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Engineering

INTELLIGENT ENERGY-AWARE DECISION-MAKING AT THE EDGE IN HEALTHCARE USING FOG INFRASTRUCTURE

KEY WORDS: Edge computing, Consumption, deep learning, Enormous

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ABSTRACT

Modern cloud computing platforms are having trouble keeping up with the enormous volume of data flow generated by crowdsourcing and the intense computational requirements posed by conventional deep learning applications. Reduced resource consumption can be achieved by edge computing. The goal of the healthcare system is to offer a dependable and well-planned solution to improve societal health. Patients will be more satisfied with their care as a result of doctors taking their medical histories into account when creating healthcare systems and providing care. As a result, the healthcare sector is getting increasingly competitive. Healthcare systems are expanding significantly, which raises issues such massive data volume, reaction time, latency, and security susceptibility. Thus, as a well- known distributed architecture, fog computing could assist in solving

INTRODUCTION

In a decentralized computing environment known as fog computing, data, compute, storage, and applications are distributed between the data source and the cloud. Fog computing brings the benefits and power of the cloud closer to where data is created and used. This is similar to edge computing.

Fog computing is an architecture for computing, storing, and communicating that uses EDGE devices to carry out a sizeable chunk of computation, storing, and communicating locally before sending it over the Internet backbone.

Edge devices are used in an architecture called fog computing or fog networking, also referred to as fogging, to perform a significant amount of compute (edge computing), storage, and communication locally while being routed via the Internet backbone.

Cloud computing that extends to a company's network is referred to as "fog computing."

OBJECTIVE

To examine and lower the enormous amount of energy usage. To increase the accuracy of data and the speed of patient data retrieval.

To safeguard the confidentiality and privacy of patient health information.

Ensuring the data's accuracy or integrity throughout the full process of data collection and decision- making. large-scale energy use. Health information about patients is private and secure.

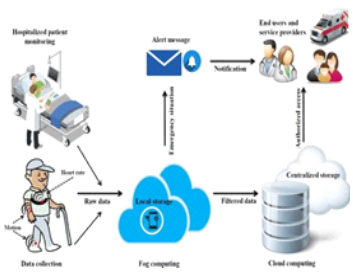

Figure 1: Healthcare Architecture

TABLE – 1 GENERAL DETAILS

Table 1

Requirements	Cloud Computing	Fog Computing
Latency	High	Low
Delay Jitter	High	Very low
Location of Service	Within the Internet	At the edge of the local network
Distance between client and server	Multiple hops	One hope
Security	Undefined	Can be defined
Attack on data enroute	High probability	Very low probability
Location awareness	No	Yes
Geo-distribution	Centralized	Distributed
No. of server nodes	Few	Very large
Support for Mobility	Limited	Supported
Real time interactions	Supported	Supported
Type of last mile connectivity	Leased Line	Wireless

Source: Cloud Vs Fog Computing APPLICATIONS

Smartgrid

The next-generation electric power distribution network is known as the "smart grid." Transmission lines, substations, transformers, and other components are all part of smart grids. It makes use of two-way streams of data and electricity to build a distributed, automated, and robust energy distribution system. A smart grid provides a clear energy distribution system where customers and service providers can monitor and manage their production, price, and consumption in real-time. Millions of smart metres are installed in customer homes in the big data environment. Fog collectors are employed at the edge process to gather, process, and filter data locally, and for long-term storage, data can be sent to cloud data centres.

Healthcaresystem

Applications and services related to health care are slow to respond and produce patient confidentiality. Sensitive and private data are included in the created data. In some circumstances, location data may also be sensitive. In telehealth and telemedicine applications, increased instability and delay can result in a number of issues. Fog computing may be a suitable paradigm in healthcare applications under such circumstances. With no latency limits associated with implantable medical devices, ambulance communications, or portable access to patient medical files, fog computing plays a significant role in emergency medical services.

Augmentedreality(AR)

The ability to surround and overlay digital and virtual objects in the physical world is known as augmented reality. The uses of augmented reality are very latency- sensitive. A slight reaction delay could harm the client's skills. Fog computing may therefore become a key participant in the field of augmented reality. The most recent augmented reality products include Microsoft Hololens, Sonny Smart Eyeglass, and Google Glass. Computer vision algorithms are needed for augmented reality applications in order to process real-time video frames while also processing voice and sensor inputs and ultimately generating timely instructive content on the screen. Nonetheless, the human being is extremely sensitive to delays in several subsequentexchanges.

- Trafic control system The video camera in a traffic control system that notices an ambulance's flashing lights can immediately adjust the streetlights and clear the tracks so the car can cross traffic. Intelligent streetlights work in conjunction with nearby sensors to detect the presence of pedestrians, bicycles, and vehicles coming from a distance and determine their speed. In addition to these, intelligent lighting is automatically turned on when a sensor detects movement and goes off as traffic passes.

An approaching vehicle is alerted by a traffic signal that is created when nearby intelligent lights that serve as fog devices work together to create. Traffic control systems are helpful in preventing accidents, maintaining steady traffic flow, and gathering pertinent data to assess and improve the performance.

- Videostreaming system Mobile users can view the most recent video that is available on screen thanks to a video streaming application for fog computing. Fog computing plays a crucial part in the effective processing and speedy decision making For an example, subsequently many targets in a drone video stream, explained in where the live

Instead of being sent to the cloud application, the video stream is being sent to the nearest fog node. Any mobile devices, including a smartphone and a laptop, can function in this environment as a fog server running a tracing algorithm and processing raw video feeds, eliminating the latency of data transfer from the surveillance region to the cloud. Also, the joint resource problem in fog nodes is eliminated by using the proximal approach, which also improves the quality of huge video streaming.

CASE STUDY

Fog nodes are essential to how fog computing functions overall since they gather data from many sources for further processing. According to forecasts by Markets and Markets, the fog computing market, which was valued at $22.3 million in 2017, would increase at an explosive rate to $203.5 million over the following five years. FOG/Cloud computing is the way of the future for businesses and might be the IoT's next big thing.To manage a cloud environment with several cloud architectures, the FOG application can be improved.

CONCLUSIONS

Fog computing is proving to be a desirable answer to the IoT's data processing issue. It relies on network edge devices that are more powerful than end devices and closer to them than more powerful cloud resources, hence lowering latency for applications.

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