e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:06/April-2024 Impact Factor- 7.868 www.irjmets.com

EDGE COMPUTING TECHNOLOGY: REVOLUTIONIZING DAILY EXISTENCE

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DOI : https://www.doi.org/10.56726/IRJMETS52305

ABSTRACT

As the need for real-time data processing and low-latency applications continues to rise, edge computing has emerged as a critical option that is revolutionizing the traditional centralized approach to computing. This article provides a thorough introduction to edge computing, exploring its underlying theories, structural models, and diverse range of uses. Edge computing reduces latency and maximizes bandwidth utilization at the network edge by enabling quick data processing and analysis due to its decentralized structure and close proximity to data sources. Numerous architectural models, such as mobile edge computing and fog computing, provide adaptable deployment choices for a range of use cases and infrastructure needs. We investigate the numerous applications of edge computing in sectors such as smart cities, healthcare, and the Internet of Things (IoT) by fusing theoretical knowledge with real-world examples. In a range of applications, such as real-time healthcare monitoring, traffic management in urban settings, and improved IoT device connectivity, edge computing has the potential to unleash new heights of efficiency, scalability, and creativity. The purpose of this article is to give researchers, practitioners, and stakeholders a thorough grasp of the revolutionary potential of edge computing and how it will influence distributed computing and data-driven decision-making in the future.

Keywords: Real-Time Data Processing, Proximity-Based Computing, Decentralized Computing, Iot, Smart Cities, Healthcare, And Autonomous Cars Are Some Of The Applications Of Edge Computing.

I. INTRODUCTION

An unprecedented amount of data has been produced in the current digital era by the spread of linked devices, the Internet of Things (IoT), and real-time applications. Traditional centralized computing systems cannot handle the enormous volume and pace of data created at the network edge, which leads to latency issues, bandwidth shortages, and inefficient data processing. In response to these challenges, edge computing has emerged as a paradigm-shifting technology that offers a decentralized approach to data processing.

Fundamentally, edge computing allows for quick processing and analysis without requiring round-trip connectivity to centralized data centers by moving computation and data storage closer to the data source. Because of its close proximity to data sources, it performs better overall, minimizes latency, and is especially well-suited for applications that call for low-latency interactions and real-time responsiveness.

The term "edge computing" refers to a broad spectrum of deployment approaches and architectural models, each suited to certain use cases and infrastructure needs. Fog computing, for instance, uses a scattered network of computing resources to provide more user-friendly services and to push cloud computing concepts closer to the network's edge. On the other hand, mobile edge computing enables efficient content delivery and mobile application processing by bringing processing and storage capacity to the edge of the radio access network (RAN).

The Internet of Things, smart cities, healthcare, and driverless cars are just a few of the businesses and disciplines in which edge computing has potential uses. Edge computing powers real-time data processing and decision-making at the device level in Internet of Things deployments, allowing for resource allocation and autonomous operation. Edge computing makes it possible to implement smart services and infrastructure in smart cities, like public safety apps, traffic control systems, and environmental monitoring. Edge computing is essential to the healthcare industry because it makes remote diagnosis, individualized treatment, and real-time patient monitoring possible. By processing and analyzing medical data at the edge, healthcare practitioners can enhance patient outcomes, save costs, and raise overall treatment quality.

Furthermore, edge computing has the potential to completely transform logistics and transportation through uses in fleet management, predictive maintenance, and driverless cars. Autonomous vehicles can increase road

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safety and efficiency by making split-second judgments based on real-time sensor data by utilizing edge computing capabilities.

All things considered, edge computing offers scalability, flexibility, and efficiency in managing the enormous volumes of data generated in today's networked world, thereby bringing about a paradigm shift in the way we approach data processing and analysis. Our goal in this paper is to present a thorough examination of edge computing, including everything from its fundamental ideas to its wide range of industrial applications. We attempt to clarify the revolutionary potential of edge computing and its implications for the future of distributed computing and data-driven decision-making through a synthesis of theoretical ideas, case studies, and real-world experiences.

In today's fast-paced digital environment, real-time data processing and low-latency applications are highly sought for. This demand is too much for traditional centralized computer architectures to handle, which causes inefficiencies and delays in data processing. Edge computing is a revolutionary technology that provides a decentralized approach to data processing and analysis. It reduces latency and improves system performance by moving computation closer to the data source.

This article delves into the fundamental ideas and technological developments of edge computing, as well as its various applications in daily life, ranging from connected cars to smart homes and more.

Fundamental Ideas in Edge Computing

By reducing the distance between data sources and processing, edge computing aims to maximize bandwidth consumption and minimize delay. Edge computing makes fast data processing and analysis possible at the location of the data, which could be IoT devices, sensors, or mobile devices, without requiring round-trip connectivity to centralized data centers. Being close to the network's edge improves real-time responsiveness and makes a variety of applications possible that call for low-latency interactions possible.

Developments in Edge Computing Technology:

Technological developments in edge computing have made it possible to create a variety of architectural models and deployment methodologies that are suited to certain use cases and infrastructure needs. Fog computing, for example, uses a scattered network of computer resources to bring cloud computing principles closer to the network edge and provide more end-user-accessible services. By extending computation and storage capabilities to the edge of radio access networks (RANs), mobile edge computing seeks to enable efficient content delivery and mobile application processing.

Edge Computing Uses in Everyday Life:

1. **Intelligent Houses:**

Edge computing makes it possible to seamlessly automate and control IoT devices and smart appliances in smart homes. To improve comfort and energy efficiency, edge computing, for instance, can evaluate sensor data from smart thermostats in real-time to modify heating and cooling settings based on occupancy patterns, weather, and energy consumption.

2. **Autos with Internet connectivity:**

In connected automotive applications, edge computing is essential because it allows real-time processing of sensor data for features like autonomous driving, adaptive cruise control, and collision avoidance. Connected automobiles can improve road safety and efficiency by making split-second judgments based on real-time traffic conditions, road dangers, and vehicle performance indicators by utilizing edge computing capabilities.

3. **Retail:**

Real-time inventory management and individualized shopping experiences are made possible in the retail sector by edge computing. To improve customer engagement and satisfaction, edge computing, for instance, can evaluate customer data and purchase history in-store to give personalized incentives and recommendations. Furthermore, edge computing can improve supply chain efficiency and inventory levels by tracking stock levels and instantly forecasting changes in demand.

4. **Medical Care:**

In the healthcare industry, edge computing enables remote diagnosis, individualized treatment, and real-time patient monitoring. Wearable health devices with edge computing capabilities, for example, can continually

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monitor health metrics and vital signs and notify healthcare practitioners of any anomalies or crises. Additionally, edge computing makes telemedicine applications possible, enabling people to get medical treatments from the comfort of their homes and consult with medical specialists remotely.

II. CONCLUSION

By enabling real-time data processing, low-latency interactions, and intelligent automation across a wide range of applications, edge computing technology is radically changing daily life. Edge computing provides scalability, flexibility, and efficiency in processing the massive amounts of data generated in today's networked world, from smart homes and connected cars to retail and healthcare. Edge computing's revolutionary influence on daily life is expected to increase as it develops further, opening up new possibilities for creativity, effectiveness, and convenience.

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