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AN OPTIMIZATION BASED INTELLIGENT BUSINESS ANALYTICS IMPLEMENTATION OVER FOG–CLOUD INFRASTRUCTURE

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***Abstract*—** The migration of smart applications towards Fog computing becomes a boon for many IoT-based systems; which performs well with the advent of 5G. As 5G empowers Fog-assisted IoT; several issues including interoperability that is integral part of fog-IoT critically solved with. Numerous research has been done, as well as ongoing for dealing unresolved issues within such environment. The summarizes recent Literature on different domain with interoperability issues; their solutions and opportunities; reinforces the point that Fog-IoT is an optimal Interoperable environment in versatile domain. In this paper we proposed an intelligent Interoperable Business module placement based on optimization heuristics which offloaded the Cloud in term of business processing and perform well for data management in versatile domain. Proposed architecture used Genetic Algorithm optimization strategy and service placement scheme that becomes interoperable solution of business analytics in Industrial IoT. The paper is organized in interoperability review, Algorithmic System Model and comparison analysis of review literature. Article contains efficient Interoperable communications work flow between the different tiers of fog-assisted IoT responding to the needs of Industrial demand which becomes future of ever demanding smart interoperable environment**.**

***Keywords*—** *Industrial Internet of Things, Business Intelligence, Genetic Algorithm, Business Analytics, 5 Generation network*

1. INTRODUCTION

In future, people will not feel the need to own assets because smart devices and hired services facilitates people in every aspect of life. Such Innovations tackle major social ills, seek more proactive approaches to predict the uncertain future, and pursue strategies to remove barriers to the smart future. In this direction Fog- assisted IoT paradigm is also a right path to tune with; it is a hub where enabling technologies are connecting and provide servicing to each and every connected IoT based smart device. Connecting devices are enormously increasing day by day; According to a global survey it is 10.07 billion in 2021, will expand to 13.15 billion in 2023 and approx. 24.44 billion in year 2030[1]. Such a huge web of interconnecting devices needs fastest generation of internet to accommodate each technology and provide fastest services; 5G accelerating such technologies and paved fully digitized and connected web of devices. Since IoT–Cloud integration with us so long and provides massive services in the field of Data management, analysis and Business Intelligence; its advanced Fog-based architecture adopted by most of industries because of their quick response time and quality services. The migration of LTE 4 to 5G also offers lowest-possible latency, allows real-time delivery of data, increase of network flexibility and service availability especially for real time applications [2]. The Migration of Cloud-IoT to Fog –based computing with 5G resolves the main issues of interoperability between these two technologies; which is a higher need of today's IoT based industries and applications. The important issues that arises in fog based IoT environments are that the all computational nodes at fog-IoT are battery-operated, increased unreliability. Moreover, every node of Fog layer does not provide the efficient services to latency-sensitive IoT applications; security holes are attached with fog computing; and seamless integration of fog/edge computing with cloud computing to provide scalable services needs to be scrutinized well for providing the scalable solution in interoperable environment of different applications in concerned data and processing abilities. As the applications are designed to work with heterogeneous web of devices with different configurations and architecture their interoperability is major concerned in Fog-assisted 5G enabled IoT environment. Concerning several issues and challenges facing by industries; need an optimal solution for overloading of cloud services with the help of Fog nodes; so that they can serve for storage and future decision making services efficiently. which we focus to elaborate in this paper.

The rest of the paper is structured as follows:
Section 2 shed light on interoperable environment; related issues and challenges, section 3 reviewed extensive recent research work in the context of Interoperability in Fog-IoT domain, Section 4 outlined the conceptual view of Fog-IoT paradigm with 5G interpolation, Section 5 elaborates Proposal and its implementation strategy and system architecture model and Section 6 Analysis the comparative constraint of reviewed and proposed model with responses and finally Section 7 conclude the research with future directions.

2. INTEROPERABILITY: A REVIEW

The world is getting narrow as people, systems and technologies connected one another over networked infrastructure. Automated data sharing facilitates systems, devices and applications; enhanced connections between various software and hardware systems; but with so many complex systems being networked together, issues of interoperability should be on the minds of people working in all types of industries. Interoperability refers to the ability of devices and digital systems to connect and communicate with one another voluntarily, even if they were developed by widely different manufacturers in different industries. As interoperability is accepted throughout the industries, it will become a reality for all stakeholders as barriers around assuring correct access of data and the availability of data in real time for taking decision within a constant time frame. We also seen that without interoperability; lights would not respond to remote switches, sensors could not be read by smartphones, and similarly such smart devices would be unable to connect to accessible networks [4] without it. Moreover, it says that, without interoperability, full potential benefits of IoT cannot be achieved.

In the paradigm of fog-assisted IoT; interoperability is the capacity for multiple components within an IoT deployment to effectively communicate, share data and perform together to achieve a shared outcome using localized processing ability. Industries must be able to transform and maintenance of data throughout all the connections from devices to the cloud. IoT deployments have three interoperability needs in such architecture:

1. Technical interoperability: It Refers in an IoT environment the physical communication architecture needs for transportation of data between layers of devices, fog nodes and cloud center.
2. Syntactic interoperability: It is a system model which provides common format to share the information and specific data within diversified applications.
3. Semantic interoperability: In an IoT deployment it is need to be explain the meaning of data during interaction between applications.

Thus in a fog-assisted IoT environment applications and architecture needs to be synchronized such a way that connected devices effectively communicate; responded according to the user data and take the corrective decision for future processing otherwise the lack of widespread interoperability limits the ability to maximize IoT value. Interoperability is a science to be understand and learn because it’s a real world model of things to be communicated each other. Ensuring interoperability among different hardware and software devices is a key requirement of realizing the connected world featured by IoT [3]. It is a core of realization of the novel vision of smart Industries and to put a lot of efforts for achieving that. For this reason, during recent years, several approaches aimed to enhance interoperability between industrial applications and IoT appeared in the literature.

3. RELATED WORK

Most of the literature lacks to complete study in application interoperable areas of IoT industries domain. Existing studies focus on fog based IoT interoperability issues, concerned challenges and their proposed solutions while; a couple of studies focus on all the type of interoperability challenges concerned in IoT application domain. In this section we present the recent research; that emphasis on the contribution towards interoperability study. The recent contributions of literature shed light on following key constraints:

- Highlights recent structured review of IoT by exploring the application interoperability issues in the realization of IoT technology.
- Emphasize on the role of diverse architectures and intelligent techniques to accomplish efficient solution for interoperability in IoT.
- Finally, we compare them on some merits and demerits and provide future initiatives to curb emerging issues in IoT. The recent systematic literature review of related work in the context of IoT broadways concern interoperability issues and their potential solutions describe here:

In Jan'2022 Guadalupe Ortiz, Meftah Zouai, Okba Kazar, Alfonso Garcia-de-Prado, Juan Boubeta-Puig [5] found that it is not an easy task to find an application software that communicate with all three tiers i.e. edge, fog and cloud for solution of interoperability in concerned environment. For such problem in this domain they proposed a novel combination of techniques which was an appropriate solution for all the devices of these three tiers. The key constraint of this proposal have intelligence, autonomy and low consumption of software agents in the edge tier; and centralized gateway at Fog layer that becomes solution for collecting data from various devices; process of such relevant data and enhance decision making. Finally, the cloud node will feedback the user and devices while also be fed back by the gateway with future perspective decisions. Despite the lack of standards, the use of protocols and data formats common to IoT information exchange in this proposal will facilitate interoperability between the layers and components of the proposed solution.

In order to next concerned literature Abdul Jaleel, Tayyeb Mahmood, Ahsen Tahir, Shehzad Aslam, Ubaid Ullah Fayyaz, [6] in 2021 taking an issue that heterogeneous devices are largely lacking interoperability in IoT paradigm; and presented an architectural design of an autonomic interoperability manager (AIM) that is capable of self-configuration, self-healing, self-optimization, and self-protection in health care environment. These services, along with self-protection and self-configuration, and a plugin-based approach ensure scalability, extendibility, and efficiency in fog-IoT environment.

Similarly, in year the 2021, Abhishek Hazara et all. [7] studied and found that there are no recent papers that primarily examine various interoperability issues that Industrial IoT (IIoT) faces; while above two research concerned with health domain in IoT. They investigated the conventional and recent developments of relevant state-of-the-art IIoT technologies, frameworks, and solutions for facilitating interoperability between different IIoT components as the pandemic hits industries a lot where smart working of industries on high demands and reset major work trends to turn new opportunities into solutions. They comply on more advanced technological smart systems to ensure industries work transition becomes flawless and smooth.

Mohamed, N.Al-Jaroodi, J. Lazarova-Molnar, S.; Jawhar [8] in year 2021 taking a challenge that how the three technologies IoT, Fog and Cloud in a smart city domain work to accommodate the dedicated solution and proposed a (integrated IoT-fog-cloud system) iIFC paradigm; to serve that how a distributed system work as a single system and get an advanced platform for enhancing and optimizing smart environment. Utilizing this powerful platform will provide many opportunities for enhancing and optimizing applications in energy, transportation, healthcare, and other areas also.

This research; survey various applications of iifcs for smart cities, and identification of different common issues associated with utilizing integrated IoT-fog cloud system too.

Dr. Joy Iong Zong Chen , & Dr. S. Smys [9] in year 2020 ; derived a semantic frame work assisted by the fog to enhance the interoperability in the internet of things. In this study they focus on cloud's commonly used semantic resources sensor networks edge and also offers an effective offloading technique between fog – fog and fog – cloud devices to diminish total computation time of the task and the energy consumed by the nodes in the fog. And a hierarchical multitier Fog network is approached with two layers, to perform the semantic annotations and the mapped data are offered to the cloud for processing. This Fog centered semantic model enhancing the interoperability of the IoT devices with a much reduced energy utilization, delay in the service, bandwidth utilization and cost, by devising a proper data balancing so that prevents the major of the requests from being executed in the cloud.

Rabeea Basir , Saad Qaisar, Mudassar Ali, Monther Aldwairi, Muhammad Ikram Ashraf , Aamir Mahmood and Mikael Gidlund[10] in year 2019 explores Industrial Internet-of-Things (IIoT) applications and studied issues like real-time processing, near-by storage, ultra-low latency, reliability and high data rate, and found that all must be satisfied by fog computing architecture. With smart devices expected to grow exponentially, the need for an optimized fog computing architecture and protocols is crucial thus focus on two main research areas: First survey the history of industrial revolution, application areas of IIoT followed by key enabling technologies that act as building blocks for industrial transformation and then deep analysis of fog computing, that providing solutions to critical challenges and issues while act as an enabler for IIoT application domains.

While in Redowan Mahmud, Fernando Luiz Koch, Raj Kumar Buyya [11] in year 2018 taken Healthcare domain in consideration and focus on issues like latency sensitivity, uneven data load, diverse user expectations and heterogeneity of the applications structure both in terms of system architecture and application model. Later, they proposed an interoperable Fog-based IoT-Healthcare solution as an improvement over general Cloud-based IoT-Healthcare solution with some enhanced features. The analysis has been simulated by iFogsim and concluded that the performance of Fog-based solution is improved in terms of service distribution, instances cost, in relation to distributed computing, low latency, data optimization, and less power consumption. The experimental results point towards improvement in instance cost, network delay and energy usage thus becomes a role model for IoT healthcare domain.

The above mentioned literature explores the versatile domains of IoT with Fog assisted architecture; which in Section VI comparatively analyses with the proposed approach.

4. FOG ASSISTED 5G ENABLED IT

5G enabling technology has been proposed in IoT pool for the challenge of increasing resources and demand of smart networking day by day. Now it is paramount of the networked society; support huge numbers of heterogeneous connected devices and increase reliability in communication of real time critical applications. It will provide wireless connectivity for various applications such as smart homes, wearables, critical infrastructure, traffic safety/control, very high speed media delivery, industry processes and health care domain.

The current explosive growth of IoT devices with Fog based architecture, 5G is a latest technology advancement adopted for advancing smart automotive vehicles to AI enabled robots on factory floors. This portfolio of network represents an extraordinary support to IoT ecosystem by unleashing a powerful combination of extraordinary speed, expanded bandwidth, low latency, and increased power efficiency. The Fog assisted -IoT environment possess some reliable solutions for interoperability

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issues in different domains of IoT area; yet remains research concerned due to unresolved challenges faced in such intelligent application domains. The key features of 5G that adds potential services to architecture are massive Machine Type Communication to deliver ultra-high speeds and efficiently transmitting low data volumes intermittently to and from devices that require wide area coverage and long battery life; which are ideal for smart meters and trace apps that just dependent on optimal power consumption. Another important feature is Ultra-Reliable Low Latency Communication that focuses on the highest possible reliability while enabling latency as low and govern applications like automotive vehicles and industrial IoT. Last but not the least enhanced Mobile Broadband service, delivers super-fast speeds, high system capacity, and better spectral efficiency for applications in the consumer space like smartphones augmented and virtual reality [12]. As the reviewed literature shed light on the fact that Fog-assisted IoT is key enabler techniques to addressed device heterogeneity, data transmission and offloading, low latency, power constraints connection density, network scalability, content semantics modelling in various field of IoT; while the enabler 5G with such fog-assisted paradigm may solution of interoperable issues; which remains unresolved. For such constraint the architecture of Fog-assisted IoT with advent of 5G comprises of following layers; while these versatile layers deal with 5 domains i.e.

1. Domain of Things or Sensors called Sensor/Device Domain
2. Network domain covering the edge and core with extension of 4G boundaries to 5G services
3. Services and Application Domain comprises of different application software's
4. Cloud Domain responsible for data storage and business Analytics for future perspective
5. The Fog Domain encompasses the Fog-enabled elements providing the compute, storage and network capabilities to the "things" [14]. This Extended IoT network with 5G capability significantly improve the performance of applications and enable huge amounts of data to be processed in real-time.

Thus the 5 domain Fog-Cloud framework for versatile application layered as depicted in Figure 4.1

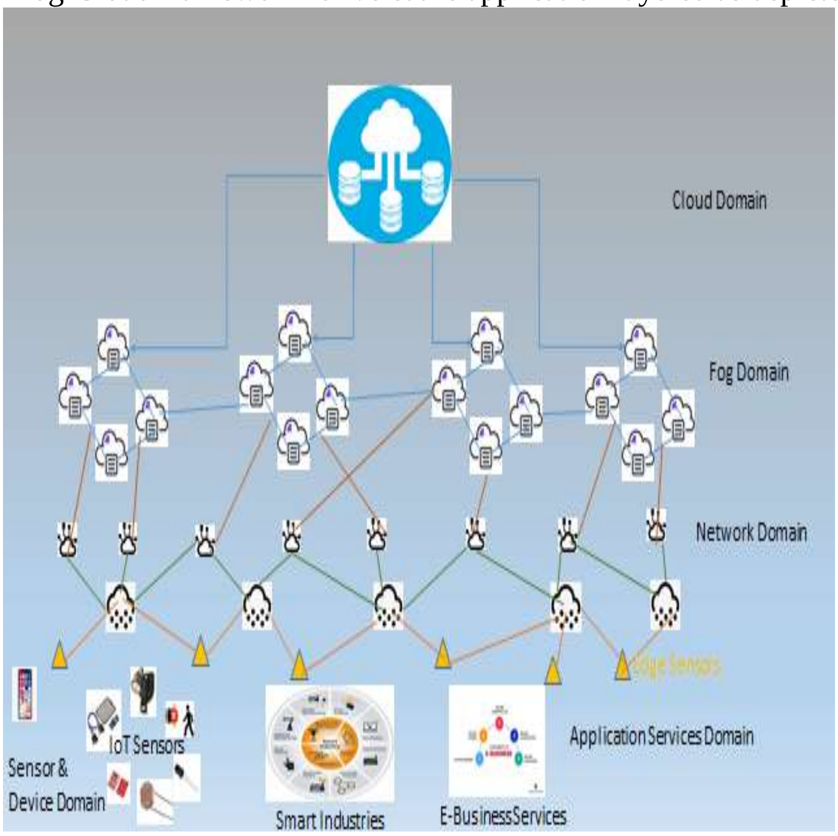

Figure 4.1 A Fog-Cloud Architecture Framework

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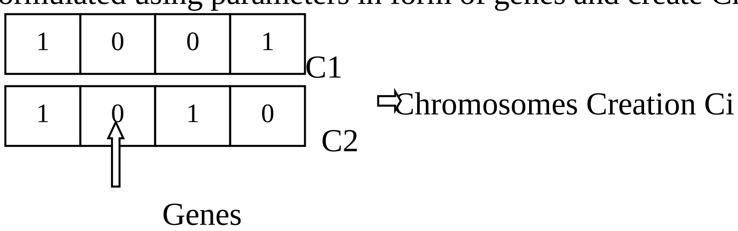
5. An Optimization Model of Data Management for Intelligent Business Analytics

Fog computing is a computing architecture in which a series of nodes receives data from IoT devices in real time. These nodes perform real-time processing of the data that they receive, with millisecond response time. The nodes every so often forward analytical summary information to the cloud. A cloud-based application then perform analysis of data based on different applications available at cloud with the goal of generate Business intelligence. This approach for business analysis in Industrial IoT is suffers from issues like high latency, data integration with similar CRM and SCM applications modules; reliability of data and its application interoperability to get unified view. Industrial IoT; where business analysis is a technology-driven process for analyzing data and delivering actionable information that helps to get conclusions regarding process data and actions with quick real time response is key constraint. An optimization model based on Genetic Algorithm; through which similar applications data through fog orchestration nodes processed and forward to cloud layer; and facilitates an interoperable solution and enhances the decision making services of Cloud layer for future action strategy and storage. This optimization approach deals with several issues arising in Fog-Cloud driven infrastructure. In this proposal Genetic Algorithm is used optimization of similar sensing nodes routes from sensor to Fog gateway; where preprocessing of data also performed through Intelligent Business Module and then forward the data to cloud center for future decision provides less delay in case of real time industrial applications and increase cloud services throughput by managing it as per applications. As per our constraint Interoperability is an important issue; while the proposal also offers optimum Interoperable solution.

GA has initialized with a randomly generated population of individuals. To each individual is applied a fitness function, that is, the objective function of the optimization problem. Therefore, to each individual we assign a fitness score that is the value of the objective function for that solution of the optimization problem. The population of individuals evolves through a defined number of generations, where the overall fitness of the population is increased using the selection and crossover operators. These operators are combined to create an evolutionary strategy. The selection operator is used together with the evolutionary strategy to define how individuals are passed from a generation to the next. The selection operation is called multiple times on a pool of individuals (typically from the older generation) and returns one individual for each invocation that will be passed in the current generation. In our analysis, we focus on Roulette selection that selects, for each individual to return, a chromosome from the population with a probability that is proportional to its fitness score. While in case of mutation we used Shuffle mutation where the mutated individual takes the genes of original chromosome applying a permutation to them. In this problem domain GA performed in following steps:

Step 1. Initial population Creation

The first step for GA is to map sensor nodes as problem domain to string representation. Then after initial Population has been formulated using parameters in form of genes and create Chromosomes.



Initial Population

The algorithm starts in first step with randomly selected sensor nodes. The size of the population depends upon no. of sensor nodes available based on decision variable. This size of population maintained in all generations.

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2. Objective function Formulation

After creating an initial population an objective function has been formulated for selection of Fitted individual. The Objective function is Fitness Proportionate Selection in which every individual can become a parent with a probability which is proportional to its fitness. Therefore, fitter individuals have a higher chance of mating and propagating their features to the next generation. In case of roulette wheel selection following steps has been performed

a) Calculate S = the sum of a finesses.
b) Generate a random number between 0 and S.
c) Starting from the top of the population, keep adding the finesses to the partial sum P, till P<S.
d) The individual for which P exceeds S is the chosen individual.

3. Selection Operators

Crossover: A uniform crossover is used for fitness selection iteration; genes are randomly chosen from the parent chromosome. Here the genes which are inherited are marked as 1 and others as 0, which comes from the uniform distribution.

Mutations Mutation helps to include new characteristics into the gene, which basically maintain the diversity within the population and prevent premature convergence of the process. In over approach we used shuffle mutations for the exploration of the search space.

After selection of fittest individual among n sensor nodes the elected head forward the data coming from different nodes to another fittest member that is in parallel simulated by parallel GA at fog layer; and elected here Head Fog node. Now the data routing between sensor head to Fog head reduced delay in data forwarding and business analytics modular application performed preprocessing of data on Fog Heads; reduced interoperability issue and provide best data management trend between fog-cloud framework. This parallel heuristic performs 3 steps optimization 1. Head Node Selection at Sensor layer 2. Head Fog Node Selection at Fog Layer and in Step 3. Perform business analytics on similar data through Intelligent Business Application modules placed on selected VM. The Pseudocode for the Intelligent Business Analytics Module is:

1. START
2. READ Data
3. IF Data == Same_Syntectic_Constraint
   PERFORM Data_Abstraction
   ELSE
   Do-Nothing
4. GENERATE Report
5. CALL fun_OLAP ()
6. CALL fun_Business_Analytics()
7. SHOW Visual_Interpreted Result
8. END

The workflow model of parallel optimization and business analytics is represented in Figure 5.1

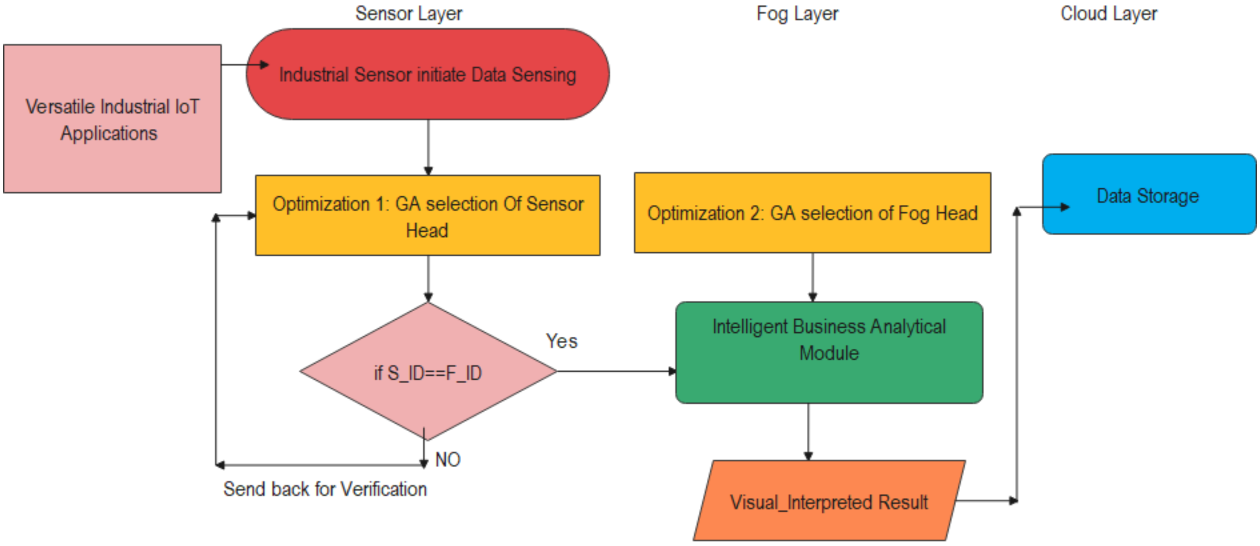

Figure 5.1 Work flow Model of parallel optimization and business analytics

Thus through parallel optimization and Modular application solution for similar data; an Intelligent Fog Head and Sensor Head done data processing at Fog orchestration and share the maximum load of Cloud nodes; while if it processes at cloud node decision making needs some more time to observed visual and interpreted results. Finally, this Proposal also supports layered architecture and Interoperability between applications and ensures the reduction of latency and increased intelligent business decision making over the Fog – Cloud. This architecture comprised of 5 layered:

Layer 1: The layer of Industrial IoT sensor Devices: As per the versatile nature of Industry applications IIoT sensors has huge category of sensing information with more precision, low cost and low power consumption to bring enhanced automation efficiency in industry. The Sensor nodes elected Head Node using GA that will treat as initial unit of data management. For example, smoke, proximity, infrared, piezo, temperature, optical and many more are capable of measuring parameters within Industry and undoubtedly the future of industrial automation.

Layer 2: The Fog Layer converted into Conceptual Cluster as per sensing data: The Fog layer is the main constraint of IoT infrastructure; here the Fog nodes are converted into Conceptual Clustering through Genetic Algorithm that will based on optimization heuristic; which largely select their groupings based on the quality of the resulting understandable descriptions. Thus, it is not sufficient that the entities in each group generally display similarity to one another, and dissimilarity to those in other groups; It goes one step further by also discovering characteristic of members.

Layer 3: The Business Intelligent Applications Software Layer: This proposed layer deploy at the Deployment Node within Fog Orchestration node and performs set of business analytics solutions to retrieve, analyze, and transform data into meaningful business insights, usually within more easy-to-read visualization like charts, graphs, and dashboards. It has traditionally taken the form of quarterly or yearly reports that report on a defined set of key performance indicators (KPIs), but today's reporting software is backed by business analytics solutions that work continuously and at light speed on real time data. These analytical report can help every company choose a course of action in a minutes. The Industrial IoT benefitted by this layer to taken the decision at very fast because of its deployment of Fog Cluster instead to wait for cloud layer operation because; the BI function's before now taken with Cloud layer.

Layer 4: The 5G enabled layer: The 5G services supporting next-generation capabilities and features within the Edges and the core network infrastructure. 5G Ultra-Reliable Low-Latency Communication (URLLC) is also one of the critical capabilities providing ultra-reliable networks and latency levels of 1 millisecond will drive the development of new services that cannot be fulfilled

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with today's mobile networks. It is ideal for applications that require end-to-end security and reliability, and deterministic time bounds on packet delivery. This can create a ubiquitous network connecting machinery, cloud and analytics services, and processes.

Layer 5: The Cloud Station and Data Center Layer: This layer provides the storage, processing and accessing large amount of data as well as applications using 5G internet capability; on which further decisions have been taken or monitored in today’s mission critical Industrial applications.

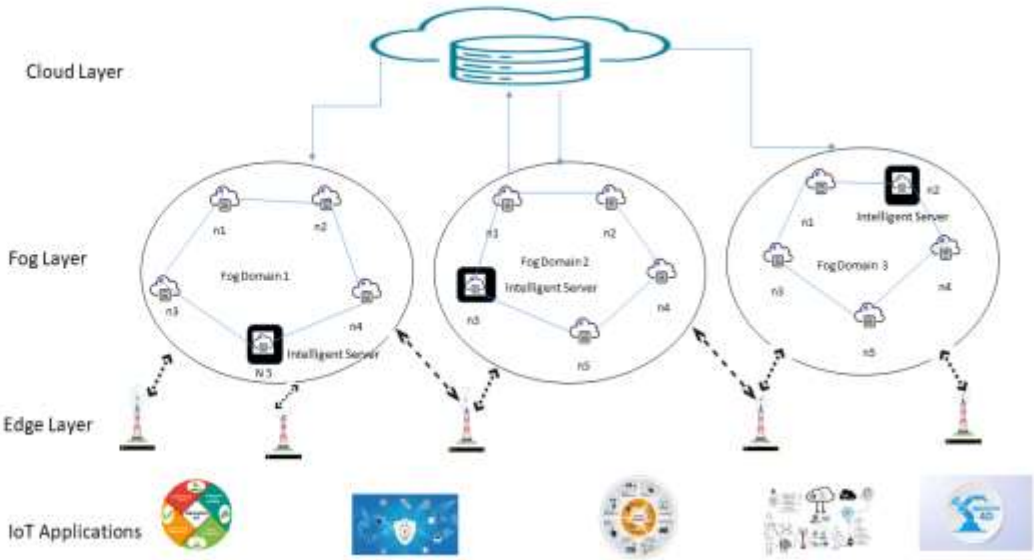

Figure 5.2 5 Layered Architecture for Business Anlytical Fog-Cloud Platform

The goal of the above proposed layered architecture is distribution of business intelligence interoperability application software within fog cloud to reduce latency, enhanced interoperability and reliability.

6. COMAPATIVE ANALYSIS

The referenced literature explores the versatile domains of IoT with Fog assisted architecture; compared with proposed approach including Interoperability Key Constraints, merits and demerits of all the approaches. Table 1 has brief comparative view focuses on IoT interoperability key constraints and find that our proposed approach is a key solution to reduced latency and increased reliability by performing the business analysis using parallel optimization at sensor and Fog layer; the performance evaluation and data management thus at Cloud layer reduces overheads exponentially. The involvement of 5G also benefitted this architecture with high speed; with inclusion of some drawbacks. Thus management of Data within Fog-Cloud is a optimization technique through 5 layer architecture proposal.

Reference	IoT Domain	Interoperability Key Constraint	Merits	Demerits
Guadalupe Ortiz et all.[5]	Health Care	A software Solution needed to work with 3 Tier of	Proposed Solution benefitted all three tier i.e. edge, Fog and Cloud	The Proposal needs an efficient communi
Abdul Jaleel et. all. [6]	Health Care	Device heterogeneity lacking Interoperability	Autonomic Interoperability Manager (AIM) reduce the average	The AIM works well with IoMT applicati

Our Proposed Work	Redowan Mahmud et all. [11]	Rabeea Basir et all. [10]	Dr. Joy Iong Zong	N.Al-Jaroodi et all. [8]	Abhishek Hazara et all. [7]
IIoT Domain	Healthcare IoT	Industrial IoT	Industrial Real	Smart Cities	Industrial IoT
Intelligent Business Interoperable analysis	latency sensitivity, uneven data load, diverse user expectations and heterogeneity of the applications	Challenges of real time data processing addressed	Real time applications data offloading techniqu	Combine IoT, Fog and Cloud to form Centralized	Extreme heterogeneity and Dynamic and spontaneous
GA based optimization at Sensor and Fog; and management of Data Through Modular Application	Fog-IoT solution is improved in terms of service distribution, instances cost, with distributed computing, reduction of latency, optimization of data communication and	Fog-IoT is a key enabler solution for IIoT	Fog-centric semantic model framework for offloading as majority	Powerful platform enhancing and optimizing applications in energy	Deep insight into Industrial IoT domain with key challenges
Implementation placement of Business Analytical module	Some unresolved issues like intelligent cluster, common prototype, common resource	Green communication within environ	Some concerned real time query	Needs some operability solution	Unresolved issues are not tackle deeply

TABLE 1. COMPARATIVE ANALYSIS OF FOG-IOT SCHEMES

7. CONCLUSION & FUTURE DIRECTIONS

There are versatile domains of IoT where numerous work has been done; but as the least concerned found regarding Industrial IoT; the above proposal enforces the optimization approach where the devices and applications not dependent on cloud layer for business analytics. This approach explores the new dimensions of Fog-IoT and become an optimal solution for business interoperability. It can greatly reduce the delay and performed well in terms of business analytics application since it's deployment located near to IoT devices and facilitates with 5G services. Yet some common issues resolved by study but the research on ongoing issues will be continued for future. This approach has been based on parallel optimization of Sensor and Fog layer; where head Fog nodes at Fog layer must be responsible for solving the Business Analytics interoperability issues by processed it on Deployment Node; selected by an Algorithm to perform analytics at such environment; while sensor head forward the data as per applications to next layer fog head through sink thus the routing as well as data management both issues will be resolved. Yet; the Proposed Layered system architecture of such model also associating with following research challenges; that becomes future research directions in this enabling environment.

1. Parallel Optimization Simulation in such environment.
2. Placement Strategy of Intelligent Business Analytics Modules on Fog Orchestration Node.

3. Programming implementation of Business Analytics' Application Interoperability Modules and measures of their efficiency in such systems with 5G environment.
4. Security and Privacy Concerned of such systems with 5G structural and service requirements parameters.

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