NOVEL ENERGY CONSUMPTION USING OPTIMIZED GENETIC MACHINE (OGA) LEARNING TECHNIQUES

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ABSTRACT: The Internet of things (IOT) is a conceptual grouping and leading process in computing and it is key solution for providing the smart environments. The optimum allocation of virtual machines is leads to reduce energy consumption. The aim of this paper is to build, test and develop low energy and control system using IoT devices. It may prevent pollution of the environment and improve the efficiency. The goal is to maintain a balance between user comfort and energy requirements, such that the user can achieve the desired comfort level with the minimum amount of energy consumption. This paper is help of optimized genetic algorithm (OGA) and variations in the parameter to reduce energy consumption. In this paper we have described detailed literature survey of the techniques used for the optimization of energy consumption and scheduling in cloud environment. The experimental results used cloud sim software to collect data and improve energy throughput and delay through the proposed method.

Keywords: IOT, Energy Consumption, Artificial intelligence, Optimized Genetic Algorithm, Cloud Environment, Throughput and Delay.

I. INTRODUCTION

Internet of Things is a major technology that with a large social and economic impact. In essence, the IOT is involves the use of devices, connected over the internet to measure, report and in some cases perform actions autonomously. It is estimated that the IoT with 50-200 billion connected devices and it led to network traffic growth and the energy cost of additional network requirement needed to support that growth is unknown. The Internet of Things (IoT) is an arrangement of interrelated processing gadgets, mechanical and advanced machines, articles, creatures or individuals that are furnished with one-of-a-kind identifiers and the capacity to exchange information over a system without expecting human-to-human or human-to-PC connection. This paper is concerned with the IoT itself and its components in terms of energy consumption.

1.1 Internet of Things Architecture

IoT is envisioned to be an ecosystem that will evolve for connectivity of environments and the services required for sufficing human life expectations. It is to facilitate the interaction of smart objects with smart environments in order to facilitate real-world human interaction and to break down the barriers between humans and machines. At present, the IoT architecture is yet to be standardized, but a number of consistencies characterize it.

The figure 1 shows the three layers in a hierarchical structure, with an application layer, a network layer and perception layer. The perception layer is describing the sensor network elements that provides the network and the application with its data. It gathers information and recognizes objects that the environmental items of objects are monitored. The perception layer is use the network layer to correspond the data together from a targeted atmosphere. The network layer is responsible for creating and managing information, building and processing intelligence, connecting the internet network systems. The network layer is makes use of the application layer information and utilized the execution of processes. For example, industrial control, energy control, work distribution, motor vehicle control and so on. The IoT fields and domains and IoT similarity/dissimilarity. It defines basic building blocks and integration schema.

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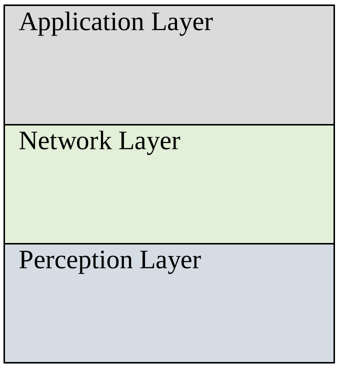

Figure 1. Layers of IoT Architecture

Internet of things (IoT) includes a lot of key technologies; wireless sensor networks are one of them. Wireless sensor technology plays a pivotal role in bridging the gap between the physical and virtual worlds, and enabling things to collect data from their environment, generating information, raising awareness about context and respond to changes in their physical environment. Communication between objects consumes power and therefore after the period sensor object loses energy and stops working. So energy efficiency is a major goal of the Internet of Things and in particular the sensor nodes. In this article, we will discuss strategies for energy optimization based on genetic algorithms in sensor objects. We also evaluate different performance optimization strategy based on GAs. Correspondence between objects expends power and consequently after the period sensor object loses energy and quits working. So energy productivity is a significant objective of the Internet of Things and specifically the sensor hubs. In this article, we will examine methodologies for energy advancement dependent on hereditary calculations in sensor objects.
The figure 2 below shows the overview of internet of things.

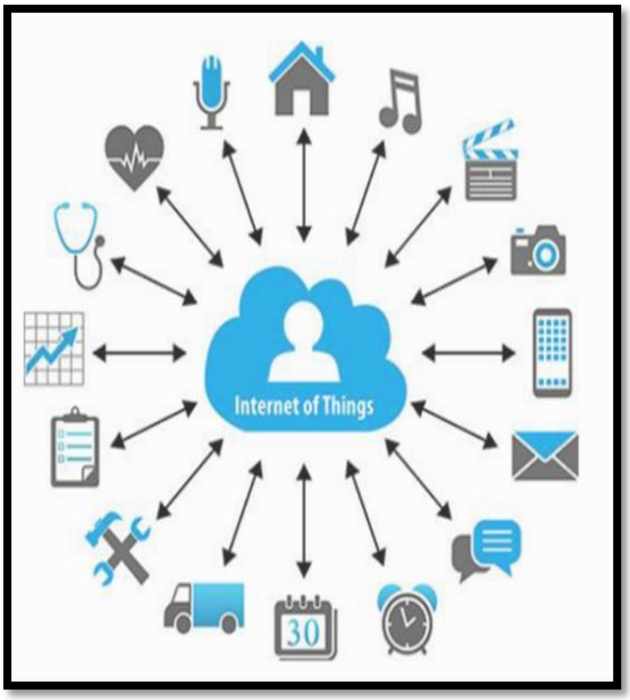

Figure 2 Internet of Things view

II. RELATED WORKS

Paula Raymond Lutui et al (2018) The Internet of things (IoT) is a conceptual grouping of technological capabilities that enable not only the interconnectivity of useful devices but also the environmental control of

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useful experiences. The IoT may be viewed as a multiplicity of connected environments in which a user can control and be controlled by experiences. Environments are populated by sensors, controllers, and other objects, which are principally powered by electricity. As a consequence the growth of the IoT impacts the requirement for renewable energy and energy consumption efficiencies. In this paper we discuss optimizing energy consumption in the IoT smart environment of a home. Optimization by simple design is adopted as the best strategy for planning and regulating energy consumption.

Chrispin Gray et al(2015) Over the past couple of years, many commentators have hailed the "Internet of Things" (IoT) as the next step in the evolution of the internet. This paper examines, from an energy consumption viewpoint, some options for deploying a network of "Things" and connecting them through their gateway into the Internet or a corporate network. It focuses specifically on the access network from the customer premises to the central office and the implications for this network of carrying uplink dominant IoT traffic. The power consumption of a number of potential access network technologies and architectures is modelled for a range of IoT traffic and background network traffic levels. It is shown that shared corporate Wi-Fi network with PON backhaul can be the most energy efficient option if the Wi-Fi background traffic level is modest. Otherwise, a 4G Wireless (LTE) access is also very efficient if the site IoT traffic level is low – up to around 100 kb/s. At higher rates a GPON access provides the most energy efficient solution.

Wesley "Tyler" Hartman et al (2018) The use of technology has become an essential part of improving lifestyle, work efficiency, and a catalyst for economic growth. The benefit of the Internet of Things (IoT) and connected nodes has been on a steep incline in recent years. This paper aims to research, build, test and implement a low-cost energy monitoring and control system using IoT devices. Electrical appliances (e.g., air conditioning units and overhead lighting) can be controlled and monitored using IoT technology from any place in the world. In order to accomplish this goal, a complete front-end to back-end system that includes a smart device application (iOS platform), a cloud-based database, an Application Programming Interface (API), and a hardware development is proposed. A small programmable specialized computing device (e.g., Raspberry Pi) for preliminary testing. This smart node was chosen due to familiarity, and its capabilities, such as general purpose pins and built-in Wi-Fi chip. The end goal is to observe energy efficiency by monitoring and controlling air conditioning appliances and standard overhead lighting units. These smart IoT devices allow for the usage energy data from each unit to be collected and stored in a Cloud-based database that can be analyzed and reported for energy conservation and analysis.

Abdul Salam Shah et al(2018)The goal of each technique is to maintain a balance between user comfort and energy requirements, such that the user can achieve the desired comfort level with the minimum amount of energy consumption. Researchers have addressed the issue with the help of different optimization algorithms and variations in the parameters to reduce energy consumption. To the best of our knowledge, this problem is not solved yet due to its challenging nature. The gaps in the literature are due to advancements in technology, the drawbacks of optimization algorithms, and the introduction of new optimization algorithms. Further, many newly proposed optimization algorithms have produced better accuracy on the benchmark instances but have not been applied yet for the optimization of energy consumption in smart homes. In this paper, we have carried out a detailed literature review of the techniques used for the optimization of energy consumption and scheduling in smart homes. Detailed discussion has been carried out on different factors contributing towards thermal comfort, visual comfort, and air quality comfort. We have also reviewed the fog and edge computing techniques used in smart homes.

Mohammad Esmaeili et al (2016) Internet of things (IoT) includes a lot of key technologies; wireless sensor networks are one of them. Wireless sensor technology plays a pivotal role in bridging the gap between the physical and virtual worlds, and enabling things to collect data from their environment, generating information, raising awareness about context and respond to changes in their physical environment. What makes the difference between IoT with other computing areas is their large-scale in terms of number of objects, events and mutual communication between the objects. Communication between objects consumes power and therefore after the period sensor object loses energy and stops working. So energy efficiency is a major goal of the Internet of Things and in particular the sensor nodes. In this article, we will discuss strategies for energy optimization based on genetic algorithms in sensor objects. We also evaluate different performance optimization strategy based on GAs.

Wembo Wang et al(2017) Internet of Things (IoT), the real-time status of resources and the data of energy consumption from manufacturing processes can be collected easily. This manufacturing information can provide an opportunity to enhance the energy efficiency in real-time production management. To achieve this target, this work presents a real-time energy efficiency optimisation method (REEOM) for energy-intensive manufacturing

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

enterprises. By this method, IoT technologies are applied to sense the real-time primitive production data, including the energy consumption data and the resources status data. Multilevel event model and complex event processing are used to obtain real-time energy-related key performance indicators (e-KPIs) which extend production performance indicators to the energy efficiency area. Then, the non-dominant sorting genetic algorithm II is used to schedule or reschedule the production plan in an energy-efficient way based on real-time e-KPIs. Finally, a case is used to demonstrate the presented REEOM.

Bimlendu Shahi et al(2015) Tele-communication and network industry are becoming extremely fascinated by the use of evolutionary smart sensor nodes in wireless sensor networks.It is overcome several challenges within WSNs needed for real time data protection via optimization technique:Genetic algorithm.It reviewed the use of Genetic algorithm with certain limitation of wireless sensor networks.It presents major application areas of wirelss sensor between a sensor and destination in a sensor network reduce the energy with degrade the life of a network. GA can prolong the network lifetime by minimizing the total communication distance.

III. PROPOSED METHODOLOGY

3.1 PROBLEM FORMULATION

In this proposed method,we discusses about the role of genetic algorithm plays in our developed method. The figure 3 below describes the flow of this paper.The figure shows overall objectives of this paper.The goal is to reduce the energy level of the current datas using optimized genetic algorithm.The energy level reduced means then transfer to the simulation process and calculate the throughtput and propagation delay using parameters of storage,RAM,MIPS,Bandwidth,Power of the cloud datasets.

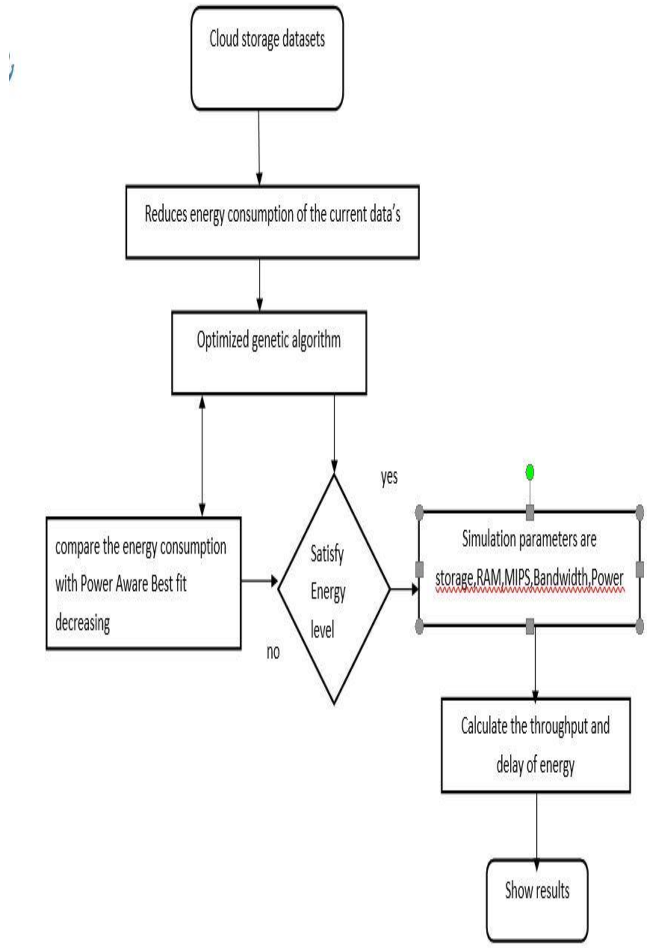


Figure 3 Flow of Proposed Methodology

3.2 LAYERS OF IoT

Data from various sources and domains produced by IoT is often data stream, such as numeric data from different sensors or social media text inputs. Common data streams generally follow the Gaussian distribution over a long period. However, In addition, in some cases, in real time or near real time. One trend in Internet applications of Things that addresses the concept of IoT Analytics is the use of fog computing that can decentralize the processing of IoT data streams and only perform the transfer of filtered IoT data from the devices from the edge of the network to the cloud. The figure 4 shows the layers of IOT

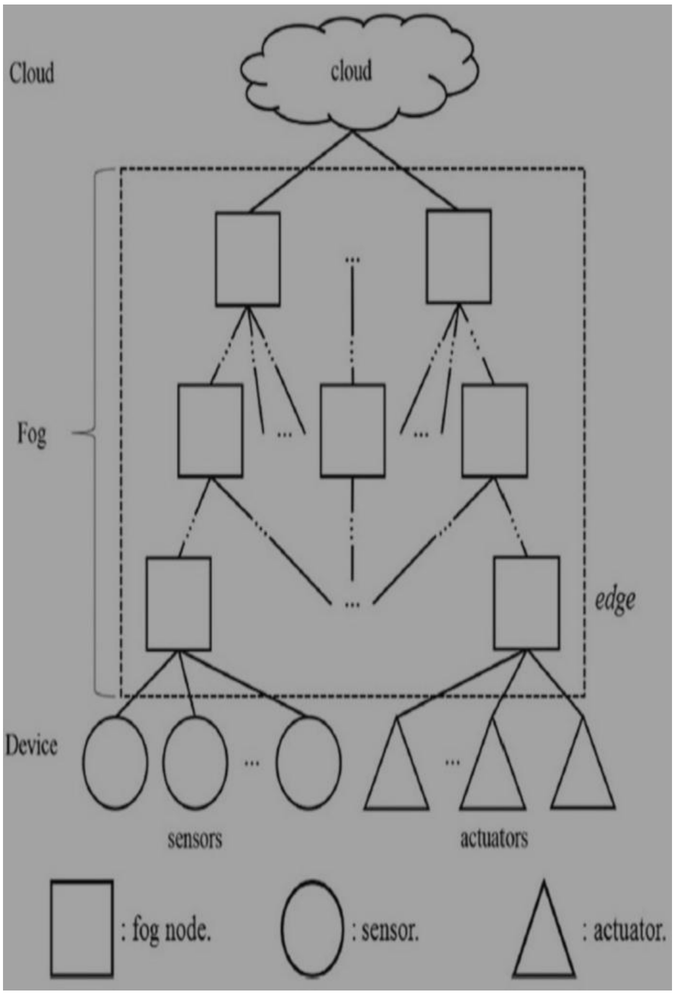


Figure 4 The IoT is composed of three layers, cloud, fog, and device layers

3.3 CLOUD REQUIREMENTS

- On-line monitoring the conditions of valuable pieces of art requires continuous data gathering and processing. As energy consumption of sensors must be low, intensive processing must take place elsewhere. Moreover, by gathering the proper information from multiple sensors, data analyses may be able to provide more accurate predictions. Cloud resources can achieve this computing capacity and cloud elasticity can provide the required energy content, even on the service-side.
- The analysis and processing of data recorded from nodes and gateways as well as their visualization involves the following requirements for the cloud infrastructure.

3.4 Non-functional Requirements of cloud

- It must enable the processing of both streamed and batch data gathered by the nodes and gateways.

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

- It should provide an efficient execution context for frameworks based on BigData such as MapReduce, Spark, STORM or DataTorrent RTS.

- It should provide data stores based on HDFS and NoSQL databases such as MongoDB. It should provide elasticity at the storage level, at least enabling new resources to be added on-demand. The resources deployed will be dynamically adjusted according the tasks in execution.

3.5 Functional Requirements of cloud

- The architecture should be cloud agnostic, that is, compatible with different IaaS providers, both on-premise systems (e.g. openNebula, OpenStack) or public cloud providers (e.g. Azure, AWS).

- It must provide access to the information distributed over the archaeological site or artwork under monitoring, including an optimal way to query and fetch the relevant data from the data stores (e.g. MongoDB).

- It should facilitate the access to data visualization from client applications, providing standard Internet protocols.

- It must provide an open source solution and a property-based configuration mechanism to enable additional processes of components, and to specify the network port where the services provided by the framework listens for incoming requests.

- It must support secure access to the data stores.

- It must support secure access to database stores.

- It must support a simplified deployment mechanism consisting only of three steps:

(i) Adjust the configuration

(ii) Deploy the infrastructure and configure the services and

(iii) Run the services of the framework.

IV. MODULE DESCRIPTION

4.1 GENETIC ALGORITHM

In genetic algorithm, genetic operators are working through different stages. The selection, mutation and crossover operators are most applicable operators in genetic algorithm.The pseudo code of genetic algorithm are illustrated below.

Algorithm

Pseudo code of genetic algorithm

Choose initial population

Repeat

Evaluate a certain proportion of the population

Select pairs of best ranking individuals to reproduce energy level

Apply crossover operator

Apply mutation operator

Until terminating condition

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

4.2 OPTIMIZED GENETIC ALGORITHM(OGA)

Genetic Algorithm is known to be an ideal technique for finding optimal solutions to various problems.

4.2.1 Population Initialization

The purpose of initialization is to generate an initial population randomly for subsequent genetic manipulation. For a simple training set, up to three hidden layers are enough to get a good detection rate. Binary coding is the most common coding method in genetic algorithm, so we encode the number of nodes in the three hidden layers directly in the binary chromosome. As shown in Fig. 5, the length of chromosome is 18 bits: the first 6 bits are reserved for the first hidden layer, the subsequent 7-12 bits and 13-18 bits are for the second and the third hidden layers respectively.

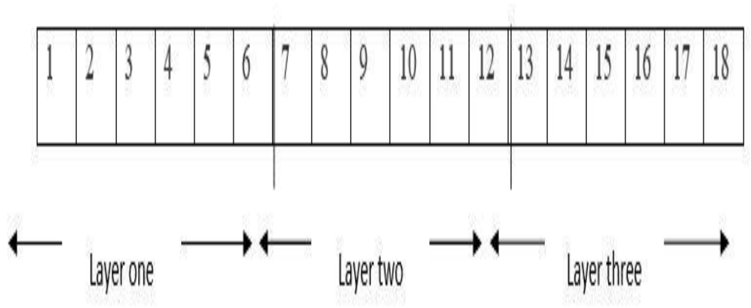


Figure 5 Chromosome schematic

A chromosome represents a network structure, which has at most three hidden layers and at least one hidden layer. Each layer has 6 bits. The value of each bit is a binary number 0 or 1. The converted decimal number is the number of neurons in a layer. According to the rules of thumb, it is shown that an acceptable number of neurons in the hidden layer could be the size between the input layer and output layer. Therefore, when the population is initialized, we must ensure that the number of nodes in each layer is smaller than the number of input features and greater than the number of output features.

$$\boldsymbol{I} \leq \boldsymbol{N} < 0$$

Where I is the size of the input layer, O is the size of the output layer and N is the number of neurons in the hidden layer.

If a chromosome has two layers, then 1-6 bits and 7-12 bits are between 000010 and 101000. The 13-18 bits are 000000.

4.2.2. Selection Operations

The selection operation is to select excellent chromosomes from the current population and prepare for crossover and mutation. As the fitness of candidate individuals increases, the probability of being selected increases. In general, a method of roulette wheel selection based on proportional fitness assignment (also known as Monte Carlo method) is used.

Firstly, we will select the individuals with the greatest fitness value to ensure that they can enter the next stage, and then select the remaining individuals according to the method of roulette. This improvement ensures that the best individuals will not be eliminated.

The specific operations are as follows:

Calculate the fitness of each individual in the population f (i 1,2, ⋯ ,M) = M is the size of population.

The individual with the largest adaptation value enters the next stage directly

Calculate the probability that each remaining individual is passed on to the next generation:

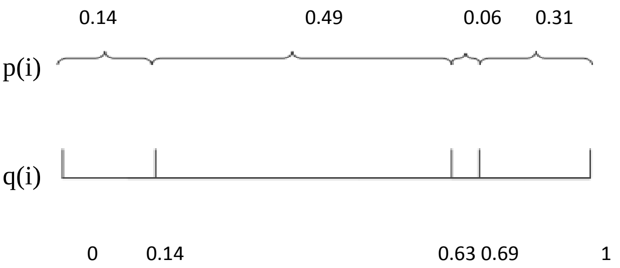
$$p_{(x_i)} = \frac{f(x_i)}{\sum_{j=1}^{N} f(x_i)}$$

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

Calculate the cumulative probability of each individual

$$q_i = \sum_{j=1}^{i} p(x_j)$$

Generate a uniformly distributed pseudo-random number r in the interval [0, 1]



Generate a uniformly distributed pseudo-random number r in the interval [0, 1]
If r < q(1),select the individual 1， if not select the individual k when q[k-1]<r≤q[k]

4.2.3. Improved Crossover

The two adjacent chromosomes remain unchanged after the crossover operation and thus this crossover operation has no effect.
So we take the interval crossover, which is as shown in eq.4,for example if we have n chromosomes, we cross the first one with $(n/2 + 1)th$,the second one with $n/2 + 1)th$ and so on

$$c = i^{th} cross\ with\ \left(\frac{n}{2} + i\right)^{th}, i = 1,2, \ldots..n/2$$

Where c representing the individuals generated after the intersection. We apply combination function to two answers via crossover operator. Middle point of the array is selected randomly and then, former part of primary answer is combined with latter part of secondary one and vice versa. The earlier answers would be replaced by the calculated findings, if recent answers are optimum.

4.2.4. Mutation Operation

The mutation operation is to change a certain bit in the chromosome. It can use the random search ability of mutation operator. When the operation result is close to the optimal solution neighborhood, it can quickly converge to the optimal solution.

4.2.5. Retention Strategy

Crossover and mutation may be lead to loss of the optimal solution and this occurrence in the evolutionary process frequently. In order to prevent the loss of the best of the population,which results in the genetic algorithm cannot converge to the global optimal solution.

V. EXPERIMENTAL RESULTS

In this paper,we employ a powerful and accurate simulation for cloud computing known as cloud sim simulator.some features of the simulators include flexibility and information report and so on.In order to evaluate the proposed approach,the first step is to simulate cloud data.Table 1 shows the simulation parameter setting and required features.

ISSN- 2394-5125 VOL 7, ISSUE 13, 2020

Table 1 Simulation Parameters Settings

	Storage	RAM	MIPS	Bandwidth	Power
Physical Host	1,000,000	10,000	1000, 2000, 3000	100,000 Mbps	250w
Virtual Machine	2500	125	240, 400, 650, 1000	2500	0w

The below table 2 and 3 shows the existing and proposed method energy throughput and propagation delay measurements in iterations

Table 2 Energy Throughput and Delay of PABFT

Iterations	Energy Throughput	Propagation delay
10	0.29	1.29
20	0.35	2.34
30	0.89	2.78
40	0.92	2.87
50	0.97	2.56

Table 3 Energy Throughput and Delay of Optimized Genetic Algorithm (OGA)

Iterations	Energy Throughput	Propagation delay
10	0.39	1.19
20	0.45	2.24
30	0.79	2.58
40	0.82	2.67
50	0.77	2.46

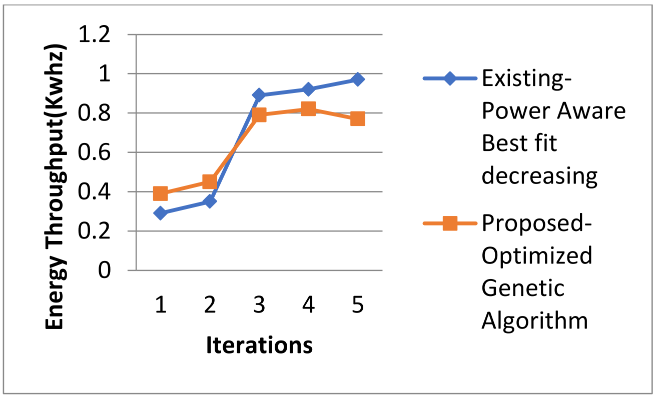


Figure 6 Simulation results of Energy Throughput

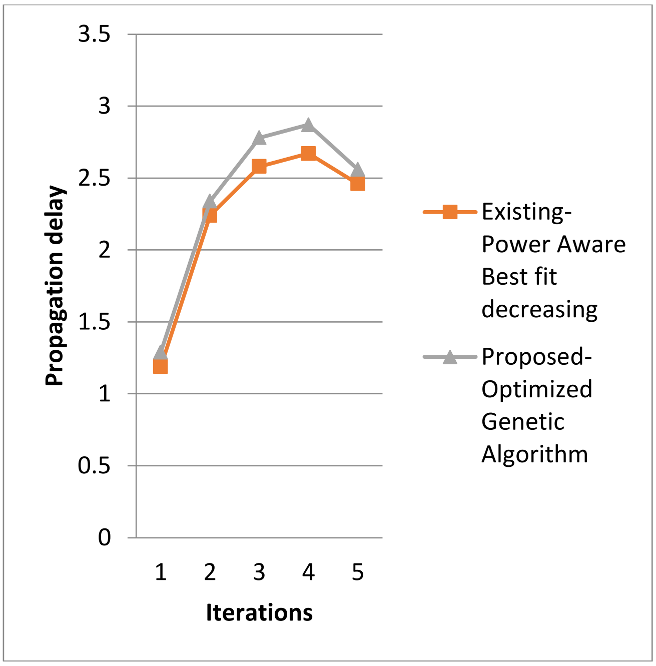


Figure 7 Simulation results of Propagation delay

Figure 6 and 7 shows the energy consumption for time slots when the GA and PABFD are adopted. Generally. this variance indicates the energy consumption of cloud data sets. The figures 6 an 7 shows the outperforms of the existing and proposed throughput and propagation delay level thus leading to a longer network lifetime.

V. CONCLUSIONS

This paper presents the integration of cloud computing and IoT, including the data analysis. Due to the massive datasets required, machine learning is a requirement for IoT to provide value. IoT holds a lot of promise in manufacturing area. Through GA,the optimal individuals can be generated.It can effectively process datas and energy consumption results are verybest.GA performs multiple iterations to perform the optimal solutions.In addition ,the GA algorithm can be used not only in IOT,also can be applied to other situations such as classification and recognition.In future we will consider to optimize the other attributes of the deep network,reduce the training time and improve the accuracy.

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