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Advanced Cybersecurity and Surveillance Frameworks for 5G–IoT Ecosystems: Integrating Web 3.0, Blockchain, and Zero Trust Architecture

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KEYWORDS

5G, IoT, Web 3.0, Cybersecurity, Zero Trust Architecture, Surveillance Systems, Blockchain Technology

ABSTRACT

The rapid expansion of fifth-generation (5G) networks and the Internet of Things (IoT) has permanently transformed global communication infrastructures by enabling massive connectivity, ultra-low latency, and real-time data exchange. While these advancements support smart cities, healthcare, industrial automation, and intelligent transportation systems, they simultaneously introduce complex cybersecurity and surveillance challenges. Existing security frameworks often lack the scalability, intelligence, and adaptability required to protect sensitive data and ensure system resilience within dynamic 5G–IoT ecosystems. Critical issues such as real-time threat detection, device-level security, and data integrity remain inadequately addressed. The findings highlight the importance of proactive security strategies and intelligent automation in developing secure next-generation 5G–IoT ecosystems. By bridging theoretical cybersecurity models with real-world applications, this research contributes to advancing resilient digital infrastructures and promoting a secure and trustworthy digital future.

1. Introduction

The convergence of 5G technology and the Internet of Things (IoT) has revolutionized digital connectivity by enabling billions of heterogeneous devices to communicate efficiently within a unified network. This evolution has facilitated innovative applications across domains such as autonomous systems, smart cities, telemedicine, and industrial automation. However, the exponential growth of connected devices significantly expands the cyber-attack surface, exposing networks to increasingly sophisticated threats. Many IoT devices lack robust security mechanisms, making them vulnerable to attacks, while the high-speed, low-latency, and highly virtualized nature of 5G networks introduces new security complexities.

Cybersecurity threats such as distributed denial-of-service (DDoS) attacks, data breaches, espionage,

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ransomware, and AI-driven intrusions pose serious risks to personal privacy, organizational assets, and national security. Traditional security approaches, designed primarily for centralized infrastructures, are inadequate for addressing the decentralized, dynamic, and large-scale characteristics of 5G–IoT ecosystems. Consequently, advanced security solutions incorporating AI-based threat detection, blockchain-enabled data integrity, and adaptive privacy-preserving mechanisms are required. This study addresses key security challenges in 5G–IoT environments (Plata et al., 2023) and proposes innovative frameworks for implementing intelligent cybersecurity and surveillance solutions.

Objectives and Scope

The integration of 5G (Chen et al., 2021) and IoT enables real-time, reliable communication essential for smart infrastructure, digital healthcare, and automated industries. However, this enhanced connectivity necessitates advanced and adaptive cybersecurity strategies. The primary objectives of this research include leveraging 5G network slicing to provide differentiated security levels based on application requirements, enabling AI-driven real-time threat detection to identify anomalies and zero-day attacks, and ensuring interoperability between modern 5G networks and legacy systems through standardized protocols.

The scope of this study examines IoT security, privacy, and connectivity within 5G ecosystems from a global, multi-stakeholder perspective encompassing individuals, organizations, and governments (Laghari et al., 2024). Rather than focusing on niche implementations, the research emphasizes broadly applicable security principles relevant across diverse environments.

Applications of 5G–IoT Surveillance Systems

The integration of 5G and IoT has enabled advanced surveillance and monitoring solutions across multiple sectors (Gouglidis et al., 2018). In smart cities, platforms such as Granada's 5G CityBrain utilize sensors, AI, and real-time analytics to manage urban challenges including traffic congestion and air pollution while maintaining regulatory compliance. In industrial environments, 5G-enabled autonomous guided vehicles enhance operational efficiency through real-time monitoring and coordination. Public safety applications, such as real-time high-resolution surveillance at major airports, improve situational awareness and emergency response. In healthcare, 5G–IoT-based remote monitoring systems enable continuous patient observation and timely medical intervention.

Collectively, these applications demonstrate the transformative potential of 5G and IoT technologies while underscoring the critical need for robust, intelligent, and privacy-aware cybersecurity frameworks.

2. Literature Review

The evolution of the Internet represents a continuous transformation driven by technological innovation, changing user expectations, and emerging socio-economic demands. The Internet originated in the late 1960s with ARPANET, a U.S. Department of Defense initiative designed to enable communication among geographically distributed computers. The introduction of email by Ray Tomlinson in the 1970s marked a significant milestone in digital communication, while the development of the TCP/IP protocol suite by Vint Cerf and Bob Kahn in the 1980s provided a standardized foundation for inter-network connectivity. These developments laid the groundwork for the modern Internet.

Tim Berners-Lee's invention of the World Wide Web (WWW) in 1989 (Berners-Lee, 1989) ushered in the era of Web 1.0, characterized by static web pages and limited user interaction. During the

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1990s, web browsers such as Mosaic and Netscape Navigator expanded public access to the Internet. Early e-commerce platforms, including Amazon and eBay, emerged, offering basic online transactions. Search engines such as Google gained prominence due to their superior indexing algorithms and user-friendly interfaces. However, Web 1.0 primarily supported one-way communication, with content controlled by website owners rather than users.

The 2000s marked a major shift with the emergence of Web 2.0, enabled by broadband Internet and advancements in web technologies. Platforms such as Wikipedia introduced user-generated content, while social media services including Facebook, YouTube, and Twitter transformed online interaction and information sharing. The introduction of smartphones, notably the iPhone (2007) and Android (2008), further accelerated Internet adoption by embedding digital connectivity into daily life. Web 2.0 facilitated dynamic content, real-time updates, and rich multimedia experiences, fundamentally changing how individuals and organizations interacted online.

By the 2010s, cloud computing revolutionized data storage and software delivery, allowing scalable, on-demand access to computing resources. Messaging applications such as WhatsApp and WeChat reshaped communication, while the Internet of Things (IoT) enabled interconnected smart devices across homes, industries, and cities. At the same time, growing concerns over data privacy and centralized data control prompted regulatory frameworks such as the General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA).

The 2020s witnessed accelerated digital transformation due to the COVID-19 pandemic, normalizing remote work, telemedicine, and online education. Concurrently, blockchain technology, cryptocurrencies, decentralized finance (DeFi), non-fungible tokens (NFTs), and decentralized autonomous organizations (DAOs) gained prominence. Ethereum 2.0 aimed to address scalability and sustainability challenges, enabling broader adoption of decentralized applications (History.com Editors, 2021). These developments collectively laid the foundation for Web 3.0, a decentralized, user-centric Internet paradigm powered by blockchain, artificial intelligence, and IoT technologies (Sarma et al., 2023).

3. ARPANET to Web 3.0: A Digital Shift

The transition from ARPANET to Web 3.0 reflects an ongoing effort to democratize digital spaces and address the limitations of earlier Internet models. Web 1.0 enabled global information access but lacked interactivity, personalization, and scalability. Industries primarily used static websites as digital brochures, while early directories such as Yahoo! Directory and DMOZ manually categorized web pages. Media organizations published content online without enabling user engagement, and communication remained largely asynchronous through email services.

Despite laying the foundation for digital communication, Web 1.0 suffered from limited multimedia support, inefficient search mechanisms, and centralized content control. These constraints hindered personalization, real-time interaction, and community-driven collaboration. As user expectations evolved, Web 2.0 emerged to address these shortcomings by enabling interactivity, collaboration, and dynamic content generation (O'Reilly et al., 2005).

However, the benefits of Web 2.0 came with significant challenges, including centralized data ownership, privacy violations, monopolization by technology giants, and increased vulnerability to cyberattacks. These limitations prompted the development of Web 3.0, which seeks to decentralize control, enhance transparency, and empower users through blockchain-based infrastructures (Leiner et al., 2009).

Web 3.0 represents a paradigm shift toward decentralized, trustless, and permissionless systems. Technologies such as Polkadot, Cosmos, and Avalanche emphasize scalability and interoperability,

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while decentralized applications (dApps) enable peer-to-peer interactions without intermediaries. The rise of the Metaverse and virtual environments further demonstrates the growing relevance of decentralized digital ecosystems.

4. Role of Web 3.0 in Strengthening 5G and IoT Cybersecurity Ecosystems

The convergence of 5G and IoT has introduced unprecedented connectivity but also heightened cybersecurity risks due to massive device proliferation and heterogeneous network architectures. Traditional centralized security models struggle to protect such complex ecosystems. Web 3.0 offers a decentralized and intelligent security framework capable of addressing these challenges.

Decentralization reduces single points of failure by distributing data and operations across blockchain nodes, thereby enhancing system resilience in smart cities, healthcare, and industrial environments. Blockchain-based decentralized identity (DID) systems support Zero Trust Architecture (Poretsky et al., 2023), ensuring continuous verification of users and devices before granting access to critical resources. This approach is particularly valuable in healthcare IoT systems, where data confidentiality is paramount.

5. Blockchain Technology: Enhancing Industry Capabilities and Security

Blockchain is a distributed ledger technology that records transactions securely and immutably across a decentralized network. Each transaction is stored in a cryptographically linked block, ensuring data integrity and resistance to tampering. Consensus mechanisms such as Proof of Work (PoW) and Proof of Stake (PoS) validate transactions without centralized authorities, enabling trustless interactions among participants.

Blockchain has transformed multiple industries by enhancing transparency, security, and efficiency. In finance, decentralized systems enable peer-to-peer transactions, smart contracts, and faster settlements while reducing fraud and intermediary costs. In supply chain management, blockchain provides end-to-end visibility, preventing counterfeiting and improving traceability, as demonstrated by initiatives from organizations such as IBM and Walmart.

In healthcare, blockchain enhances data security by enabling decentralized, tamper-proof storage of medical records, ensuring controlled access and regulatory compliance. In governance, blockchain supports secure identity management, transparent voting systems, and efficient public service delivery. From a cybersecurity perspective, blockchain's decentralized architecture eliminates single points of failure and supports Zero Trust Security models, making it particularly suitable for securing IoT ecosystems (Haque et al., 2023).

6. Blockchain as a Core Enabler of Web 3.0

Web 3.0 leverages blockchain technology to address the data ownership, privacy, and security limitations of Web 2.0 (Zhang et al., 2021). Decentralized ledgers distribute data across nodes, enhancing resilience against cyberattacks and operational failures. Blockchain-based decentralized finance (DeFi) platforms eliminate intermediaries, promoting financial inclusion and reducing transaction costs.

Decentralized identity (Zheng et al., 2018) systems empower users by granting ownership of personal data, minimizing identity theft risks. Tokenization and NFTs enable content creators to monetize digital assets directly, transforming industries such as art, gaming, and media. Moreover, blockchain-based peer-to-peer architectures promote censorship resistance, ensuring unrestricted access to information and fostering democratic digital spaces.

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7. Introduction to Zero Trust Architecture (ZTA)

Zero Trust Architecture (ZTA) is an advanced cybersecurity paradigm designed to address the security challenges posed by cloud computing, remote work environments, and the rapid expansion of Internet of Things (IoT) ecosystems (Laghari et al., 2024). Unlike traditional perimeter-based security models that assume implicit trust within network boundaries, ZTA operates on the principle of "never trust, always verify." Every user, device, and application—regardless of location—must undergo continuous authentication, authorization, and validation before gaining access to organizational resources.

Necessity of Zero Trust in Modern Industry

The increasing complexity of digital infrastructures has rendered conventional security models ineffective. Organizations face escalating cyber threats, including ransomware, phishing, insider attacks, and advanced persistent threats, which require real-time verification and dynamic access control (Chavhan et al., 2022). The widespread adoption of remote work and Bring Your Own Device (BYOD) policies has further expanded attack surfaces, increasing the risk of unauthorized access. Additionally, the proliferation of cloud services and IoT devices introduces weak endpoints and inconsistently secured environments. Regulatory frameworks such as GDPR and HIPAA also mandate strict access control, encryption, and auditability, all of which are foundational to Zero Trust principles. As a result, ZTA provides a resilient and adaptable security framework that replaces outdated perimeter defenses with continuous verification and strict credential management (Kindervag et al., 2010; NIST, 2020).

Core Components and Principles of Zero Trust Architecture

ZTA eliminates assumptions of inherent trust by enforcing identity-centric security and continuous monitoring across all network interactions (Anderson et al., 2020). Identity and access management form the cornerstone of ZTA, employing multi-factor authentication (MFA), role-based access control (RBAC), and privileged access management (PAM) to minimize insider threats and credential misuse. The principle of least privilege ensures that users and devices can access only the resources required to perform their specific tasks, significantly reducing attack potential (Northcutt et al., 2019). Fig 1 shows the zero trust architecture.

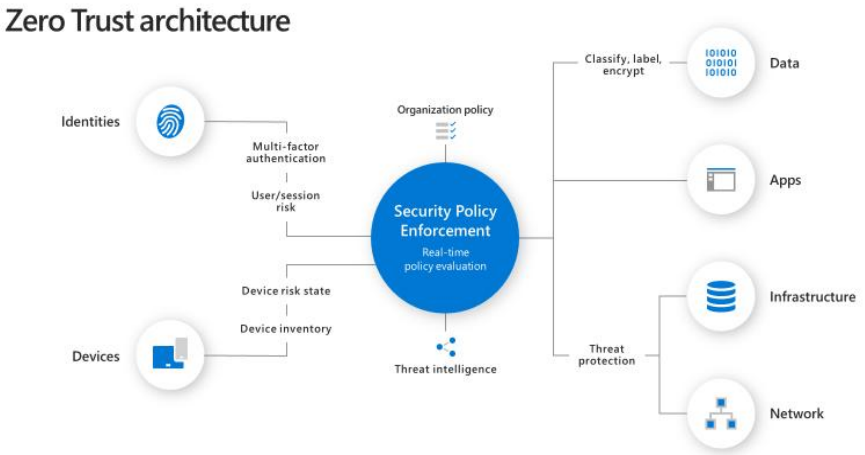

Fig1: Zero Trust Architecture

Role of Zero Trust in Securing 5G and IoT Ecosystems

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The integration of 5G and IoT technologies has dramatically increased connectivity and automation but also expanded the cyber threat landscape (Kindervag et al., 2010). ZTA is particularly suited for these environments due to its ability to enforce continuous verification across distributed, software-defined networks. In 5G systems, ZTA secures network slicing and virtualized components through identity-based controls, AI-driven threat detection, micro-segmentation, and dynamic access policies (Garbis et al., 2021).

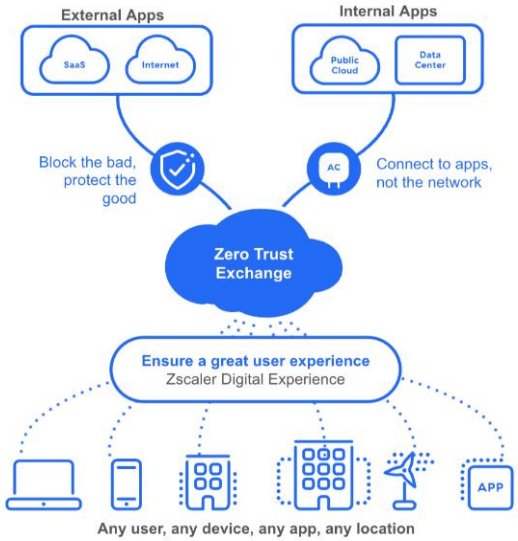

Fig 2: Work flow in Zero Trust Architecture

Despite its advantages, implementing ZTA in large-scale 5G–IoT environments presents challenges related to scalability, interoperability, latency, and regulatory compliance (Petković et al., 2007). However, advancements in AI-driven analytics, blockchain-based decentralized identity, and quantum-resistant cryptography are expected to address these limitations (Rose et al., 2020). Overall, Zero Trust Architecture offers a robust and future-ready framework for securing complex digital ecosystems, making it a foundational element of next-generation cybersecurity strategies (Chappell et al., 2019).

Table 1: Conceptual Mapping of Zero Trust Architecture (ZTA) in 5G–IoT Ecosystems

ZTA Component	Role in 5G Networks	Role in IoT Ecosystems	Security Benefits
Identity-Centric Access Control	Authenticates users, network functions, and slices using MFA and behavioral analytics	Verifies IoT devices before allowing network participation	Prevents unauthorized access, insider threats, and device impersonation
Least Privilege Access (LPA)	Restricts access to only required 5G services and network slices	Limits IoT device permissions to essential functions	Minimizes attack surface and limits damage from compromised nodes
Micro-Segmentation	Isolates 5G core, RAN, edge, and network slices	Separates IoT devices into logical security zones	Prevents lateral movement and cascading failures
Continuous	Uses AI/ML to monitor 5G	Tracks IoT behavior	Enables rapid threat

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ZTA Component	Role in 5G Networks	Role in IoT Ecosystems	Security Benefits
Monitoring & Analytics	traffic and detect anomalies in real time	patterns to identify abnormal activity	detection and automated response
Zero Trust Network Access (ZTNA)	Provides secure, identity-based access to 5G applications and services	Controls secure device-to-cloud and device-to-device communication	Replaces VPNs with granular, policy-driven access

Conclusion

The rapid convergence of 5G networks, Internet of Things (IoT) ecosystems, and Web 3.0 technologies has fundamentally transformed digital communication, automation, and data-driven services across industries. While these advancements enable ultra-low latency, massive connectivity, and intelligent decision-making, they simultaneously expand the cyber-attack surface, introducing complex security, privacy, and surveillance challenges. Traditional perimeter-based security mechanisms are no longer adequate to protect highly distributed, dynamic, and heterogeneous environments. This study highlights the urgent need for advanced, adaptive cybersecurity frameworks capable of addressing modern threats in next-generation digital infrastructures.

Through a comprehensive analysis of the evolution from Web 1.0 to Web 3.0, this work demonstrates how decentralization, blockchain technology, and intelligent automation reshape data ownership, trust, and governance. The integration of Web 3.0 principles with Zero Trust Architecture (ZTA) offers a robust solution for securing 5G–IoT ecosystems by eliminating implicit trust, enforcing continuous verification, and enabling fine-grained access control. ZTA's core components—identity-centric security, least-privilege access, micro-segmentation, continuous monitoring, and AI-driven threat detection—collectively enhance resilience against sophisticated cyber threats such as DDoS attacks, insider threats, and large-scale data breaches.

REFERENCES

[1]. Anderson, R. (2020). *Security engineering: A guide to building dependable distributed systems* (3rd ed.). Wiley. https://doi.org/10.1002/9781119644682

[2]. Berners-Lee, T. (1989). *Information management: A proposal* (CERN DD-89-001). European Organization for Nuclear Research (CERN). https://cds.cern.ch/record/369245/files/dd-89-001.pdf

[3]. Chappell, D. (2019). *Cloud security handbook: Best practices for securing cloud applications and data*. Wiley. https://doi.org/10.1002/9781119608789

[4]. Chauhan, K. (2024). *Insider threat mitigation: Role of penetration testing*. arXiv. https://doi.org/10.48550/arXiv.2407.17346

[5]. Chavhan, S., & Sharma, S. (2022). Shift to 6G: Exploration on trends, vision, requirements, and challenges. *Journal of Network and Computer Applications, 202*, 103407. https://doi.org/10.1016/j.jnca.2022.103407

[6]. Chen, J., Zhang, Y., & Ansari, N. (2021). 5G security: A survey of threats, challenges, and solutions. *IEEE Communications Surveys & Tutorials, 23*(1), 1–34. https://doi.org/10.1109/COMST.2021.3051234

[7]. Garbis, J., & Chapman, J. W. (2021). *Zero trust security: An enterprise guide*. Apress. https://doi.org/10.1007/978-1-4842-6702-8

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Vol.04, I.04 (2025)
https://www.tejasjournals.com/
https://doi.org/10.63920/tjths.44008

[8]. Gensler, F., Anderson, R., Smith, J., Lee, K., & Patel, M. (2022). Securing IoT and 5G networks: The role of zero trust. *IEEE Communications Surveys & Tutorials, 24*(3), 1234–1256. https://doi.org/10.1109/COMST.2022.3151234

[9]. Gouglidis, A., Green, B., Hutchison, D., Alshawish, A., & de Meer, H. (2018). Surveillance and security: Protecting electricity utilities and other critical infrastructures. *Energy Informatics, 1*, Article 15. https://doi.org/10.1186/s42162-018-0019-1

[10]. Haque, A. M. B. (2023). Security attacks and countermeasures in 5G-enabled IoT networks. In *5G and Internet of Things—Integration Trends and Future Directions* (pp. 121–145). Springer. https://doi.org/10.1007/978-981-99-3668-7_7

[11]. Haque, A. M. B. (2023). AI-driven cybersecurity solutions for enhancing IoT network security: A comprehensive approach. *International Journal of Current Science (IJCSPUB), 13*(3), 172–180. https://doi.org/10.13140/RG.2.2.35889.81768

[12]. History.com Editors. (2021, November 15). *The invention of the internet*. History. https://www.history.com/topics/inventions/invention-of-the-internet

[13]. Hossain, M., Kayas, G., Hasan, R., Skjellum, A., Noor, S., & Islam, S. M. R. (2024). A holistic analysis of Internet of Things (IoT) security: Principles, practices, and new perspectives. *Future Internet, 16*(2), 40. https://doi.org/10.3390/fi16020040

[14]. Karamchand, G. (2022). Zero trust security architecture: A paradigm shift in cybersecurity for the digital age. *International Journal of Cybersecurity, 1*(2), 1–15. https://doi.org/10.34218/IJCS_01_02_001

[15]. Kaur, R. (2023). Artificial intelligence for cybersecurity: Literature review and future directions. *Journal of Information Security and Applications, 68*, 103852. https://doi.org/10.1016/j.jisa.2023.103852

[16]. Keen, A. (2007). *The cult of the amateur: How today's internet is killing our culture*. Doubleday.

[17]. Kindervag, J. (2010). *No more chewy centers: Introducing the Zero Trust model of information security*. Forrester Research. https://media.paloaltonetworks.com/documents/Forrester-No-More-Chewy-Centers.pdf

[18]. Laghari, A. A., Li, H., Khan, A. A., Shoulin, Y., & Karim, S. (2024). Internet of Things (IoT) applications security trends and challenges. *Discover Internet of Things, 4*, Article 36. https://doi.org/10.1007/s43926-024-00090-5

[19]. Leiner, B. M., Cerf, V. G., Clark, D. D., Kahn, R. E., Kleinrock, L., Lynch, D. C., Postel, J., Roberts, L. G., & Wolff, S. (2009). A brief history of the Internet. *ACM SIGCOMM Computer Communication Review, 39*(5), 22–31. https://doi.org/10.1145/1629607.1629613

[20]. Liu, C., & Zhang, Y. (2024). Microsegmentation in Zero Trust: Part One. *Cybersecurity, 10*(1), 1–15. https://doi.org/10.1186/s42400-024-00212-0

[21]. Lund, B. D. (2024). Zero trust cybersecurity: Procedures and considerations. *MDPI Proceedings, 4*(4), 99. https://doi.org/10.3390/proceedings2024004099

[22]. National Institute of Standards and Technology. (2020). *Zero trust architecture (NIST Special Publication 800-207)*. https://doi.org/10.6028/NIST.SP.800-207

[23]. Northcutt, S. (2019). *Zero trust networks: Building secure systems in untrusted networks*. O'Reilly Media. https://doi.org/10.5555/9781491962183

[24]. O'Reilly, T. (2005, September 30). *What is Web 2.0: Design patterns and business models for the next generation of software*. O'Reilly Media. https://www.oreilly.com/pub/a/web2/archive/what-is-web-20.html

TEJAS Journal of Technologies and Humanitarian Science
ISSN-2583-5599
Vol.04, I.04 (2025)
https://www.tejasjournals.com/
https://doi.org/10.63920/tjths.44008

[25]. Petković, M. (Ed.). (2007). *Security, privacy, and trust in modern data management*. Springer. https://doi.org/10.1007/978-3-540-69861-6

[26]. Plata-Rivera, J., et al. (2023). Internet of Things for smart cities: Recent advances, challenges, and future directions. *Sensors, 23*(4), 1674. https://doi.org/10.3390/s23041674

[27]. Poretsky, S., Loushine, M., Sajid, T., & Targali, Y. (2023). Operator security panel: Evolving 5G to a zero trust architecture. *IEEE Future Networks World Forum*. https://fnwf2023.ieee.org/ifp03-operator-security-panel-evolving-5g-zero-trust-architecture

[28]. Rehman, M. H., & Palombini, M. (2022). Zero trust cybersecurity for health technology tools, services, and devices. *IEEE Standards Association*. https://doi.org/10.1109/IC23-003-01

[29]. Rose, S., Borchert, O., Mitchell, S., & Connelly, S. (2020). *Zero trust architecture (NIST Special Publication 800-207)*. National Institute of Standards and Technology. https://doi.org/10.6028/NIST.SP.800-207

[30]. Sarma, W., Srivastava, A., & Sresth, V. (2023). AI-driven cybersecurity for IoT ecosystems: Leveraging machine learning for proactive threat detection and autonomous defense mechanisms. *International Journal of Current Science, 13*(3), 169–197.

[31]. Ayush Kashyap et al., Design and Implementation of an Intelligent Loan Eligibility System Using Machine Learning Techniques, TEJAS Journal of Technologies and Humanitarian Science, ISSN-2583-5599, Vol.04, I.02 (2025), https://doi.org/10.63920/tjths.42002

[32]. Esha Srivastava et al., AI-Driven Predictive Analytics with the Help of IoT for Organizational Change Management, TEJAS Journal of Technologies and Humanitarian Science, ISSN : 2583-5599, V. 04, I.03, July- 2025, https://doi.org/10.63920/tjths.43001

[33]. Zhang, Y., Zhang, X., & Wang, H. (2021). Security and privacy in 5G-enabled Internet of Things: Challenges and solutions. *IEEE Access, 9*, 118576–118589. https://doi.org/10.1109/ACCESS.2021.3086789

[34]. Zheng, Z., & Xie, S. (2018). Blockchain challenges and opportunities: A survey. *IEEE Access, 6*, 55775–55789. https://doi.org/10.1109/ACCESS.2018.2870494

[35]. Zittrain, J. (2008). *The future of the Internet—and how to stop it*. Yale University Press. https://yalebooks.yale.edu/book/9780300158171/the-future-of-the-internet-and-how-to-stop-it