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PRIVACY AND SECURITY IN THE INTERNET OF THINGS AND THE APPLICATIONS OF THIS CREATION

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Abstract
The **Internet of Things (IoT)** represents a revolutionary advancement in digital technology, connecting billions of devices globally to facilitate seamless communication, automation, and data sharing. It has found widespread use in sectors such as healthcare, smart living environments, industry, agriculture, and urban planning. Despite its transformative potential, IoT also introduces significant concerns regarding privacy and system security.
This research delves into the broad spectrum of privacy and security vulnerabilities inherent in IoT infrastructures. Among the critical issues are weak device authentication, lack of encrypted communication, outdated or insecure firmware, and the absence of uniform standards. The decentralized and resource-limited nature of many IoT components further amplifies these risks, often making them susceptible to cyberattacks, data breaches, and operational disruptions.
Through case-based analysis, the study investigates the implications of security threats across key IoT domains including medical devices (IoMT), urban systems (smart cities), industrial automation (IIoT), and precision farming. The findings emphasize the necessity of deploying flexible and robust security models capable of adapting to diverse application environments.
The paper also evaluates contemporary defense mechanisms such as distributed ledger technology (blockchain), lightweight encryption protocols, fog and edge computing models, and AI-enabled threat detection. Additionally, it highlights the importance of compliance with privacy regulations like **GDPR**, **HIPAA**, and **NIST** standards in safeguarding user rights and institutional data.
Finally, it proposes forward-looking research priorities in areas such as quantum-resistant encryption, federated learning for secure AI, and the adoption of zero-trust security principles. These innovations are essential for fostering a secure and privacy-conscious IoT future.

Keywords: **IoT (Internet of Things), Cybersecurity, Data Protection, AI (Artificial Intelligence), IoMT (Internet of Medical Things), GDPR (General Data Protection Regulation), HIPAA (Health Insurance Portability and Accountability Act), NIST (National Institute of Standards & Technology).**

1. Introduction

The **Internet of Things (IoT)** has rapidly evolved into a vast digital framework where every-day physical objects ranging from household appliances and automobiles to medical instruments and industrial equipment are embedded with technologies that enable them to connect and interact over the internet. These devices are equipped with sensors, processors, and communication interfaces, allowing them to autonomously gather and exchange data, often without direct human input. As a result, conventional passive objects are now part of dynamic, responsive systems that improve operational efficiency and real-time decision-making.

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The accelerating adoption of IoT can be attributed to advancements in wireless technologies, cloud infrastructure, artificial intelligence, and microelectronics. It is projected that by 2030, the number of interconnected IoT devices will exceed 30 billion. These devices are expected to generate vast streams of real-time data, fueling innovations across various sectors such as smart homes, intelligent transportation systems, wearable health technologies, and automated industrial setups.

However, the rapid expansion of IoT comes with complex **security and privacy concerns**. Unlike traditional computing systems, IoT devices often operate in unmonitored environments, possess limited processing capabilities, and are sometimes manufactured with minimal attention to security features. These constraints result in issues like inadequate encryption, weak authentication protocols, and infrequent software updates, leaving them susceptible to exploitation.

Moreover, the interconnected nature of IoT involves multiple stakeholders including developers, service providers, manufacturers, and users which further complicates data governance, privacy protection, and security enforcement. These devices frequently collect sensitive personal data, such as biometric details, geographic location, and behavioral patterns, raising the risk of unauthorized access, data breaches, and potential misuse.

Addressing privacy and security in IoT environments demands not only technical innovations but also ethical and legal considerations. Complying with frameworks like the **General Data Protection Regulation (GDPR)** and the **Health Insurance Portability and Accountability Act (HIPAA)** is essential. In addition, the adoption of intelligent, lightweight, and energy-efficient security mechanisms is critical for protecting users and ensuring trust in IoT solutions.

This paper focuses on:

- Examining key security and privacy threats within IoT systems.
- Understanding their implications across core application areas such as healthcare, urban infrastructure, industry, and agriculture.
- Evaluating modern defense techniques and emerging technologies.
- Exploring policy measures and research gaps necessary for creating safe and resilient IoT ecosystems.

Through this investigation, the study aims to offer a balanced view of the technological potential and risks associated with IoT in today's interconnected world.

2. Review of Literature

A robust understanding of privacy and security within the IoT domain requires a deep engagement with prior research that outlines both the theoretical foundations and real-world implications of emerging threats and countermeasures.

2.1 Foundational Concepts in IoT Security

Weber (2010) [1] was among the earliest scholars to articulate the unique privacy challenges posed by IoT, emphasizing the legal and regulatory vacuum surrounding connected devices. His work highlights how the constant data generation by IoT devices—often without the user's explicit awareness—fundamentally alters traditional notions of data ownership and control.

2.2 Taxonomies of Threats and Attacks

Ammar et al. (2018) [2] provided a detailed survey on IoT security frameworks, categorizing vulnerabilities into device-level, network-level, and cloud-level risks. They also emphasized the

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lack of standardized protocols and the difficulty of securing devices with limited computational capacity. Sicari et al. (2015) [3] explored trust models in IoT ecosystems and highlighted the role of encryption, access control, and secure routing as foundational components of a secure architecture.

2.3 Emerging Technologies and Their Role

Dorri et al. (2018) [4] introduced blockchain as a decentralized approach for achieving trust and transparency in IoT networks. Their findings suggest that blockchain could mitigate single-point-of-failure risks and enhance auditability. Sharma and Wang (2017) [5] presented the potential of combining edge computing with AI for real-time intrusion detection, thus addressing the latency and bandwidth constraints of cloud-dependent architectures.

2.4 Privacy Preservation and Regulatory Compliance

Recent research has focused on privacy-preserving machine learning techniques like **federated learning**, which allows decentralized training without exposing sensitive data. Arshad et al. (2021) [6] analyzed the effectiveness of such approaches and the need for adaptive, context-aware security policies.

Regulatory compliance is another key area of investigation. **NIST** [8] has contributed technical standards to guide secure IoT development and deployment. The **GDPR** [9] and **HIPAA** [10] frameworks have influenced global IoT practices by enforcing strict data handling and user consent requirements.

2.5 Literature Gap

Although significant progress has been made, current literature still lacks integrative frameworks that simultaneously address security, privacy, ethics, and real-time adaptability across heterogeneous IoT platforms. There is also a limited focus on the real-world deployment of AI-based security agents in constrained environments, signalling the need for further interdisciplinary research.

3. Real-World Applications, Implications and Privacy & Security Risks

The Internet of Things (IoT) has rapidly transitioned from a conceptual innovation to a functional component of daily life. As interconnected devices proliferate across homes, cities, industries, healthcare, and agriculture, they offer enhanced automation, efficiency, and decision-making capabilities. However, each domain presents unique privacy and security challenges, influenced by the nature of data collected, device deployment contexts, and system criticality. This section outlines major sectors utilizing IoT technologies and evaluates the risks and implications tied to their use.

3.1. Healthcare: Internet of Medical Things (IoMT)

Applications:

- Health monitoring wearable (e.g., ECG trackers)
- Remote diagnostics platforms
- Automated medication dispensers
- AI-assisted surgical tools and smart hospital systems

Implications: IoMT plays a transformative role in patient care, especially in remote health management and personalized medicine. The continuous flow of medical data to cloud platforms or healthcare providers raises concerns around the confidentiality and integrity of sensitive

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information. Any compromise in device functionality or data privacy can have serious clinical consequences.

Privacy & Security Risks:

- Breach of protected health data (e.g., EHR access)
- Data transmission vulnerabilities
- Unauthorized alteration of device operations
- Inadequate encryption protocols
- Failure to meet compliance standards (e.g., HIPAA)

3.2. Smart Homes

Applications:

- Voice-controlled digital assistants
- Automated environmental controls (lighting, HVAC)
- Connected home appliances and entertainment systems
- Smart surveillance and alarm systems

Implications: Smart homes enhance lifestyle convenience but also increase exposure to cyber risks. With interconnected devices monitoring behaviors, voice inputs, and physical presence, users often unknowingly generate data that can be exploited for profiling or surveillance. Security lapses can compromise both privacy and physical safety.

Privacy & Security Risks:

- Audio and video eavesdropping
- Breach of internal network via poorly secured devices
- Exploitation of weak or default credentials
- Behavioral pattern mining
- Lack of end-user awareness regarding data collection

3.3. Smart Cities

Applications:

- Adaptive traffic signaling systems
- Sensor-based public lighting and utilities
- Environmental quality monitoring
- Integrated video surveillance and law enforcement systems

Implications: Urban IoT systems aim to streamline governance, optimize resource usage, and enhance citizen services. However, they generate massive datasets involving public behavior and infrastructure control. Poorly secured systems risk mass surveillance, critical infrastructure disruption, and erosion of public trust.

Privacy & Security Risks:

- Exposure of personal or location-based data
- Compromised control over urban systems (e.g., traffic, power)
- Abuse of surveillance technologies
- Exploitable communication interfaces (e.g., APIs)
- System-wide attacks (e.g., ransomware)

3.4. Industrial IoT (IIoT)

Applications:

- Predictive equipment diagnostics
- Automated logistics and production

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- Condition monitoring in hazardous environments
- Remote management of factory operations

Implications: IIoT enhances productivity, reduces downtime, and supports real-time monitoring in manufacturing and logistics. However, integration of operational technology (OT) with information technology (IT) expands the attack surface. Compromises can lead to financial losses, intellectual property theft, or operational paralysis.

Privacy & Security Risks:

- Lack of regular firmware patching
- Weak endpoint protection on legacy equipment
- Data interception or manipulation
- Insider threats and espionage
- Dependency on third-party platforms for core processes

3.5. Agriculture: Smart Farming

Applications:

- Soil health and irrigation system sensors
- Livestock geolocation and activity monitoring
- Autonomous spraying and fertilizing machinery
- Satellite and drone-based crop analytics

Implications: IoT enables precision agriculture, helping optimize inputs, improve yield, and reduce labor. However, farm data—if altered or accessed by adversaries—can lead to supply chain disruptions, insurance manipulation, or economic sabotage.

Privacy & Security Risks:

- Unauthorized access to sensor networks
- Tampering with crop or livestock data
- Exploitation of unencrypted telemetry channels
- Interference with autonomous farm equipment
- Exposure of proprietary agricultural methods or metrics

Sector	Benefits	Key Privacy Issues	Key Security Threats
Healthcare	Remote monitoring, early alerts	EHR breaches, identity theft	Device tampering, insecure transmission
Smart Homes	Automation, convenience	Behavioral profiling, surveillance	Hijacking, voice command spoofing
Smart Cities	Urban efficiency, safety	Mass surveillance, public data leaks	Infrastructure sabotage, ransomware
Industrial IoT	Operational efficiency	Trade secret exposure, data misuse	Espionage, system control compromise
Agriculture	Precision farming, cost savings	Data misuse, insurance fraud	Drone hijacking, remote sabotage

3.6 Data Analysis of IoT Security Incidents across Key Application Domains

This section provides an analytical overview of the distribution of IoT security incidents across key application domains. The data has been synthesized from global IoT threat intelligence reports, case studies, and industry whitepapers.

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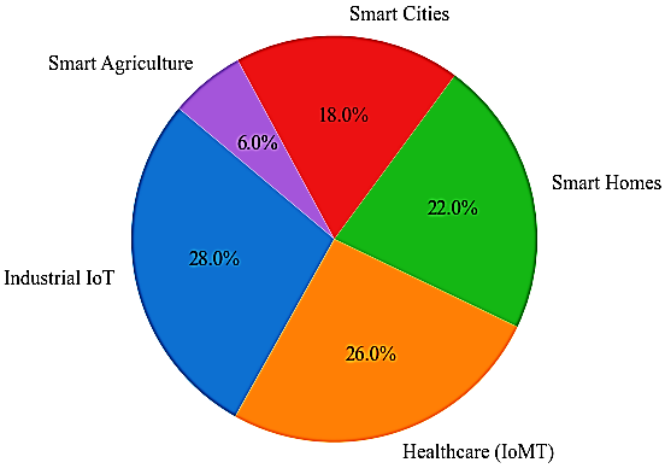
1). Sector-Wise Distribution of IoT Incidents

IoT Domain	Incident Share (%)	Frequent Threats	Key Vulnerabilities
Healthcare (IoMT)	26%	Data breaches, ransomware, device hijacking	Lack of encryption, weak access controls
Smart Homes	22%	Camera hijacking, voice spoofing, botnet recruitment	Default credentials, insecure APIs
Industrial IoT	28%	Espionage, DDoS attacks, firmware exploits	Legacy systems, lack of segmentation
Smart Cities	18%	Infrastructure sabotage, surveillance misuse	Public network exposure, weak endpoint security
Smart Agriculture	6%	GPS spoofing, data manipulation, drone hijacking	Low-cost, insecure sensors, open wireless links

Figure 1: Distribution of IoT Security Incidents by Domain



2). Threat Severity by Category

Threat Category	Prevalence (%)	Severity	Example
Data Leakage	35%	High	Unencrypted health data intercepted
Device Hijacking	25%	High	Botnet-controlled smart cameras
Firmware Exploitation	15%	Moderate	Out-dated IIoT controllers infected
Privacy Violation	15%	High	Behavioral profiling via smart devices
Surveillance Abuse	10%	Moderate	Facial recognition misuse in smart cities

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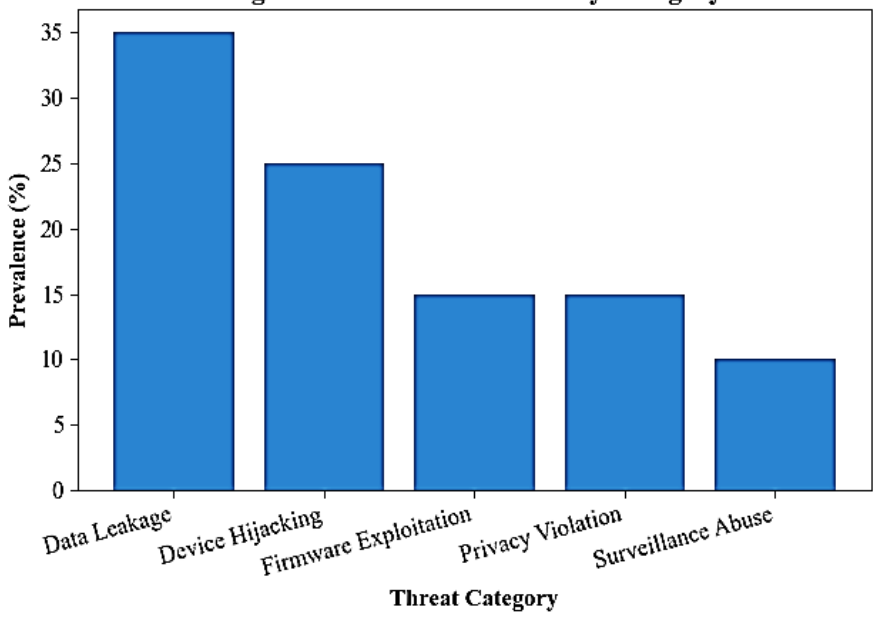
Figure 2: Threat Prevalence by Category



The **Industrial IoT (IIoT)** domain exhibits the highest proportion of incidents, often due to legacy equipment and inadequate updates. **Healthcare systems** are frequently targeted due to the sensitivity of patient data, while **smart homes** face risks from under-secured consumer-grade devices. Although encryption is widely adopted, more advanced mechanisms like blockchain and federated learning remain underutilized, primarily due to deployment and resource constraints.

4. Solutions and Security Mechanisms

With the continuous expansion of the Internet of Things (IoT) into various sectors, the demand for flexible and effective security and privacy strategies becomes critical. The diversity of devices, resource limitations, and varied deployment environments call for customized, low-overhead, and adaptable security frameworks. This section presents a range of strategic, architectural, and operational approaches designed to tackle the primary security and privacy issues in IoT infrastructures.

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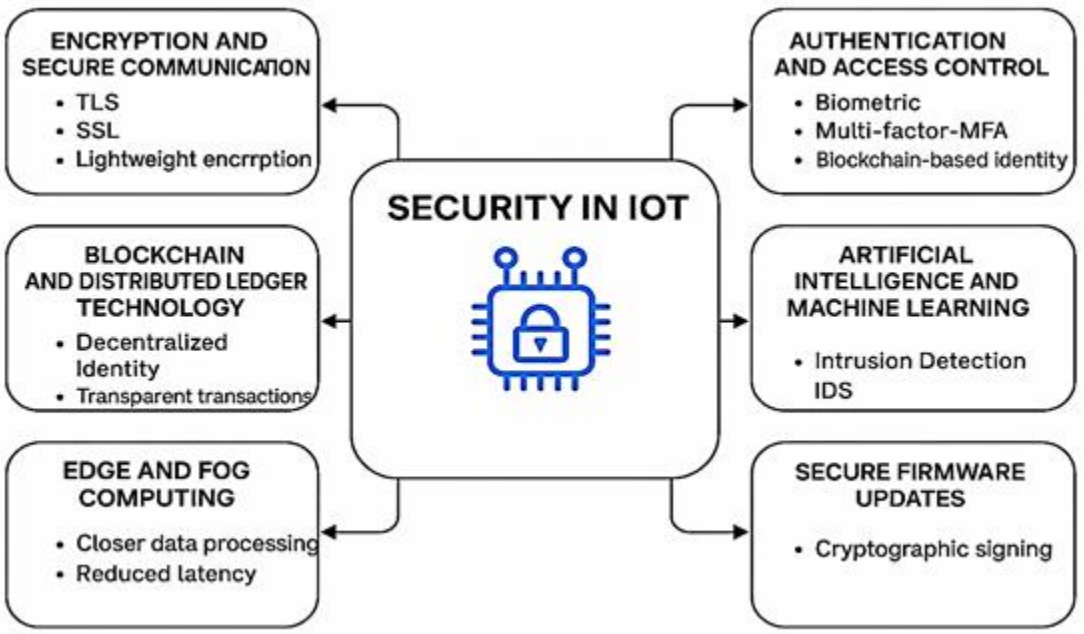

Figure-3: Security Architecture Model in IoT

4.1. Encryption and Secure Communication Protocols

Encryption serves as a core component in protecting data integrity and confidentiality within IoT environments. As many IoT devices operate with limited processing power and memory, adopting encryption methods that are both secure and computationally efficient is essential.

Key Approaches:

1) **Lightweight Encryption Schemes**: Examples include AES-128 and other compact algorithms suited for constrained devices.
2) **Secure Protocols**:
   - TLS and DTLS for encrypted communications over standard networks.
   - MQTT-S and CoAP over DTLS for low-power IoT protocols.
3) **End-to-End Data Protection**: Ensures that only the intended endpoints can access the plaintext data.

Benefits:

- Guards against interception and data manipulation.
- Maintains the confidentiality of user-sensitive information.

4.2. Authentication and Access Management

Robust authentication verifies the legitimacy of users and devices, while access control ensures that they interact only with authorized services and resources.

Key Mechanisms:

1) **Multi-Factor Authentication (MFA):** Incorporates multiple forms of identity verification.
2) **Digital Certificates via PKI:** Ensures device legitimacy using public-private key pairs.
3) **OAuth and OpenID:** Provide user-friendly authentication for consumer IoT.
4) **Role-Based and Attribute-Based Access Controls:** Offer fine-grained authorization policies.

IoT-Specific Practices:

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- **Device Signature Recognition**: Identifies devices through behavioral or hardware characteristics.
- **Embedded Security Modules**: Hardware-based solutions to secure key storage and operations.

4.3. Blockchain and Distributed Ledgers

Blockchain introduces a distributed approach to data integrity and transparency, ideal for multi-device IoT networks.

Common Use Cases:

1) **Identity Management**: Verifies devices and users without central authorities.
2) **Secure Software Distribution**: Tracks firmware changes to prevent unauthorized updates.
3) **Transparent Logging**: Records transactions and actions for audit purposes.

Advantages:

- Avoids central points of compromise.
- Builds verifiable trust across systems.
- Enables decentralized coordination among devices.

Considerations:

- Resource demands can be high, requiring optimization or lighter alternatives like DAGs or permissioned blockchains.

4.4. Machine Learning for Threat Detection

AI and ML can enhance IoT security by identifying abnormal patterns and reacting to threats dynamically.

Applications:

1) **Intrusion Detection Systems**: Analyze network traffic for suspicious activity.
2) **Anomaly Detection**: Recognize deviations in device behavior.
3) **Botnet Identification**: Detects signs of coordinated device misuse.

Methods:

- Supervised models for known attack types.
- Unsupervised techniques for discovering new vulnerabilities.
- Reinforcement learning for adaptive threat response.

4.5. Decentralized and Proximal Computing

By processing data closer to its source, edge and fog computing can limit exposure and improve response speed.

Advantages:

- Enhances data privacy by avoiding unnecessary transmission.
- Supports immediate reaction to threats.
- Reduces overall data traffic.

Practical Scenarios:

- In-vehicle decision systems.
- Hospital-based processing of medical sensor data.

4.6. Resilient Firmware Update Infrastructure

Many security flaws stem from outdated or poorly maintained software. Ensuring a secure, streamlined update process is essential.

Recommended Measures:

- **Remote Update Delivery (OTA)**: Allows efficient and centralized patch distribution.

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- **Digital Signing**: Validates the authenticity and integrity of update files.
- **Safe Recovery Mechanisms**: Enables systems to revert in case of faulty installations.

Challenges:

- Coordinating secure updates at scale without service disruption.

Mechanism	Role in IoT Security	Key Benefits
Encryption Protocols	Secures data in transit and at rest	Prevents eavesdropping, ensures confidentiality
Authentication & Access	Ensures only authorized entities access devices/data	Mitigates spoofing, identity theft
Blockchain	Decentralized trust, secure updates	Eliminates central failure points
AI/ML for IDS	Detects real-time threats and zero-day attacks	Enables proactive security
Edge/Fog Computing	Local processing and filtering	Enhances privacy and reduces latency
Secure Firmware Updates	Patches vulnerabilities remotely	Keeps devices resilient to new threats
Privacy-Preserving Analytics	Protects sensitive user data during processing	Enhances compliance and user trust
Legal Compliance Frameworks	Guides ethical, lawful deployment	Aligns with global privacy expectations

Table-2: Summary of Security Mechanisms and Their Role in IoT

5. Privacy Frameworks and Regulations

5.1. Advanced Techniques for Privacy Preservation

In an increasingly connected IoT landscape, safeguarding sensitive information throughout its entire lifecycle including during storage, transmission, and processing has become essential. Several advanced methods have been developed to ensure data confidentiality without compromising system functionality.

Notable Techniques:

1) **Homomorphic Encryption:**
   This cryptographic method enables computation on encrypted data without needing to decrypt it first. While currently limited by computational overhead, its future potential in secure IoT data processing is significant.
2) **Differential Privacy:**
   This approach involves inserting statistical variations into datasets, helping protect individual data entries while preserving overall analytical accuracy. It's particularly useful in anonymizing large-scale behavioral or location data collected by IoT systems.
3) **Federated Learning:**
   A decentralized machine learning approach where models are trained locally on edge devices. Instead of transmitting raw data to the cloud, only model updates are shared, making it ideal for privacy-centric sectors like telemedicine or financial analytics.

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Illustrative Example:
Hospitals can collectively train diagnostic AI models by leveraging federated learning, thereby preserving patient confidentiality while still improving medical insights across institutions.

5.2. Legal Compliance and Policy Frameworks

Ensuring lawful operation of IoT systems requires adherence to established regulatory standards that prioritize user rights, consent, and accountability. These frameworks set the foundation for secure and ethically-aligned deployments.

Major International Standards and Policies:

1) **General Data Protection Regulation (GDPR):**
   Implemented across the EU, GDPR emphasizes principles like informed consent, purpose limitation, and the right to data erasure, directly impacting how IoT applications must be designed and managed.
2) **Health Insurance Portability and Accountability Act (HIPAA):**
   Applies to health-tech and IoMT (Internet of Medical Things) systems in the United States, mandating secure handling of health data, including access logs, encryption, and audit trails.
3) **NIST IoT Cybersecurity Framework:**
   Developed by the U.S. National Institute of Standards and Technology, this framework outlines risk-based strategies tailored to the unique challenges of connected device ecosystems.
4) **ISO/IEC 27030:**
   An international standard focusing on best practices for securing information systems that involve IoT components, including device authentication, data confidentiality, and service availability.

Recommended Organizational Practices:

- Conduct **routine security audits** and **vulnerability assessments** to evaluate risk posture.
- Implement **Privacy by Design** principles, embedding data protection measures from the earliest design phases.
- Use **Privacy Impact Assessments (PIAs)** prior to new deployments to identify potential risks and necessary controls.

6. Future Research Directions

As IoT systems evolve in scale, diversity, and complexity, security solutions must transition from reactive to proactive. This requires not only technical innovations but also regulatory foresight and ethical stewardship. The following areas highlight the frontier of IoT privacy and security research.

6.1. Cryptographic Innovation beyond Classical Algorithms

With the looming rise of quantum computing, cryptographic tools like RSA may become obsolete. **Post-quantum cryptography** is an active research area that focuses on developing secure alternatives, including lattice-based and hash-based algorithms that can be efficiently implemented on IoT hardware.

6.2. On-Device Learning and Decentralized Intelligence

Federated learning continues to gain traction for enabling intelligent services without compromising user privacy. Research is focused on optimizing training accuracy, minimizing network communication, and ensuring robustness in unreliable IoT networks.

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6.3. Zero Trust-Based Network Architectures

Zero Trust Architecture (ZTA) rejects the idea of a trusted internal network and instead enforces continual verification. Ongoing research explores automated trust scoring, policy enforcement engines, and adaptive access control methods that are context-aware and scalable.

6.4. Predictive and Autonomous Cyber Defense

The concept of **digital twins** virtual replicas of physical IoT systems combined with **AI-based self-healing mechanisms**, presents a new path toward autonomous threat management. These technologies allow simulated testing, real-time system mirroring, and dynamic risk forecasting.

6.5. Lightweight Distributed Ledger Systems

While blockchain provides secure, tamper-proof records, traditional implementations are unsuitable for IoT due to latency and resource demands. Researchers are exploring **low-overhead distributed ledger technologies (DLTs)** like Directed Acyclic Graphs (DAGs) and energy-efficient consensus protocols to make blockchain feasible for constrained devices.

6.6. Standardized Security Ecosystems

The absence of global standards for device interoperability and security hinders scalable IoT deployment. Future efforts should focus on establishing **harmonized frameworks**, certification schemes, and vendor-neutral security APIs that promote consistency across industries.

6.7. Ethical Governance and Responsible AI Use

Emerging technologies raise ethical questions related to surveillance, profiling, and data commodification. There is a growing need for **algorithmic transparency**, **informed consent mechanisms**, and **cross-border data accountability** laws that protect individual autonomy in connected environments.

7. Conclusion

The evolution of the Internet of Things (IoT) marks a pivotal moment in the digital age, influencing critical sectors such as healthcare, manufacturing, agriculture, and urban development. With its potential to drive automation, real-time decision-making and data-driven services, IoT promises considerable improvements in operational efficiency and quality of life. Yet, this rapid expansion is paralleled by complex concerns regarding privacy breaches, system vulnerabilities, and the protection of sensitive information.

Current protective measures, although valuable, often fall short when faced with the dynamic and heterogeneous nature of IoT infrastructures. New and adaptive technologies such as blockchain, federated machine learning, and decentralized edge computing are being introduced as forward-looking solutions. However, to be truly effective, these innovations must be tailored to the limitations and diversity of IoT devices and their communication environments. At the same time, privacy-preserving strategies and ethical considerations must advance in parallel with technical development.

To foster a secure and resilient IoT ecosystem, a multidimensional strategy is required one that not only emphasizes technological progress but also integrates policy reform, public engagement, and cross-sector collaboration. Only through coordinated efforts between researchers, policymakers, and industry leaders can sustainable and intelligent frameworks be established to safeguard the future of interconnected systems.

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(https://jetjournal.us/)
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8. Bibliography

[1] R. H. Weber, "Internet of Things–New security and privacy challenges,"*Computer Law & Security Review*, vol. 26, no. 1, pp. 23–30, 2010.

[2] M. Ammar, G. Russello, and B. Crispo, "Internet of Things: A survey on the security of IoT frameworks," *Journal of Information Security and Applications*, vol. 38, pp. 8–27, 2018.

[3] S. Sicari, A. Rizzardi, L. A. Grieco, and A. Coen-Porisini, "Security, privacy and trust in Internet of Things: The road ahead," *Computer Networks*, vol. 76, pp. 146–164, 2015.

[4] A. Dorri, S. S. Kanhere, and R. Jurdak, "Blockchain in internet of things: Challenges and solutions," *Computer Communications*, vol. 120, pp. 10–29, 2018.

[5] S. K. Sharma and X. Wang, "Live data analytics with collaborative edge and cloud processing in wireless IoT networks," *IEEE Access*, vol. 5, pp. 4621–4635, 2017.

[6] S. Arshad, M. A. Azad, A. Al-Dubai, and E. Abdelfattah, "A survey on security challenges in internet of things: Issues, threats, and solutions," *Internet of Things*, vol. 14, p. 100129, 2021.

[7] H. Shafagh, L. Burkhalter, A. Hithnawi, and S. Duquennoy, "Towards blockchain-based auditable storage and sharing of IoT data," in *Proceedings of the ACM Workshop on Blockchain, Cryptocurrencies and Contracts*, 2017, pp. 45–50.

[8] NIST, *Considerations for Managing Internet of Things (IoT) Cybersecurity and Privacy Risks*, NISTIR 8228, U.S. Department of Commerce, 2019.

[9] European Union, “Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 (General Data Protection Regulation),” *Official Journal of the European Union*, Apr. 2016.

[10] U.S. Department of Health & Human Services, “Health Insurance Portability and Accountability Act (HIPAA),” [Online]. Available: https://www.hhs.gov/hipaa