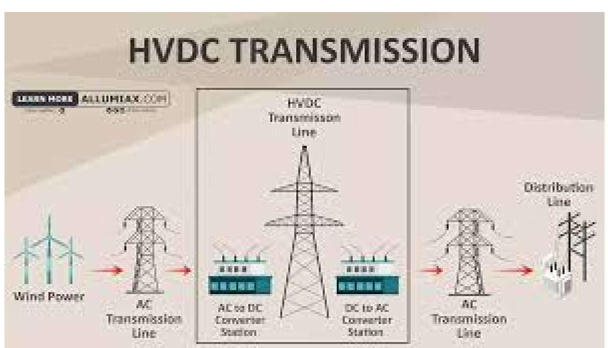
Electric Vehicle Charging: https://en.wikipedia.org/wiki/Electric_vehicle_charging

Supercapacitor: https://en.wikipedia.org/wiki/Supercapacitor

4. High Voltage DC (HVDC) Transmission Systems- ***Sangle Rani sharad***

HVDC systems revolutionize long-distance power transmission. In 2025, HVDC lines connect solar farms in Rajasthan to major cities. Losses are lower than in traditional AC systems. Converter stations now use silicon carbide-based devices. Voltage ratings exceed 800 kV for bulk transmission. Offshore wind farms connect to the mainland via HVDC. China and Europe lead in HVDC expansion. Compact converter stations suit urban locations. AI monitors line stability and auto-corrects phase imbalance. Cables are buried underground to avoid visual pollution. Submarine HVDC lines power island communities. HVDC is ideal for intercontinental power exchange. Hybrid AC/DC grids offer flexibility and backup. India launched the largest bi-directional HVDC line in 2025. Transmission tower designs are optimized for wind resistance. Remote monitoring reduces operational labor. Protection systems use AI fault classifiers. HVDC supports large-scale integration of renewables. Grid-forming converters aid black start capabilities. Courses in HVDC are now part of electrical curriculums.

High-voltage direct current: https://en.wikipedia.org/wiki/High-voltage_direct_current



5. Internet of Things (IoT) in Power Systems - ***Gangurde Rahul Sunil***

IoT is transforming the way we manage electrical infrastructure. Smart sensors are deployed across power plants and substations. They monitor temperature, voltage, and humidity in real-time. In 2025, utility companies use IoT for remote diagnostics. Smart poles adjust lighting based on pedestrian movement. Wearable IoT devices ensure worker safety in high-voltage zones. Predictive maintenance is driven by continuous sensor data. Grid health is displayed on interactive dashboards. IoT ensures fault localization within seconds. Substations are controlled via mobile apps. Power theft is reduced through anomaly detection. Home energy management is enhanced via IoT plugs. AI agents respond to sensor alerts instantly. Cloud platforms manage terabytes of sensor data. Smart thermostats adapt to user behavior patterns. IoT nodes are powered by energy-harvesting techniques. Electric meters now send real-time usage reports. Government policies support nationwide IoT rollout in grids. University labs simulate smart grid scenarios with IoT kits. Cybersecurity layers protect sensor data and actuation commands. The result is a smarter, faster, and more responsive power network.

Internet of Things: https://en.wikipedia.org/wiki/Internet_of_things

ELECTRONICS AND TELECOMMUNICATION ENGINEERING ARTICLES

1. 6G Technology and Beyond- *Thoke Khushali Sumersing*

6G is the frontier of mobile communication in 2025, promising data rates up to 1 Tbps. It builds on terahertz frequencies for ultra-low latency. Real-time holographic communication becomes possible. AI integration automates signal optimization and fault recovery. Satellites form the backbone for remote 6G access. Quantum cryptography enhances data security across mobile networks. 6G-enabled wearables monitor health parameters live for remote diagnostics. Edge computing nodes reduce dependence on centralized servers. Research continues on radiation safety and energy consumption. Smart cities leverage 6G for sensor networks and intelligent traffic control. Robotics and autonomous vehicles coordinate via 6G. Telecom firms invest in hybrid fiber-6G towers. Academic institutions build testbeds with AI-powered base stations. High-mobility use cases include drones and bullet trains. AI-driven frequency sharing improves spectrum utilization. Government policies support fair 6G spectrum allocation. 6G trials link augmented reality classrooms and virtual labs. Dense urban coverage benefits from beamforming antennas. Adaptive modulation boosts performance in dynamic environments. Inter-satellite 6G mesh networks ensure global coverage. Low-earth-orbit constellations carry real-time data to IoT nodes. Ethical AI governs bandwidth priorities in emergency scenarios. Cloud-native core networks increase operational flexibility. Open RAN architecture allows vendor-neutral equipment deployment. E-waste reduction is targeted with modular hardware upgrades. The 6G era is set to redefine connectivity and human interaction.

6G: https://en.wikipedia.org/wiki/6G

2. AI-Powered VLSI Design Automation - Wadghule Uday nitin

In 2025, AI reshapes Very-Large-Scale Integration (VLSI) design. AI algorithms optimize transistor placement for performance and power. EDA tools now predict thermal behavior during layout. ML-based routing reduces wire length and delay. Quantum dots are emerging in experimental chip prototypes. AI-enhanced verification shortens time-to-market drastically. Edge AI chips are designed for low-power inference tasks. Neural processing units become common in consumer electronics. Universities use AI to teach logic synthesis interactively. Chiplets are arranged by AI to improve reusability. Silicon photonics is merged with CMOS for high-speed data transmission. AI suggests failure-resilient floorplans under process variability. Adaptive clocking improves energy efficiency in AI accelerators. Hardware-software co-design uses reinforcement learning for optimal pairing. Testbench generation is automated by large language models. Defect classification is now handled by convolutional networks. Chip validation simulates 10x faster with AI-guided heuristics. RISC-V designs are enhanced by open-source AI compilers. Universities host AI challenges in VLSI layout optimization. Industry adopts synthetic data to train design models. Graph neural networks analyze design rule violations. AI curates reusable IP blocks across projects. AI bridges analog-digital design with predictive tuning. With AI, VLSI enters a new phase of innovation and speed.

VLSI: https://en.wikipedia.org/wiki/Very-large-scale_integration (While not specifically "AI-powered VLSI design automation," this provides the foundational context for VLSI.)

3. Quantum Communication Systems ***Khatri Pratik Prasad***

Quantum communication technology sees real-world deployment in 2025. Entangled photon pairs enable ultra-secure data exchange. Fiber and satellite channels support quantum key distribution (QKD). India launches its first quantum communication satellite. Cold atom-based systems improve coherence over long distances. Telecommunication providers deploy QKD in banking and defense. Photonic chips miniaturize quantum communication hardware. Entanglement swapping ensures repeaters extend secure communication. AI detects eavesdropping attempts through anomaly signals. Quantum internet prototypes link labs across continents. Government policies support secure quantum backbone development. Quantum memory extends data relay capabilities. Research labs experiment with time-bin and polarization encoding. Cryogenic hardware reaches compact, cost-effective forms. Error correction techniques mature for quantum optical networks. Quantum-safe encryption coexists with classical systems. Multi-party secure video conferencing is trialed in universities. Startups develop portable quantum comm kits for field usage. Military integrates quantum channels for encrypted radio links. Data centers test hybrid quantum-digital firewall layers. Interoperability standards emerge for global quantum links. Quantum satellites offer latency-immune communication to remote areas. Quantum-secure 5G backhaul gets trialed in smart cities. Fiber networks get quantum layer overlays for sensitive nodes. Quantum technology is no longer theoretical—it's foundational to next-gen communication.

Quantum cryptography: https://en.wikipedia.org/wiki/Quantum_cryptography (Often discussed as a key aspect of quantum communication systems.)

4. Embedded Systems in Autonomous Surveillance - *RAJPUT SAKSHI ASHOK*

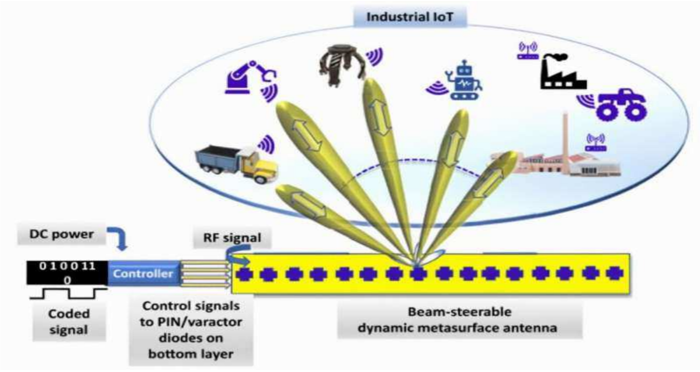
Autonomous surveillance in 2025 is driven by embedded intelligence. Drones patrol borders with onboard visual processing units. AI-enabled cameras detect intruders and alert command centers. Embedded systems power underwater surveillance bots. Public transit stations monitor activity via sensor fusion modules. Wildlife parks deploy solar-powered surveillance robots. Real-time analytics distinguish animals from humans. Low-latency AI processors execute object detection models onboard. Swarm drones collaborate using wireless mesh networks. Embedded GPS units enhance tracking precision. Urban surveillance adapts dynamically to threat levels. Edge analytics prevent overloading central data centers. Encryption modules onboard maintain data integrity. Smart helmets for police contain thermal vision chips. Fire detection systems embed AI for smoke pattern recognition. Universities train students in real-world embedded security applications. Inter-vehicle communication enables convoy surveillance in disaster zones. Public infrastructure embeds surveillance for safety compliance. 5G enhances bandwidth for high-resolution video transmission. AI filters false alarms to optimize alert reliability. Biometric scanners embed face and gait recognition. Embedded sensors track radiation in sensitive locations. Firmware updates are secured by blockchain integration. Embedded AI makes surveillance faster, smarter, and more autonomous.

Embedded system: https://en.wikipedia.org/wiki/Embedded_system (Provides the basis for "Embedded Systems in Autonomous Surveillance.")

5. Reconfigurable Antennas and Intelligent RF Systems - *Waje Vaibhav Ashok*

Technosavior

Modern RF systems are dynamic and adaptable thanks to reconfigurable antennas. Frequency-agile designs allow single hardware to operate across bands. Beam-switching antennas enhance performance in mobile 5G nodes. MEMS-based actuators adjust radiation patterns mechanically. AI predicts the best frequency based on channel feedback. SDR (Software Defined Radios) allow firmware-based modulation switching. Cognitive radios sense spectrum and avoid congestion autonomously. Universities experiment with graphene-based flexible antennas. AI tunes impedance for minimum reflection loss. IoT hubs use reconfigurable antennas for robust connectivity. Autonomous vehicles maintain line-of-sight with smart RF links. Smart textiles now embed patch antennas for health telemetry. Low-orbit satellite terminals feature steerable RF arrays. AI detects jamming attempts and shifts frequencies instantly. Ultra-wideband devices benefit from real-time beam shaping. Agriculture drones adapt antenna modes based on terrain. Security forces use RF beamforming to avoid interception. Maritime systems utilize frequency-hopping for resilience. RF front-ends adapt gain based on interference levels. Adaptive matching networks improve SNR in handheld devices. AI-generated lookup tables accelerate antenna retuning. Remote firmware pushes update antenna profiles. Medical implants use dynamically-tuned miniature antennas. Reconfigurable RF is at the heart of future-ready wireless communication.



Reconfigurable antenna: https://en.wikipedia.org/wiki/Reconfigurable_antenna (Covers the core concept of reconfigurable antennas.)

1. AI in Predictive Healthcare Diagnostics- *Barahate Shraddha Baburao*

AI-powered predictive diagnostics is transforming healthcare in 2025. Machine learning models now detect diseases from X-rays, MRIs, and ECGs. Deep learning networks identify anomalies in real-time patient data. AI alerts doctors before heart attacks and strokes occur. Large language models generate patient reports from notes. Wearable health devices stream real-time vitals to AI systems. Federated learning preserves patient privacy while training models. AI distinguishes between COVID-19, flu, and pneumonia from lung scans. Genomic sequencing is interpreted via neural networks. Smart clinics in rural areas use AI chatbots for triage. AI predicts cancer recurrence based on historical treatment data. Drug response is personalized using AI and genetic markers. AI platforms monitor elderly patients for fall prediction. Mental health apps use NLP to detect depressive behavior. Decision trees assist in recommending diagnostic tests. AI improves accuracy in mammography screenings. Hospitals employ anomaly detection for sudden ICU events. Real-time dashboards aid emergency response teams. AI supports organ transplant matching with fast compatibility checks. By 2025, AI brings precision, speed, and personalization to healthcare like never before.

Artificial intelligence in healthcare:
https://en.wikipedia.org/wiki/Artificial_intelligence_in_healthcare

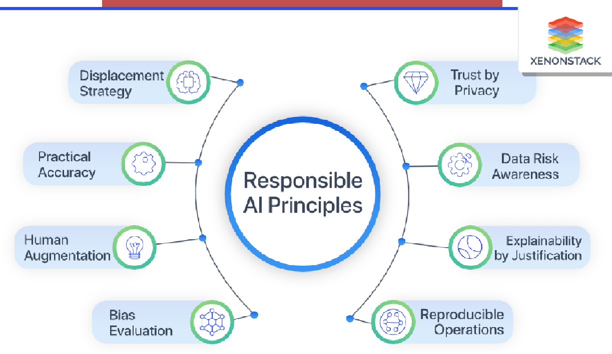
2. Generative AI in Content Creation- *Bhadane Maheshwari Govind*

Generative AI tools dominate content creation in 2025. Language models write blogs, news, and code within seconds. AI creates realistic human avatars for films and virtual events. Designers use AI to generate product mockups and UI/UX elements. GANs help fashion brands design and visualize outfits. Music composition is automated using style-transfer AI tools. Students get AI-generated summaries of research papers. Marketers rely on AI for video scripts, voiceovers, and subtitles. News agencies use AI to cover sports and election results. AI fine-tunes messaging based on user engagement metrics. AI-generated podcasts cover daily news in multiple languages. LLMs co-author novels, biographies, and even textbooks. Teachers use AI to generate lesson plans and test papers. Video editors apply AI to auto-cut and enhance footage. Companies use AI avatars for HR training simulations. Game developers generate plots and characters with AI prompts. AI monitors plagiarism and generates original ideas. Personalized educational content is created for each learner. In 2025, generative AI becomes a creative partner across industries.

Generative model: https://en.wikipedia.org/wiki/Generative_model (The foundation of "Generative AI in Content Creation.")

3. Responsible AI and Ethics - *Gite Atharva Prakash*

As AI systems grow powerful, 2025 sees a push for responsible AI. Ethical frameworks are implemented in major organizations. Bias mitigation is prioritized in recruitment and credit scoring AIs. Explainable AI helps users understand why decisions are made. AI developers use fairness audits to evaluate algorithms. Facial recognition is banned or regulated in several countries. Regulatory bodies enforce AI usage standards in sensitive sectors. Differential privacy ensures individual data isn’t misused. Algorithms are trained on diverse datasets to avoid demographic bias. Transparent reporting of AI limitations becomes standard practice. Companies adopt AI ethics boards for accountability. AI decision-making logs are made accessible for audits. LLMs are trained to refuse harmful or offensive outputs.



Researchers publish AI risks alongside performance benchmarks. Universities teach AI ethics as a mandatory course. NGOs monitor the use of AI in elections and public policy. AI regulation bills are passed in EU, India, and USA. Companies face penalties for deploying untested AI. Crowd-sourced feedback loops correct AI behavior over time. In 2025, ethics is a critical pillar in AI development

AI ethics: https://en.wikipedia.org/wiki/AI_ethics (Addresses "Responsible AI and Ethics.")

4. Data Engineering for Scalable AI Pipelines - ***Deore Pooja Vilas***

Data engineering supports every large AI system in 2025. Data pipelines extract, clean, and transform data at scale. Real-time ingestion engines process millions of events per second. Data lakes combine structured and unstructured data seamlessly. Feature stores make AI training faster and more consistent. Data versioning tools ensure reproducibility in experiments. Engineers deploy ELT frameworks using Spark, Kafka, and Airflow. Time-series databases optimize performance for IoT applications. Data quality monitors detect anomalies in streaming pipelines. Scalable NoSQL databases handle petabytes of AI training data. Metadata management tools help in lineage and governance. Cloud-native platforms ensure elastic resource allocation. Synthetic data generators fill gaps for rare class training. MLflow and Kubeflow support model lifecycle management. Companies automate data validation with schema detection tools. Data mesh architecture decentralizes ownership in large enterprises. Vector databases power semantic search and recommendation engines. Teams use Python, SQL, and APIs to orchestrate workflows. In 2025, efficient data engineering is key to fast, trustworthy AI.

Data engineering: https://en.wikipedia.org/wiki/Data_engineering (Relevant to "Data Engineering for Scalable AI Pipelines.")

5. AI for Climate Modeling and Sustainability - *Patil Shruti Vinod*

Climate science benefits significantly from AI in 2025. Deep learning models predict regional temperature changes accurately. Satellite data is processed by AI to detect illegal deforestation. AI tracks melting glaciers and polar ice caps over time. Machine learning forecasts rainfall and monsoon variability. AI monitors carbon emissions from factories using visual sensors. Crop yield prediction uses drone imagery and neural networks. Smart irrigation systems adjust based on AI climate forecasts. Researchers model ocean acidity and marine health using AI. AI simulations test the effect of policy changes on climate. Wildfire prediction models use weather and vegetation data. Renewable energy forecasting is improved with AI and IoT. Wind turbines optimize performance with predictive maintenance. Governments use AI dashboards for climate emergency planning. AI helps design sustainable urban layouts with optimal airflow. Carbon capture facilities are monitored using computer vision. Weather apps use AI to personalize alerts per user location. AI analyzes climate change impacts on biodiversity. Electric grids balance renewable inputs using AI control systems. In 2025, AI becomes an indispensable tool in the fight for planetary health.

Climate model: https://en.wikipedia.org/wiki/Climate_model (Context for "AI for Climate Modeling and Sustainability.")

MASTER OF COMPUTER APPLICATIONS (MCA) ARTICLES

1. Cloud-Native App Development in 2025 - *Pekhale Rutuja Dnyaneshwar*

Cloud-native development dominates enterprise app design in 2025. Microservices architecture enables modular development and scaling. Developers use Kubernetes and Docker for container orchestration. Serverless computing reduces infrastructure management burdens. CI/CD pipelines automate testing, building, and deployment. Cloud platforms like AWS, Azure, and GCP offer seamless DevOps support. Developers use Infrastructure as Code (IaC) tools like Terraform. Cloud-native apps adapt better to fluctuating workloads. Security is embedded through DevSecOps practices. Observability tools track performance across distributed services. Edge computing integrates with cloud-native systems for low latency. This approach enhances agility, scalability, and innovation speed.

Cloud-native computing: https://en.wikipedia.org/wiki/Cloud-native_computing (Related to "Cloud-Native App Development in 2025.")

2. Cyber security Trends for Enterprise Applications- ***Maknor Pooja Nandalal***

With rising digital threats in 2025, enterprise cyber security is vital. Zero-trust architecture is adopted widely across IT infrastructures. Multi-factor authentication becomes mandatory for access control. AI-powered threat detection identifies anomalies in real-time. Security Information and Event Management (SIEM) tools gain popularity. DevSecOps integrates security in early development stages. Data encryption at rest and in transit is now default. Endpoint protection includes mobile and IoT devices. Companies conduct regular penetration tests to identify vulnerabilities. Identity and Access Management (IAM) platforms streamline user roles. Cloud providers offer enhanced security toolkits with compliance tracking.

Cybersecurity: https://en.wikipedia.org/wiki/Computer_security (Provides a broad overview relevant to "Cybersecurity Trends for Enterprise Applications.")

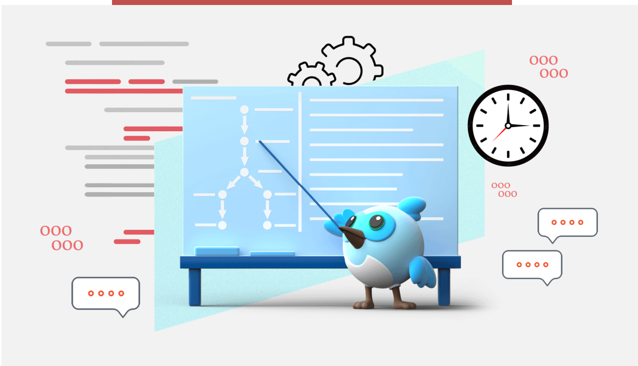
3. Blockchain Integration in Financial Applications- ***Shinde sonam anil***

Blockchain applications extend far beyond cryptocurrency in 2025. FinTech companies use blockchain for secure digital payments. Smart contracts automate settlements and reduce transaction delays. Permissioned blockchains ensure privacy in banking processes. Decentralized finance (DeFi) platforms expand user accessibility. KYC and AML checks are faster through blockchain identity verification. Blockchain enhances supply chain transparency for goods and services. NFT-based asset tokenization becomes common in wealth management. Digital audit trails help reduce fraud in financial systems. MCA professionals build DApps using Solidity and Web3 libraries.

Blockchain: https://en.wikipedia.org/wiki/Blockchain (Context for "Blockchain Integration in Financial Applications.")

4. Cross-Platform Mobile App Development with Flutter 3- ***Mali Darshan Sanjay***

Flutter 3 leads cross-platform mobile app development in 2025. Developers build native-like apps for Android, iOS, and web from one codebase. Dart language powers UI development with high performance. Material You and Cupertino widgets offer platform-specific designs. Hot reload accelerates the development cycle. Firebase integration enables authentication, real-time database, and notifications. Flutter supports desktop and embedded platforms too. Developers use BLoC and Provider for state management. App Store and Play Store deployments are optimized via build automation. Flutter reduces cost, time, and effort in mobile app delivery



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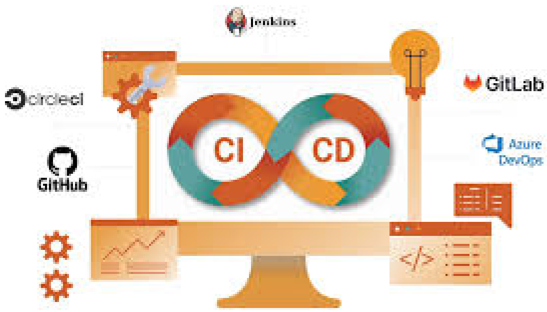
Flutter (software): https://en.wikipedia.org/wiki/Flutter_(software) (Directly addresses "Cross-Platform Mobile App Development with Flutter 3.")

5. DevOps and CI/CD Automation Tools in 2025 - *Patil Krishnal Ramakant*

DevOps culture is deeply embedded in 2025 software teams. Continuous Integration/Continuous Deployment (CI/CD) ensures faster delivery. GitHub Actions and GitLab CI streamline automated testing and deployment. Jenkins pipelines orchestrate builds and workflows. Docker and Kubernetes manage environment consistency. Monitoring tools like Prometheus and Grafana provide real-time insights. Configuration management is handled with Ansible and Puppet. Cloud-native CI/CD adapts to serverless and container workloads. Developers receive feedback faster with automated unit and integration tests. Teams deploy confidently using blue-green and canary deployment strategies.



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DevOps: https://en.wikipedia.org/wiki/DevOps (Relevant to "DevOps and CI/CD Automation Tools in 2025.")

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Matoshri College of Engineering & Research Centre, Nashik

Eklahare shivar, Near Odhagaon,

Opposite to Nashik-Aurangabad Highway, Nashik, Maharashtra 422105

Website:engg.matoshri.edu.in/Email:matoshricoe.hr@gmail.com

Contact:0253-2406600/1/2/3

Toll freeNo.:18002336602