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Fog Computing Analysis Based on Internet of Thing: A Review

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Abstract
Cloud machine architectures face many drawbacks due to the improved autonomous and distributed IoT configuration. The IoT is closer to the cloud infrastructure. The fog offers IoT data care and storage locally on IoT devices rather than in the cloud. The fog provides quicker responses and better performance in relation to the cloud. The best alternative for IoT to provide powerful and effective resources for many IoT customers may therefore be called Fog Computing. This paper aims at fog computing's state-of-the-art and alignment with IoT in detailing the advantages and challenges of implementation. This study will concentrate also on the conception of cloud and fog technology and the application of the cloud and fog paradigm to improve modern IoT technologies. Finally, open issues and alternative research directions are discussed on fog estimation and IoT.

Keywords: *Internet of Things (IoT) , Big data , Analyses ,Fog Computing , Cloud computing.*

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1. Introduction

Fog processing or fog networking is often referred to as fogging, moving the limits of the software, records, and computing from the centralized cloud to the Edge of the Network's logical service stream. The Fog networking strategy works to construct a network (Anawar et al., 2018; Sharma & Trivedi, 2014; Delfin et al., 2019; Ahmed & Zeebaree, 2021). Instead of key network access Gateways and those located in the LTE switches, management, configuration, and power over the Internet Backbone Uh, network (Mouradian et al., 2018). The fog computing system can be illuminated as a strongly virtualized computing framework that offers Uh, nodes with the assistance of the edge processor, hierarchical computing facilities. This fog node is coordinated by large frameworks and applications. Facilities for the processing and delivery of content that is close to end-users users (Saleem et al., 2020; Ahmed & Yasin, 2012; Bargarai et al., 2020). An immense amount of artifacts that link via a network or the Internet are the Internet of Things (IoT). These objects are a blend of circuitry, cameras, and applications for tracking other parts of the way the object operates. Each entity produces and extracts information from its surroundings using sensors and transfers it via a channel to other artifacts or a central database (Sadeeq & Zeebaree, 2018; He et al., 2020 ;Aburukba et al., 2018).The preservation and transformation of this produced data is one of the main challenges of IoT and is one of the major problems of all IoT technology companies(Abdulazeez et al., 2020; He et al., 2020; Husain et al., 2021).

Fog Analytics The aggregation and transfer to the cloud of all data generated from IoT devices and sensors poses serious challenges for the Internet infrastructure and is often prohibitively costly, practically unrealistic and often unnecessary (Mehdipour et al., 2019; Rashid et al., 2019; Ali et al., 2020).Transferring data to the cloud for vast volumes of historical data with low latency, the analytics performs well, just not for apps in real-time. The launch of IoT, which makes real-time high data speed implementations faster, moves analytics to the network, and increases real-time analysis, appears to make things simpler(Taneja & Davy, 2016; Khalid & Askar, 2021). Approaching Fog computing enables data to be stored until they enter the cloud, shortens the time and expense of transmission, and eliminates the need for mass storage of data. It is usually an optimum strategy for smartphones and utilities (Aburukba et al., 2018; Etemadi et al., 2020).

A systematic analysis of the new and most successful methods undertaken by researchers in the past three years on decision trees in various areas of machine learning is conducted in this article. The particulars of each method, such as utilizing algorithms/approaches, databases, and the outcomes obtained, are also outlined. Furthermore, we outlined the most widely employed techniques and the maximum methods of precision attained. The organization of the remaining paper is as follows: Section 2 contains the Analysis of Fog computing to the internet of thing algorithm mentioning its types, benefits, and drawbacks; Section 3 gives a related work on Analysis of Fog computing to the internet of thing Algorithm; Section 4 comparison and discussion on the Analysis of Fog computing to the internet of thing, and the last section conclude the research work.

2-Background Theory

2.1 Fog Computing (FC).

An extension of the cloud computing model from the heart to the end of the network is a term launched by CISCO in 2012. Calculation on the edge of the network, closer to IoT and/or end-user devices is likely. It also facilitates virtualization. However, in relation to MEC and cloudlet, fog is explicitly associated with the life of a cloud. The relations between the fog and the cloud have been especially centered (Baucas & Spachos, 2020; Aljumah & Ahanger, 2018;

Aljumah & Ahanger, 2018; Mohammed & Zeebaree, 2021).Computing Fog extension to the edge of the conventional cloud computing model network enables the creation of sophisticated and improved products or applications. The calculation, retrieval, and networking facilities between IoT and conventional cloud end nodes are highly modified computing machines (Aazam & Huh, 2014; Aazam et al., 2018; Kaur et al., 2020).

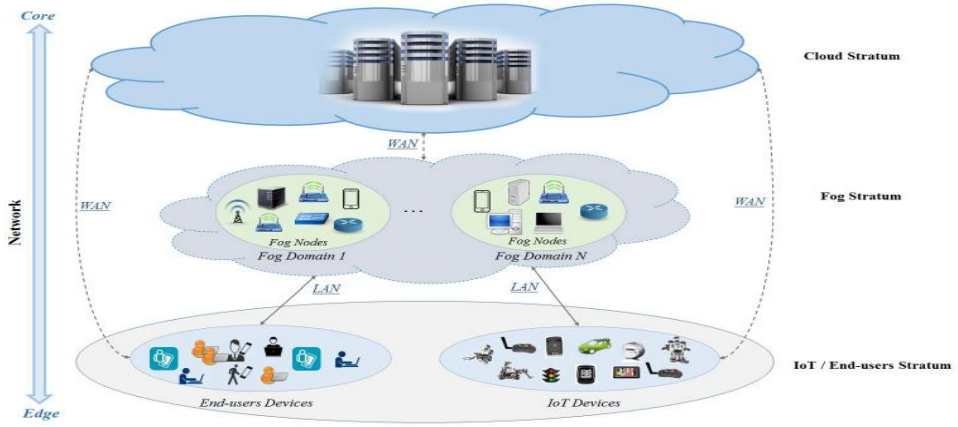

Figure 1: The Fog System (Aljumah & Ahanger, 2018)

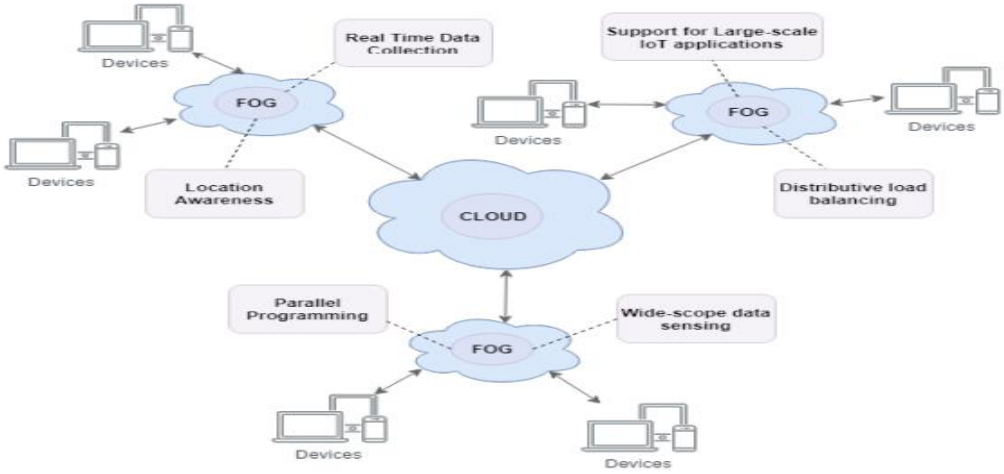

Figure 2: Fog-based IoT network (Baucas & Spachos, 2020)

2.2 Internet of Thing (IOT)

The Internet of Things (IoT) is going to become the next big trend when the Internet itself emerges. Millions and probably millions of Billions of 'intelligent' computers are expected to be linked to each one and exchange knowledge and data over the internet. IoT backers see nearly all parts of our lives(Aazam & Huh, 2014 ; Atitallah et al., 2020). To be protected by these intelligent tools. The sensors are conventional models of that kind of smart system. Revolution, reflecting the future of communication and connectivity achieve capacity, IoT, the technological being. In the IoT,' Stuff' refers to any object on the face of the planet, be it a contact system or a stupid non-communicating being(Pop et al., 2020) . The objects become Internet contact nodes, means of data communication, mostly through radio, frequency tags for recognition, from a clever computer to a leaf of a tree or a soda bottle. Smart includes IoT and objects as well. Smart objects are certain artifacts for the environment and individuals

that are not just physical, but also interactive, organizations, and some performing tasks (Baucas & Spachos, 2020; Zhang et al., 2020).

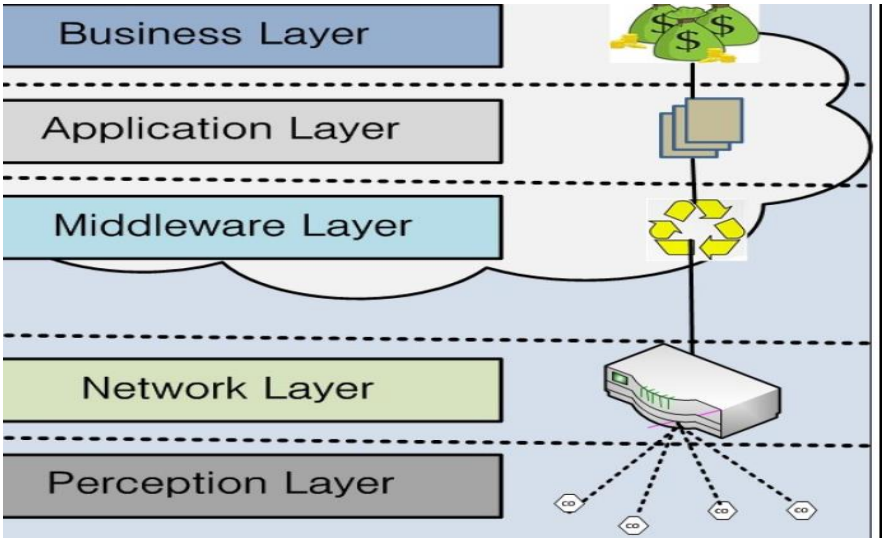

Figure 3 :Internet of Things layers (Aazam & Huh, 2014)

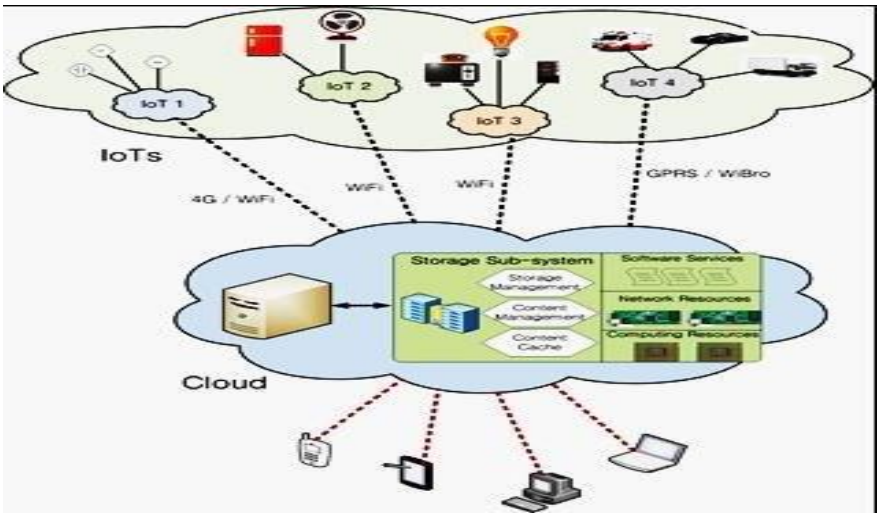

Figure 4:Cloud and Fog of Things –data communication (Aazam & Huh, 2014)

2.3 Big Data Analytics.

Companies, associations and even research companies can collect huge amounts of knowledge in various fields. Big data refers to a large amount and is continuously distributed to and across organizations of unstructured, semi grouped or hierarchical information (Mehdipour et al., 2019; Shen et al., 2020; Khalid & Zeebaree, 2021). The Big Data concept has been available for years; many firms now recognize that analytics can be used to collect practical knowledge from their data. Market analysis is an applied analysis category that includes complex applications of components, including predictive modeling, mathematical algorithms and what if the analysis is supported by high-performance analytical systems. Big data research is used to answer key business process and performance questions. Big data analysis analyzes massive volumes of data to detect secret trends, associations and other findings. A batch or a simplified model can be used for large-scale data processing. This ensures that some implementations store the data and generate the output on a store-and-

process basis. Many time critical processes consistently generate and predict data in real time, including stock market analyzes, results processed, etc (Anawar et al., 2018; Tuli et al., 2020; Patel et al., 2017).

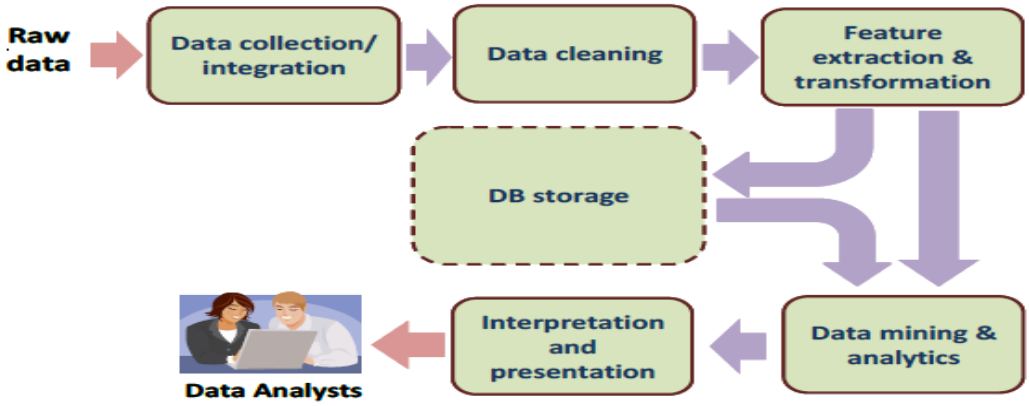

Figure 5: Typical data analytics flow (Anawar et al., 2018) .

3-Related Work

Fog Computing has been utilized in many different implementations of IOT, in this section, we will study some of its utilizations and how it has performed under different implementations and approaches. Zhang et al. (2020) suggested to minimize the necessity of storing the common calculation matrix, the Computation Service Center is constructed using few independent random variables. The CS block fixes the long-term problem. The traditional storage norm can be prevented with only a few independent random variables. To cope with the long-running time problem, the block CS is used. This paper suggests a system for Privacy-Assured Fog CS. Fog computation with the assistance of stable industrial Large Picture Data Processing. Problems, including malicious record tampering, the secrecy of measurements with bad records, large storage Matrix capacity requirement estimation, and long-run In the proposed process, the duration of CS reconstruction is explicitly resolved; the CS-based data integrity verification system is used to determine if the restored picture has been misused. The tampering research, the compression efficiency analysis, the main sensitivity analysis, and the restoration time analysis show the viability and productivity of the proposed scheme. Shen et al. (2020) explained in this post, a new data aggregation data security protocol was proposed In fog estimation. As CS proposes the protocol, it allows CS to retrieve all of the raw data and quantify predetermined functions while still protecting the privacy of TDs. The dynamic partnership and exit of terminal devices are achieved. We would concentrate on designing more powerful systems of data aggregation that handle diverse data types and safeguard privacy. Nguyen et al. (2020) proposed a full multi-layer streaming analytics network with a two-tier fog layer consisting of streaming and analytics (IoT-device, edge, fog, and cloud). This case shows that our two-level fog test bed for CPS IoT applications is a modular, efficient and risk-low approach. Furthermore, testbeds can also be used for research and education purposes in distributed, parallel treatment, broadcasting or data mining courses. The app is therefore suitable for private users, and cost-effective. In order to simulate the IoT-Device Layer mechanism in real time or directly connected to IoT Device layer, we also introduce an intelligent edge layer in the network. Etemadi et al. (2020) explained that IoT services experience workload variations over time, it is necessary to provide the correct number of appropriate fog resources automatically to fix IoT service workload modifications in order to prevent over-or under-provisioning problems when meeting the QoS requirements. Because IoT services may undergo shifts in workload over

time, it is important to automatically provide the correct amount of sufficient fog resources to address IoT service workload changes in order to avoid over-or under-provisioning issues whilst fulfilling the QoS specifications. Finally, under three functioning load traces, we affirm the efficacy of our approach.

Ali et al. (2020) suggested an Innovative Computing Suggested Model incorporates Voluntary Computing (VC) and Fog Computing (FC) to facilitate the use of under-utilized free computing resources nearby fog machines. Hence, this will result in a massive amount of energy savings to use. To address the latency issue arising when moving space-intensive staff to cloud's distant data centers. We suggest the theoretical control of dispersed Fog and utilities (VSFC). Routing domains minimize delays and increasing the efficiency of the network We also expanded the VSFC help toolkit to fog sim. VSFC has outstanding latency gain of 47.5%, 93%, and 92% in FC-cloud and under medium to extreme network use. Pop et al (2020)proposed the ICRA Platform (FCRA) for IoT applications has been suggested. The FCP focuses its solution on deterministic virtualization that reduces the protection and security interaction required; the middleware supports both essential control and dynamic Fog applications; the deterministic network and interoperability that uses the same standard as IEEE 802.1 Time Sensitive Network (TSN) and OPC Unified Architecture (OPC UA). We use the AADL and a set of industrial applications for modeling the FCP reference architecture to determine its suitability for the Internet. Tuli et al. (2020) explained the Health Fog, as a fog service, delivers healthcare across IoT devices and handles patient details effectively as customer demands are needed. The fundamental cause why back-end loading is not quicker is attributed to the impact of latency (latency). For designing Edge computing devices that incorporate deep learning techniques, we proposed and implemented a novel framework named Health Fog. Moghadas et al. (2020) proposed a tracking system to control the wellbeing of patients has been suggested. Fog estimation is the essence of this framework. And the processing of evidence for rhythmic patients. The device is used to maximize data transfer across the cloud instead of being used for data on patients. Cardiac failure, because of certain complications with the effective operation of the heart, is currently considered the second level cause of death around the world. One is a heart arrhythmia, which, if not treated, may contribute to irreparable risks including heart failure. The electrocardiogram (ECG) of a patient is an approach to this disorder. The aim is to recommend a way to monitor the well-being of the patient (a case of cardiac arrhythmia). The Arduino electronic table and the AD8232 sensor module for heart rhythm and electrocardiography control and operation of the device are attached. Therefore, one of the most popular data mining algorithms is the K-Nearest Neighbor (KNN) algorithm used to detect and validate heart arrhythmias.

Yacchirema et al. (2018) suggested of the Obtrusive sleep apnea (OSA) is one of the most significant disorders of sleep since the quality of life is compromised directly. Any of the effects of OSA are intellectual deterioration, decreased psychomotor output, behavior, and personality disorders. Consequently, a crucial need for health solutions is the real-time surveillance of this epidemic. This research offers a pioneering mechanism for both the detection and promotion of elderly OSA treatment through measuring several factors, such as the sleeping climate, sleep state, physical activity, and physiological parameters, as well as the usage of smart cities with accessible data. For this processing, Cloud Storage Large Data tools are used. In the prediction of AQI to steer a remedy for OSA, the tests conducted suggest a 93.3 percent reflectivity. Rabay'a et al (2019) explained the Most IoT computers speak about cloud computing as an infrastructure for technological outsourcing. Peer-to-peer Fog computing is a proposed model for fog computing bandwidth efficiency to fulfill the evolving needs of IoT computers. With the Peer to Peer Chord process, our Pair to Pear Fog model

expands the fog machine architecture. We also used PeerfactSim.KOM to simulate cloud computing for our claims, fog computing, and p2p fog computing. The findings of this study provide a clear base for future studies that use the p2p framework to enhance fog computing. One region of future work is the comparison of other P2P overlays to see if the effects of bandwidth and latency are enhanced. Further research is required to validate the p2p fog model for applications that are less resistant to latency, such as broadcasting applications. He et al. (2018) suggested a smart area provides a multi-level fog computing network. The multi-level fog made up of ad-hoc fogs and committed computer power neutrals. The result of the experiment demonstrates the performance of the analytical systems against multi-stage fog and the feasibility of the proposed QoS schemes. In terms of a job blocking likelihood and service efficiency, Fogs will greatly boost the output of intelligent city research systems rather than just a cloud model. It introduced a modern fog computing paradigm of simple working modules that we're able to mitigate future computing power issues and weak cloud computing responses. El-Hasnony et al. (2020) explained this essay gives a detailed analysis of the Internet of Things and how the generated data can be utilized effectively. We still have cloud estimation, nebulization, and fog computing in comparison to consolidated data storage and DDM. Our capacity is to adjust our proposed model to practical health, transportation, and energy problems. Among the most reliable is the REP tree algorithm, varying from 90.66% to 93.6%, based on the details included in the analysis. Although the naïve algorithm of Bayes took longer to construct, Bayes was the naïve one of four to calibrate the prototype.

Table 1: Summary of Literature review related of Analysis from to Fog Computing to internet of thing (IoT).

Use Reference	Tools	Objective	Result and Accuracy
(Zhang et al., 2020)	MATLAB	Just a few ways, the CSC is designed to solve a broad storage space need by utilizing a common matrix for the calculation. Independent random variables. The CS block will be advantageous as the flow rate reduces.	Maintenance analysis, compression efficiency analysis, primary sensitivity analysis, Restauration analysis demonstrate the feasibility and productivity of the proposed schema.
(Shen et al., 2020)	MNIST	The dynamic partnership and exit of terminal devices are achieved.	We would concentrate on designing more powerful systems of data aggregation that handle diverse data types and safeguard privacy.
(Nguyen et al., 2020)	Testbed	This case shows that our two-tier fog testbed for CPS-dependent IoT applications is a scalable, effective and low-risk solution. In addition, test beds can also be used for testing and training in distributed/parallel computing, streaming and data analytics schools.	The site for 'private' users is thus suitable and accessible. Furthermore, we are adding an intelligent edge layer to the network to abstract and Simulate the mechanism of the IoT layer in real time or to be explicitly connected to the IoT system layer.
(Etemadi et al., 2020)	iFogSim toolkit	The workload of IoT resources can vary over time. In order to prevent over-or under-supply of problems in the fulfillment of QoS requirements, the appropriate fog tool needs to be established.	Lastly, we affirm the feasibility of our approach under three operating load traces.
(Ali et al., 2020)	iFogSim toolkit	Addressing the issue of higher latency by transferring data-intensive workers to distant data centers in the cloud.	We recommend volunteering with you. The interaction between these two distributed computers is explored, funded as a computational model (VSFC). Domains that help reduce cloud storage, capital utilization, and network use intrinsic delays. To this end, we expanded the toolkit to support VSFC for Fog Sim. Comprehensive simulations reveal that by decreasing the latency by 47.5%, FC cloud by 93%, and the FK cloud by 92%, under uniform heavy load networks, VSFC is superior to conventional.

(Pop et al., 2020)	TELSA	The FCP concentrated on virtualization of detergents, minimizing the security and security initiative, promoting critical Fog applications, and dissuasive and interoperability networking using open standards, for example, IEEE 802.1 Time-Sensitive Networking (TSN) and OPC Unified Architecture (OPC UA);	The framework for describing and analyzing the architecture of reference is suggested. In order to model the FCP architecture reference architectures we use the AADL (Architecture Analysis Design Language) and collected industrial cases to define their suitability for IoT.
(Tuli et al., 2020)	Cooja	The main idea is to load a large volume of (big data) data from the consolidated storage and from the database into the cloud data centers, thereby restricting the use of latency-sensitive technology such as health tracking and surveillance systems.	We suggested the implementation of a new method, named Health Fog for the real application of automatic detection of heart illness, in order to integrate deep learning into Edge computing systems.
(Moghadas et al., 2020)	MATLAB	Because of numerous cardiac problems, coronary disease is considered world's second leading cause of death. One is cardiac arrhythmia, which, if not treated, may contribute to irreparable risks, including heart failure. The electrocardiogram (ECG) of a patient is an approach to this disorder.	The purpose is to suggest how to monitor the well-being of a patient (a case of cardiac arrhythmia). In order to control and operate the device, Arduino electronic table and AD8232 sensor module are attached for monitoring heart rhythm and electrocardiography. Therefore, the algorithm k-Nearest neighbor, used for detection and validation of cardiac arrhythmias, is one of the most common data mining algorithms.
(Yacchirema et al., 2018)	MATLAB	This study provides a pioneering method for defining and encouraging elderly OSA care through the monitoring of different variables, for instance sleeping conditions, sleep state, physical activity, and physiological parameters, and the use of available data in smart cities.	For this processing, Cloud Storage Large Data tools are used. The experiments carried out display a 93.3 percent reflectivity in the prediction of AQI to steer A cure for OSA.
(Rabay'a et al., 2019)	P2P Simulation tool	In this document, we examine the p2p model of fog, used to exchange a file program, and explain increased bandwidth performance in contrast with cloud simulation and fog calculation models.	In the results of this report, the potential work on fog computation utilizing the p2p mechanism is fully endorsed.
(J. He et al., 2018)	Raspberry Pi computers	It suggested a modern Fog Calculator model with simple usable modules that could alleviate the potential problems of committed Resources and inadequate cloud response.	The experimental results demonstrate that analytical facilities may rely on the fog across many stages and that the proposed QoS schemes can be introduced. Fogs will greatly enhance the efficiency of an intelligent town analysis framework compared to a cloud-only model in terms of job blocking likelihood and service utilization.

4-Discussion

The debate on the functionality of fog computing introduces the latest technology specifications of IoT. Alongside the following is the related centralized fog device. Accumulation of substantial data and storage near the end-user, considering the fact that only the cloud data center manages the storage device. Accumulation of large quantities of data needed to process end-user or IoT devices at the closer site. Reduce the fog framework's computing features, such as processing. For instance, in (Nguyen et al., 2020)the application suggested a solid multi-layer, two-tier fog layer streaming analytical framework. And the findings indicate that the platform is suitable and inexpensive for "private" consumers. For instance, a novel Health Fog method for automatic analysis of heart disease has been proposed in (Tuli et al., 2020)And the findings indicate smart layering for the IoT-device layer phase can be simulated in real-time. In automatic Heart Disease Detection, we suggest a novel method named Health Fog. For smart city applications, for instance, a multi-tier fog computing device with a broad data processing service is recommended (Moghadas et al., 2020)Data from sensor Internet of Things (IoT). And the findings indicate the experiment's results that analytical installations can be reliable against multi-level fog. Fogs are planned to

improve the performance of new artificial intelligence technologies. The examples reveal that our proposed algorithms outperform the baseline algorithms by at least 30.3 percent in terms of the primary utility metrics of the three use cases. Several ongoing tasks seek to improve our system of fog computing.

5-Conclosion

Computing with fog is becoming an important part of our lives. It has the power to connect almost anything on our planet to everything else. IoT systems are complex in design and have minimal storage and processing space. However, there are many issues with the traditional organized cloud, such as high latency and network failure. Fog computing has been established as cloud extensions to address these issues, But like IoT computers, where fog nodes are stored all the data, and delay is reduced. Particularly for applications that are time-sensitive. The introduction of IoT fog computing would offer many advantages for numerous IoT applications. In this document, we explored the state-of-the-art fog a calculation, including an evaluation of fog attributes. The theme was also focused on various fog-enhanced IoT technologies. In the incorporation of IoT with fog and open questions, difficulties are also addressed. In brief, this paper aimed at summarizing up-to-date research contributions to our IoT and fog computing technologies, as well as at demonstrating the avenues for potential research and available problems about the integration with the IoT of fog computing.

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