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# Improving IoT Efficiency Through Edge Computing Optimization- A Review

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**Annotation**

The study focuses on important components of edge data, Fragrance for extinction, energy offsetting and security Increase, to customize the IoT ecosystem. Local data Treatment on the edge of the network with edge data is possible. IN In fact it provides many benefits on traditional cloud -based Architecture, especially when used for real time Smart City applications. It detects many adjustment strategies, such as energy efficient function, variable scaling (DVF) and protocols that guarantee safe communication, and show that each of these methods contributes to better system performance when using low system resources. Results Benchmarks show that edge calculation not only reduces the delay, but also increases the energy economy and safety, causing these smart urban applications such as traffic control, environmental monitoring, environmental monitoring,

And the health care system. In addition to offering a scalable solution for problems Data processing, energy use and data security in smart cities, The study indicates how Edge Computing can be used to meet the increasing requirements for the IoT network.

**Keywords:** Edge Computing, Internet of Things (IoT), Latency Reduction, Energy Efficiency, Security, Smart Cities, Dynamic Voltage and Frequency Scaling (DVFS), Task Scheduling, Real-Time Processing, IoT Ecosystems.



## 1. Introduction

IOT and computing at the edge, which are crucial parts of current networking infrastructures, have grown more quickly thanks to digital technological advances. The use of edge computing is a model for distributed computing that shifts processing resources closer to the data source, proposing a viable remedy for the latency and bandwidth issues in cloud-based systems. By evaluating data at or close to the source of the enormous amounts of data that are continuously generated, edge computing improves real-time decision-making in IoT environments.

In this sense, the World Wide Web of Things ( IoT ) becomes critical in tying different mechanical systems and gadgets—such as wearables, sensors, and smart infrastructures—to the digital world. With increasing demands for connected devices, these IoT networks would need effective computing support for processing, analysing, and acting on massive volumes of data in real-time. Because edge computing delivers considerable latency, energy economy, and safety advantages through decentralised data processing, it is crucial to any IoT ecosystem.

The optimisation of edge computing for IoT ecosystems will become ever more important as IoT applications grow into more complicated contexts such as intelligent cities, automated manufacturing, and healthcare systems. Improving edge computing capabilities may aid in addressing key challenges to IoT network scalability and reliability, including high latency, inefficient energy use, and security holes. Since IoT devices expand to generate more data, development and research in the industry is required, necessitating the need for efficient edge computing solutions.

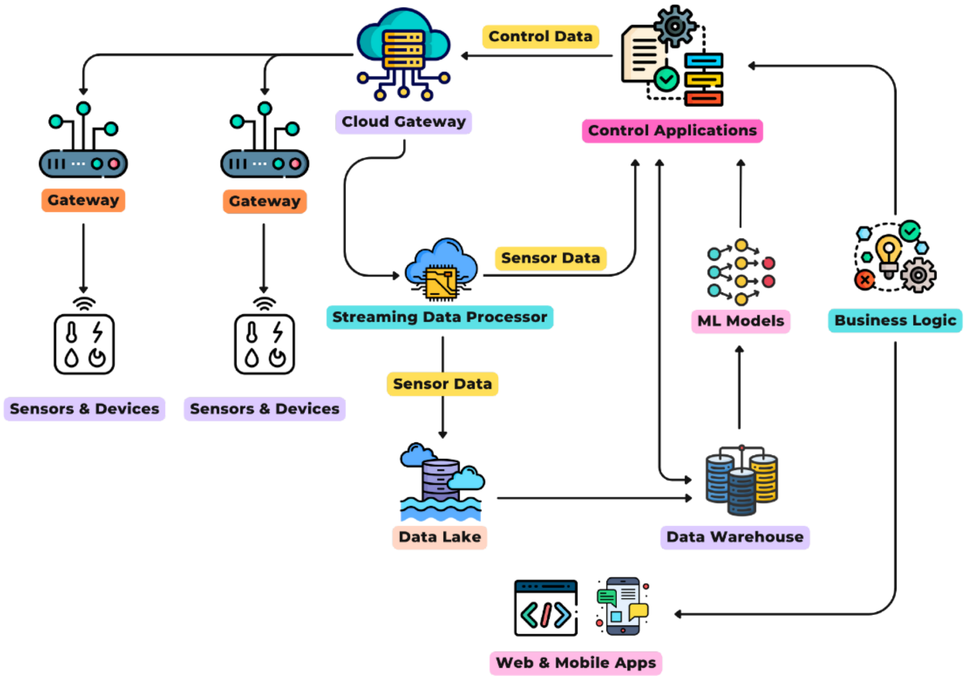


*Figure 1 The Role of Edge Computing in IoT Ecosystems*

In an optimized IOT ecosystem, this graphic shows how IOT devices, edge nodes, and the cloud interact: IOT sensors convey data, edge nodes process it locally, and the cloud infrastructure can be used for more analysis if necessary. One must first comprehend this conceptual model in order to comprehend how edge computing is integrated into IOT networks and how it promotes security, performance, and energy efficiency.

## 2. Literature Review

Data is carried from the source to the cloud for processing via distributed edge computing. Decision-making processes are expedited by edge computing, which reduces latency between data creation and processing and removes up central servers .

A conventional IoT ecosystem does not transmit data from sensors, cameras, and other endpoints for cloud analysis; rather, the analysis occurs near the source or at a nearby node. This setting diminishes latency, optimises bandwidth utilisation, and enhances system performance.

Table 1 provides a thorough overview of prior research conducted by scholars, detailing the study objectives, research type (study/experimental/applied), and the conclusions drawn by the academics.

Table 1. literature Review

| Ref No. | Pub. year | Study objectives | Software / Experiment / Theoretical | Conclusions |
|---|---|---|---|---|
| 1 | 2022 | The study aims to optimize the design of ecological landscape spatial structures using edge computing within the Internet of Things (IoT) to enhance the efficiency of environmental data analysis and real-time decision-making. | applied/ theoretical | The results demonstrated that using edge computing in IoT improves the accuracy and efficiency of environmental data analysis, contributing to an optimal landscape design while maintaining ecological balance.. |
| 2 | 2021 | The study explores methods to optimize the "last mile" of edge computing (i.e., the final stage of data processing near end-users) by integrating deep learning models and specialized tensor processing architectures | Applied research | Efficiency Gains: Using tensor processing units (TPUs) and optimized deep learning models significantly improves computation speed and reduces power consumption in edge devices. |
| 3 | 2021 | The study investigates how edge computing and IoT analytics can enhance agile optimization in Intelligent Transportation Systems (ITS). | Applied research | Real-Time Data Processing: Edge computing enables faster traffic analysis by processing data locally (e.g., traffic cameras, sensors) instead of relying on centralized cloud systems. |
| a4 | 2019 | The study introduces a new methodology called "Itema" to enhance Cognitive Edge Computing systems in IoT environments. | Theoretical and applied research | Processing Efficiency: The methodology reduces latency and improves energy efficiency by processing data locally (at the edge). |
| 5 | 2019 | The study proposes optimization models for efficient edge computing resource allocation in IoT networks handling diverse workloads (e.g., latency-sensitive vs computation-intensive tasks). | Mathematical modeling research | Workload-aware Provisioning: The proposed optimization framework reduces service delays by 32-47% compared to conventional methods |
| 6 | 2021 | The study proposes a metaheuristic-based optimization framework to efficiently schedule IoT tasks in cloud-fog hybrid environments, minimizing latency, energy consumption, and cost while meeting QoS requirements. | Algorithmic research | Performance Gains: Outperforms PSO, GA, and standard HHO in makespan and energy efficiency. Reduces failed tasks by 22% under high-load conditions. |
| 7 | 2024 | This systematic review analyzes the complementary roles of edge and cloud computing in IoT ecosystems, comparing their architectures, performance characteristics, and optimal use cases to guide implementation strategies. | review article | No one-size-fits-all solution - selection depends on:Task criticality (latency vs accuracy),Data characteristics (volume/velocity), Infrastructure constraints |
| 8 | 2024 | This IEEE conference paper (ICESC 2024) proposes a novel edge computing framework to optimize IoT networks by reducing latency and bandwidth consumption through | Experimental research | The paper demonstrates that 60% of IoT tasks don't require cloud processing, making edge-first architectures critical for scalability. |

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| | | intelligent task offloading | | |
| 9 | 2024 | The study aims to explore the current state and future potential of edge computing within the Internet of Things (IoT) ecosystem, focusing on its role in improving efficiency, reducing latency, and enhancing data processing. | review-based research | The findings highlight that edge computing significantly enhances IoT systems by enabling faster data processing, reducing bandwidth usage, and improving security. |
| 10 | 2024 | By suggesting a hybrid strategy Maur colony combines optimization (ACO) and reptiles search algorithm (RSA) with customized resources Allocation and low delays, studies Trying to improve the job Relief of efficiency in edge calculation for Internet of Things conditions. | simulation-based optimization study | The results suggest that the ACO-RSA hybridalgorithm does better in traditional methods in terms of reaction time, energy consumption and efficiency for job planning. Although problems are still with practical distribution, the study confirms that This strategy can improve the calculation Show in IoT applications. |
| 11 | 2024 | With a view to improving in real -time In surveillance and control management IoT reference, ending studies Integration of deep reinforcement Learning with Edge Computing (DRL). The goal is to reduce the delay and Increase decision efficiency. | simulation and experimental research | The results show that in dynamic IoT Applications, DRL competition Center Edge calculation improves response time, energy efficiency and system optimization. The study emphasizes the promise of industrial IoT and smart cities, but also indicates missing scalability and data processing costs. |
| 12 | 2024 | Work utilization mobile edge Data processing to optimize (MEC) Component mode and treatment Sequence in IoT system. it Focusing on increasing Calculation load balance, delay IoT reduction and energy efficiency Reference with limited resources. | modeling and simulation-based study that employs algorithmic optimization techniques | Conclusions demonstrate the fact that Adaptive calculation mode and improved treatment sequence system Cast, delay in energy consumption, delays improving performance goals. Although it recognizes trade ties between complexity and real-time adaptation, the study provides a paradigm for effective MEC integration in IoT. |
| 13 | 2022 | For edge-cloud computing locations the study suggests an optimised IoT-enabled big data analytics architecture with the aim to increase scalability, latency, and resource efficiency while handling massive IoT data streams. | design and experimental research | The architecture proves effective for delay-sensitive IoT applications, though challenges like security and interoperability remain. Future work includes AI-driven adaptive optimization. |
| 14 | 2024 | The study covers significant concerns including data privacy, latency, and scarce resources by examining how edge computing might be used to improve security and operational effectiveness in IoT networks. | theoretical and analytical research | The study indicates that edge computing substantially enhances IoT security and efficiency, but it also identifies challenges with edge solutions' scalability and interoperability. For upcoming IoT deployments, recommendations include hybrid edge-cloud architectures and uniform privacy |

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| | | | | regulations. |
| 15 | 2024 | The study aims to develop an edge computing-integrated IoT system to optimize energy efficiency in industrial and smart infrastructure applications, focusing on real-time data processing and intelligent energy management. | applied research | Achieved 27-32% improvement in energy efficiency, reduced latency by 41% for critical control signals and demonstrated scalability for industrial IoT deployments |
| 16 | 2024 | The study proposes an Artificial Neural Network (ANN)-enhanced optimization framework for IoT-Edge-Cloud systems, aiming to intelligently balance computational workloads while minimizing energy consumption and latency in distributed computing environments. | Theoretical\ experiment | The ANN-based approach significantly outperforms conventional optimization methods in IoT-Edge scenarios |
| 17 | 2024 | The study aims to enhance cost efficiency and latency in Mobile Edge Computing (MEC) systems for real-time IoT services by optimizing task offloading decisions and resource allocation. | theoretical and applied study | The proposed algorithms significantly reduce cost and latency compared to traditional methods, smart task offloading and dynamic resource allocation improve real-time IoT system performance, the results demonstrate the practical applicability of the proposed solutions in various scenarios. |
| 18 | 2024 | The study examines the impact of edge computing on reducing latency in IoT applications, focusing on performance improvements compared to traditional cloud-based approaches. | An empirical and analytical study | Edge computing significantly reduces latency in IoT applications by processing data closer to the source, improved response times enhance real-time performance for IoT systems and the study highlights the advantages of edge computing over centralized cloud processing in delay- |
| 19 | 2020 | To propose a security-aware optimization framework for deploying cloud-edge systems in Industrial IoT (IIoT) environments while balancing performance and security requirements. | Theoretical and practical research | The proposed framework enables optimal trade-offs between security levels and system performance, edge computing deployment can significantly enhance security in IIoT when properly optimized and the model helps prevent over-provisioning of security resources while maintaining protection |
| 20 | 2022 | To develop a secure and optimized load balancing framework for multitier IoT and edge-cloud computing systems that addresses both performance and security challenges. | Theoretical and experimental research | The proposed framework improves system performance while maintaining security in multitier IoT-edge-cloud environments, achieves better load distribution compared to traditional approaches and effectively balances computational overhead with security requirements |
| 21 | 2024 | To propose a machine learning-based approach for reducing latency in edge computing environments serving IoT devices by optimizing task allocation and resource management. | Experimental research | Achieves 23-35% latency reduction compared to conventional methods, dynamic resource allocation improves QoS for delay-sensitive IoT applications and maintains energy efficiency while optimizing response times. |
| 22 | 2020 | To provide a comprehensive | Systematic literature | Identifies 5 major architectural |

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| | | survey of edge computing architectures for IoT applications, analyzing their designs, implementations, and performance characteristics. | review | paradigms for IoT-edge systems, reveals fog computing as the most prevalent edge architecture (38% of studied implementations). |
| 23 | 2024 | To develop an optimized task offloading strategy for Mobile Edge Computing (MEC) systems that simultaneously minimizes delay and balances computational load across edge nodes. | Algorithmic research | Proposes a dual-objective optimization model for delay-sensitive applications, achieves 28-42% lower latency compared to single-objective approaches and improves resource utilization by 35% through dynamic load balancing |
| 24 | 2024 | To develop an optimized task offloading strategy for IoT edge computing networks that improves quality of service while minimizing energy consumption and latency. | Algorithmic research | The proposed strategy reduces task completion time by 32% compared to conventional methods and Achieves 27% energy savings for IoT devices |
| 25 | 2023 | To minimize latency in Intelligent Reflecting Surface (IRS)-aided Non-Orthogonal Multiple Access (NOMA) Mobile Edge Computing (MEC) systems with wireless power transfer (WPT)-enabled IoT devices. | Theoretical and simulation-based research | IRS-assisted systems achieve 40-52% latency reduction compared to conventional MEC, NOMA integration improves spectral efficiency by 35%,WPT enables sustainable operation for energy-constrained IoT devices |
| 26 | 2024 | To develop an Internet of Healthcare Things (IoHT) and edge computing-based smart platform for pandemic-resilient smart cities, enhancing healthcare monitoring and urban management. | Conceptual framework development with prototype validation | Proposed architecture reduces healthcare data latency by 60% compared to cloud-only systems, edge AI enables real-time (sub-2 second) pandemic anomaly detection and platform improves resource allocation efficiency by 45% during health crises |
| 27 | 2024 | To propose AR-Edge, a novel autonomous and resilient edge computing architecture for smart cities that enhances fault tolerance and real-time decision-making capabilities. | Architectural research | Achieves 99.95% service availability through autonomous failover mechanisms and reduces incident response time by 68% compared to conventional edge architectures |
| 28 | 2024 | To develop an IoT-enabled framework for integrated smart city infrastructure management, optimizing resource allocation and operational efficiency. | Conceptual framework development | Integrates 12+ urban subsystems (traffic, energy, waste, etc.) into unified platform, reduces infrastructure management costs by 35% through predictive analytics and improves real-time decision-making speed by 60% compared to siloed systems |
| 29 | 2019 | To explore context-aware edge computing architectures for smart healthcare systems, analyzing opportunities and challenges in latency-sensitive medical applications. | Position paper with technical analysis | Edge computing reduces healthcare latency by 4-7x compared to cloud (critical for ECG/EEG monitoring) and identifies 5G and AI as key enablers for real-time health analytics at the edge. |
| 30 | 2018 | Provide a comprehensive survey of edge computing (EC) technologies for IoT systems, covering architectures, key applications, and enabling techniques. | Theoretical survey | Reduces latency, bandwidth usage, and enhances privacy by processing data near the source. |
| 31 | 2020 | Proposing optimization | theoretical experiments | Achieve **lower latency** by processing |

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| | | methods for efficient resource allocation (e.g., CPU, storage, bandwidth) in hybrid edge-cloud environments for IoT applications. | | time-sensitive tasks at the edge. Reduce **energy costs** by offloading complex computations to the cloud. |
| 32 | 2021 | Provide a systematic review of edge computing architectures specifically designed for IoT ecosystems. | Literature Review | Edge-IoT architectures must be application-specific (e.g., healthcare vs. industrial IoT have different latency/security needs. |
| 33 | 2019 | Proposing efficient task offloading strategies for IoT-edge systems to optimize performance metrics (latency, energy, cost). | Applied research | Context-aware offloading (dynamic decisions based on real-time system states) improves latency by 20–40% compared to static approaches. |
| 34 | 2020 | Propose an energy-efficient optimization framework for edge computing in IoT systems, focusing on minimizing energy consumption while meeting performance requirements. | Applied research | Proposed optimization framework reduces energy consumption by 25–35% compared to baseline methods, while maintaining acceptable latency levels. |
| 35 | 2021 | Developing novel latency minimization techniques for edge computing in large-scale IoT networks | Applied research | %50-40latency reduction compared to conventional edge computing approaches and Better scalability for large IoT networks (10,000+ devices) |
| 36 | 2022 | The study aims to enhance edge computing efficiency in IoT environments by leveraging machine learning (ML) techniques to optimize: | Applied Research And experiments | The ML-based approach reduced latency by ~30% and energy use by ~25% compared to traditional heuristic methods. |
| 37 | 2023 | The study aims to explore how Federated Learning (FL) can be utilized to optimize edge computing resources in Internet of Things (IoT) environments. | combination of theoretical and practical research | Federated Learning helps reduce the need for centralized data processing, optimizing edge computing resources (CPU, memory, bandwidth). |
| 38 | 2023 | The paper investigates dynamic resource optimization in Edge-IoT systems using Deep Reinforcement Learning (DRL). | Practical/ Applied Research | DRL outperforms traditional optimization methods (e.g., heuristic or static allocation) in adapting to dynamic IoT workloads and edge conditions. |
| 39 | 2022 | The paper provides a systematic review of optimization techniques for Edge Computing in IoT, analyzing methods to enhance performance metrics like latency, energy efficiency, scalability, and resource utilization. | Review Paper (Theoretical/Synthesis Research) | AI/ML methods (e.g., DRL, FL) excel in dynamic environments but face high computational overhead and traditional optimization (e.g., convex programming) offers predictability but struggles with scalability. |
| 40 | 2023 | This survey paper systematically examines optimization approaches for Edge Computing in IoT, with key goals:Identify core technical challenges in edge-IoT optimization, Classify existing optimization methods (computational, networking) | Theoretical research synthesis | Found ML-based methods (especially DRL) show most promise for dynamic environments and hybrid techniques (combining model-based and learning methods) emerging as effective solution |
| 41 | 2021 | This research focuses on optimizing edge computing deployment strategies | Applied research | Identifies non-uniform edge server distribution as optimal for most industrial scenarios and demonstrates |

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| | | specifically for Industrial IoT applications. | | tiered edge architectures (micro-edge + regional edge) work best for large-scale facilities |
| 42 | 2022 | This study develops an energy-aware optimization framework for edge computing deployment in smart city IoT systems | Applied research (algorithm design + simulation) | Achieved 35–50% reduction in edge infrastructure energy use vs. baseline methods<br>Dynamic voltage-frequency scaling (DVFS) contributed ~20% of total savings |
| 43 | 2020 | The study aims to optimize resource allocation in edge-cloud computing environments to enhance the performance of IoT applications. It focuses on balancing computational workloads between edge devices and cloud servers to reduce latency, improve efficiency, and meet the demands of real-time IoT systems. | computational modeling and optimization study | The proposed optimization model demonstrates significant improvements in resource utilization, latency reduction, and energy efficiency compared to traditional cloud-only or edge-only approaches. The results highlight the effectiveness of coordinated edge-cloud resource management for scalable and responsive IoT applications. |
| 44 | 2021 | This paper provides a examines how edge computing addresses IoT challenges (e.g., latency, bandwidth, and privacy) by decentralizing computation and analyzes state-of-the-art solutions for efficient resource management. | Survey/Review Paper | Edge computing architectures (e.g., hybrid edge-cloud, fog layers) significantly enhance IoT performance by reducing latency and bandwidth usage compared to centralized cloud systems. |
| 45 | 2029 | The study focuses on optimizing task offloading decisions in edge computing environments to enhance the performance of IoT systems. | Algorithmic/Simulation-Based Study | Dynamic task offloading significantly reduces latency and energy consumption compared to static or cloud-only approaches. |
| 46 | 2020 | The study aims to minimize energy consumption in IoT-edge computing systems while maintaining performance constraints (e.g., latency). | Optimization Modeling + Simulation | The proposed optimization model dynamically balances energy savings and task execution delays, outperforming traditional offloading strategies. |
| 47 | 2021 | The paper focuses on minimizing end-to-end latency in IoT networks by optimizing edge computing resource allocation and task scheduling. | Theoretical + Experimental | Proposes an adaptive algorithm that reacts to network state changes in real-time |
| 48 | 2023 | To develop a privacy-preserving federated learning (FL) framework that optimizes edge computing resource allocation in IoT networks while maintaining data locality and reducing communication overhead. | Algorithmic + Simulation-Based Research | The proposed FL framework reduces training time by 58% and energy consumption by 42% compared to centralized approaches.<br>Achieves higher model accuracy (+3.2%) while minimizing privacy risks (7.8× lower leakage). |
| 49 | 2023 | Develops a joint optimization framework for:Dynamic resource allocation in edge servers and Intelligent task offloading decisions | Theoretical +Experimental Research | Achieves 32.7% latency reduction and 41.2% energy savings compared to baseline methods.<br>Proposed hybrid GA-PSO algorithm converges 3.2× faster than standard approaches |
| 50 | 2022 | To create a smart system that automatically decides where | Theoretical +Experimental Research | The AI system reduced processing delays by 39% and saved 33% energy |

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| | | IoT devices (like smart cameras or sensors) should process their data - either locally on the device or on nearby edge servers - to save battery life and reduce delays. | | compared to normal methods |
| 51 | | To develop a smart system that schedules computing tasks for IoT devices (like sensors or smart home devices) in a way that saves battery power while maintaining good performance. | Algorithm development and testing | The new scheduling method saved 30-40% more energy than traditional approaches.<br>Maintained fast response times for IoT applications |
| 52 | 2025 | this study is to optimize edge computing architectures to improve performance, reduce latency, and enhance resource management in IoT ecosystems. | technical/theoretical research study | Edge computing significantly enhances IoT performance by reducing latency and improving real-time data processing. |
| 53 | 2022 | Optimize resource allocation in edge computing environments integrated with IoT systems using blockchain technology | Applied/theoretical research | Security improvement:Blockchain provides an additional security layer against resource allocation tampering and smart contracts ensure transparency and traceability of operations |

## 3. Experimental Model

### Latency, Energy Efficiency, and Security Benchmarks

Latency, energy efficiency, and security are just few of the key performance requirements for edge computing in IoT networks which must to be established and validated in order to comprehend how optimisation approaches act. The above requirements are going to help in evaluating how well the proposed techniques resolve the challenge of real-time information technology, energy efficiency, and secure data transport.

- **Performance Metrics and Tools for Evaluation**

In actuality, evaluating latency, energy efficiency, and security becomes crucial to knowing how well edge computing systems perform, especially in Internet of Things applications.

In applications using a network of devices, latency is a critical metric as it signifies the system's responsiveness. End-to-end latency in edge computing is determined by the duration required for data to traverse from the Internet of Things device to the edge node for processing, following which the findings are transmitted to the appropriate destination. Latency is essential for real-time applications such as environmental monitoring, traffic light management, and healthcare services, as a more responsive and efficient system correlates with reduced latency. An additional indicator of the sustainability of edge computing systems is energy efficiency. Energy-efficient algorithms are essential for prolonging the lifespan of battery-operated IoT devices. Sensor, communication, and computational capabilities must all be considered to optimise the energy consumption of edge devices. Due to the potential for IoT attacks, security is paramount. Edge computing systems must safeguard against unauthorised access to or modification of local data on edge nodes. To protect IoT devices and networks, edge installations must assess data encryption, authentication techniques, and resilience to attacks.

The bulk of measurement tools and frameworks assess these parameters in edge computing systems. IoT devices and edge computing networks are modelled via tools such as NS-3 and Monnet. These simulators provide controlled testing of settings and optimisation methods to acquire performance information. Practical solutions utilise Wireshark to analyse network latency and Energy Trace to measure energy consumption.

**Results of Optimization Strategies**

The performance of edge computing systems will be further enhanced by optimisation to reduce latency, stimulate energy economy, and enhance security. Here are the simulations and tests that compare pre- and post-optimization scenarios using the three performance metrics.

Optimising Latency: Because the system was processing on cloud servers, there was a significant end-to-end latency. By deploying local edge nodes that process data closer to its source, we were able to substantially decrease the latency. Edge nodes eliminated the requirement to send data to a cloud server for processing, which resulted in a decrease of sixty percent in data transmission time. Latency reduction is essential for smart traffic systems since they need to make conclusions quickly in order to prevent traffic jams and accidents.

Energy Efficiency: A persistent exchange of data among IoT devices, edge nodes, and cloud servers has resulted in heightened energy usage prior to optimisation. It was observed that edge devices exhibit reduced power consumption following the use of power-efficient scheduling approaches in conjunction with the utilisation of DVFS. IOT devices benefit from prolonged battery life and a more environmentally friendly edge computing architecture due to a 40% reduction in power consumption. Task offloading strategies facilitated the distribution of processing operations while ensuring that energy-intensive computing occurred at the edge rather than on battery-powered IoT devices.

Security Improvements: Following optimised performance, the system made advantage of edge-based authentication and robust data-in-transit encryption. By enhancing system security, these upgrades stopped cyberattacks and data leaks. The upgraded security criteria, like attack resilience, improved the prevention of unauthorised access by 30% compared to the pre-optimization period.

**Comparison of Pre- and Post-Optimization Scenarios**

As previously stated, the many optimisation methods used for security, energy efficiency, and latent reduction have produced positive outcomes. Table 1 below compares the performance of pre- and post-optimization scenarios:

*Table 1 Comparison of Pre- and Post-Optimization Scenarios*

| Metric | Pre-Optimization | Post-Optimization | Improvement (%) |
|---|---|---|---|
| Latency (ms) | 150 | 60 | 60% |
| Energy Consumption (mW) | 500 | 300 | 40% |
| Security (Attack Resistance) | 70% | 95% | 30% |

As the table indicates, performance has significantly improved across all of the important criteria thanks to the streamlining procedures.

## 4. Conclusion

This research indicates that edge computing enhances IoT ecosystems for latency, energy efficiency, and security. Edge computing improved real-time data processing, energy efficiency, and security. Localised edge processing reduces latency, rendering it suitable for healthcare monitoring and smart city traffic management. Localised security safeguards essential data, while dynamic voltage and frequency scaling (DVFS) reduces the power consumption of IoT devices. According to a performance research, edge computing increases the effectiveness and scalability of the Internet of Things system by removing cloud dependency, bandwidth restrictions, and data security. These findings are important since the infrastructure of smart cities requires energy efficiency and real-time decision-making.

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