Load Balancing Approach in Internet of Things Using ACO and PSO

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Abstract : One of the emerging areas in the field of Information Technology (IT) is Cloud Computing. It is internet based technology which emphasizes its utility and follows pay-as-you-go model. Load balancing is a critical issue in internet of things. It is a technique which uses multiple nodes and distribute dynamic workload among them so that no single node is overloaded. The main objective of this paper is to improve load balancing using particle swarm optimization and ant colony optimization algorithm. This review helps in analyzing the issues of existing load balancing algorithms and gives a comparison among these algorithm on the basis of different qualitative metrics like spectrum efficiency, performance measurement, time complexity etc.

Index Terms : Internet of Things; Load Balancing; ACO; PSO; Security

I. INTRODUCTION

Internet of things is the process of physical objects embedded with software and sensors to require the data exchange[1]and it is the wireless network is the good option for communication due to its convenienc. Objects in the IoT network must be inte-connected. By the Internet of Things, objects recognize themselves and obtain intelligence behavior by making or enabling related decisions thinks to the fact that they can communicate information about themselves[2]. These objects can access information that has been aggregated by other things, or they can added to other services[2]. Cloud service providers is distribute application requests to various data centers. It is dynamic because load seprated according to the client or end users request. When the various servers get over loaded through user requests then we need a load balancing approach to distribute the load to unutilized servers. Load balancing is the critical issue in internet of things.

Load balancing is the systematic approach to reassign the total load of the various overloaded servers to under loaded servers, data servers, hard drives or other computing resources by helping cloud service[3]. Load balancing has many different types likes static or dynamic, periodic or non periodic, centralized or decentralized. In static load balancing algorithm, we have prior knowledge of load or system resources and it does not depend over the current status of the network whereas in dynamic algorithm load seprated or changes on the server and it depends the current status of the network. It generally gives better performance then static algorithm.

1.1 Related Work

A. Round rabin algorithm

It is a simple mechanism in which the workload is distributed evenly across all processors. In this algorithm the content access request is responded by the load balance in a rotational basis. Each new process is assigned to a new processor. The first request grants access to the first available content server giving its IP address and the second to the second server IP address and so on. The moment a server IP address has been given its IP address is moved to the back of the list of available IP addresses and it moves back to the top of the list and becomes available again.

B. Weighted round rabin algorithm

This builds on the simple Round Robin load balancing method. In the weighted version each server in the pool is given static numerical weights. Servers with higher ratings get more requests sent to them [4]. For example when a client's start coming in, the first 5 will be assigned to Server 1 and the 6th to Server 2. If more clients come in, the same sequence will be followed. That is, the 7th, 8th, 9th, 10th, and 11th will all go to Server1, and the 12th to Server 2, and so on.

C. Least connection algorithm

The current server load is neither taken by Round Robin nor Weighted Round Robin when distributing requests. The Least Connection method does take current server load into consideration. The current request goes to the server that is servicing the

least number of active sessions at the current time that is it checks the number of current connections each server has [5]. For example say if client attempts to connect server 1 and server 2 but the server are already active in session, so the request is sent to Server 3 because it does not have any load.

D. Ant colony optimization

Ant Colony Optimization (ACO) was introduced by M. Dorigo and colleagues [6]. The basic idea of ACO is to simulate the foraging behavior of ant colonies. When an ants groups try to search for the food, they use a special kind of chemical to communicate with each other. That chemical is referred to as pheromon [7]. Initially ants start search their foods randomly. Once the ants find a path to food source, they leave pheromone on the path. An ant can follow the trails of the other ants to the food source by sensing pheromone on the ground,. As this process continues, most of the ants attract to choose the shortest path as there have been a huge amount of pheromones accumulated on this path. This collective pheromone depositing and pheromone following behavior of ants becomes the inspiring source of ACO [7].

E. Honeybee foraging behaviour

The idea behind the BCO(Bee Colony Optimization) is to create the multi agent system capable to successfully solve difficult combinatorial Optimization problems[7]. Aim of this algorithm is to achieve well balanced load across VMs to maximize the throughput and to balance the priorities of tasks on the VMs. So, the amount of waiting time of the tasks in the queue is minimal. Using this algorithm average execution time and reduction in waiting time of tasks on queue were improved. This algorithm works for heterogeneous type of systems and for balancing non preemptive independent tasks. The algorithm checks periodically load on each virtual machine and migration or tansfer of load takes place. This optimization identifies the highly loaded VM and finds the less loaded VM then transferring f, so that the loads are distributed evenly, the response time minimizes and resource utilization increases. The task can be considered as a bee and it is searching for a less loaded VM when it finds the suitable VM assignment of task to VM takes place, and the next task also tries to assign to the same VM ,this assignment continues until the load on the VM reaches threshold

F. Particle swarm optimization

The particle swarm optimization (PSO) is a population based algorithm that was invented by Kennedy and Eberhart, which was inspired by the social behavior of animals such as fish schooling and bird flocking. Similar to other population based algorithms, such as evolutionary algorithms, PSO can solve a variety of difficult optimization problems but this shown a faster convergence rate than other evolutionary algorithms on some problems [8].
Another advantage of PSO is that it has very few parameters to adjust, which makes it particularly easy to implement. It was pointed out that although PSO may out perform other evolutionary algorithms in the early iterations, its performance may not be competitive as the number generations are increased.
Particle Swarm Optimization algorithm is a new kind of modern heuristics algorithm and it is well characterized by its self-organizing, self-learning, self-adaptive characteristics and the implicit parallelism and guided search, which is often used to solve different kinds of NP-complete problems and complex task scheduling problems[8].

II. LITERATURE SURVEY

2.1 Relevance Survey on Load Balancing

This paper [10] proposed a novel association approach which takes backhaul link, quality of service and resource consumption.This approach improves spectrum efficiency in relay enhanced network and also maintains the load balancing between cells. Their main object is to design an association approach which maximize system capacity and guarantee quality of service requirements for user equipments(UE). The load balancing approach is derived based on the resource consumption and link quality. So that UE selects a serving node based on a function of SINR and resouce consumption.

In this paper [11] they propose an efficient clustering algorithm based on load adjustment for the IoT under the software defined network architecture. They utilise cloud resources such as data centers and storage units by a centralised SDN controller located over the cloud and calculate a load balanced using particle swarm optimization clustring algorithm. The SDN controller implements the PSO that considers load balancing, communication cost and remaining energy factors to construct a clustering table.

This paper [12] proposed an adaptive and load balanced routing technique for IoT network called Adaptive routing using Multi technology and load balancer for maximizing throughput of IoT networks by distributing the load across all the gateway present in the network.

This paper has [13] as huge number of devices are deployed in the narrowband cellular internet of things(NB-CIoT) system. Traffic load of PDCCH message for each coverage class might be unequal and it is difficult to distribute the traffic overload. To solve this problem, they proposed a novel load balancing scheme for PDCCH and random access channel(RACH) in the NB-CioT. In this scheme when load conjection occurs in the coverage class, base station(BS) dynamically adjust configuration related to the ratio of resources within coverage class.

In this paper [14] they propose an agent Loadboat that measures network load and process structural configuration by analyzing the large amount of user data and network load. And applying Deep Learning's Deep Belief Network method to achieve efficient load balancing in IoT.

This paper [15] propose the cloud solution with optimization for scalable RFID based IoT application deployment. Ths is the cloud solution with load prediction and migration management. They designed a system that focuses on load balancing optimization for RFID application on cloud.

This paper [16] has RPL designed for low power and lossy networks has many features like loop-freeness, self-healing mechanism, and low battery usage. But it was initially designed for low traffic networks, it cannot deal with problems of a high traffic rate network. And when the network traffic is heavy, RPL cannot handle it, and the network faces with multiple problems such as high packet loss rate and load imbalance. To resolve this problem, they proposed a new objective function, known as context aware objective function. This is avoid thundering herd phenomenon.

2.2 Comparative Study

Table 1 Comparison table of literature survey

NO.	Title	Method used	Advantages	Disadvantages
1.	An Association Approach that Combines Resource Consumption and Load Balancing in Heterogeneous Cellular Networks [10]	Novel Association Approach	Decreases the resource consumption, Maximise system capacity and Gurantee Qos requirements for Ues	Capacity based on the UE association sequence and Difference between average rate and fairness very less
2.	Optimised clustering algorithm based centralized architecture for load balancing in IoT network[11]	Clustering algorithm for load balanced in IoT network	Increasing network lifetime, Distributing and balancing the load and Energy depletion among selected CHs	Time complexity, network lifetime decrease.
3.	Adaptive Load Balanced Routing in Heterogeneous IoT Networks[12]	Adaptive Routing using Muity-technology and Load balancer	Fewer number of interfaces, Multi hop path, Increase the overall throughput of the IOT network, Maximizing reliability, power saving, and energy efficiency in resource constrained multi hop WSNs	Network throughput is directly proportional to the number of IGWs in the network
4.	Control Channel Load Balancing in Narrow Band Cellular IoT Systems Supporting CoverageClass[13]	Novel load balancing scheme	Improve the random access successful ratio, Reduce the number of transmission for random access procedure and Reduce the battery power consumption	low language
5.	A load balancing scheme based on deep-learning in IoT[14]	Agent Loadbot and Agent Balancebot	Analyzing a large number of user data and network load	Such migration occurs less frequently than dynamic scheme
6.	Optimizations for RFID-based IoT applications on the Cloud[15]	Load balancing optimizations for RFID application	Higher prediction accuracy for high load levels, Small connection establishment time and Load balancing improvement	Low range communication and Issues in migration
7.	CLRPL: Context-Aware and Load Balancing RPL for Iot Networks Under Heavy and	Context Aware and Load balancing RPL for	Avoid the thundering herd problem in the network, Handel heavy and dynamic	Power depletion, Misappropriate parent selection,

	Highly Dynamic Load[16]	Heavy and highly dynamic network load	load, Avoid the Equality Illusion Problem, Increases network lifetime and Balance the traffic and load balance	Energy consuming and bigger subtree size

III. PROPOSED MODEL

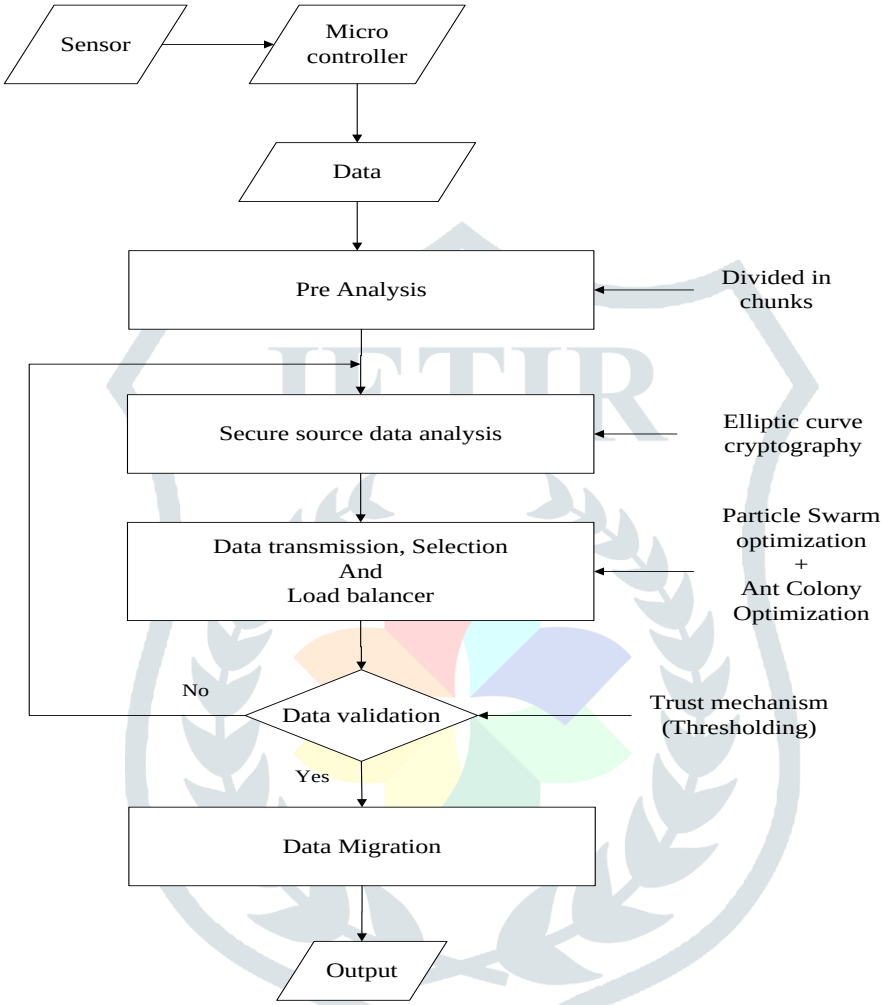

Fig. 1 Proposed System

IV. IMPLEMENTATION RESULT

4.1 Temprature and Humidity sensor with microcontroller for data generated

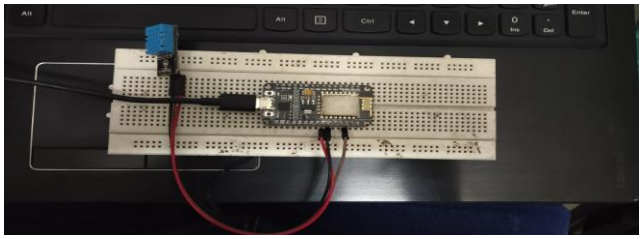

Fig.2 Data Input

4.3 Using Particle Swarm Optimization and Ant Colony Optimization

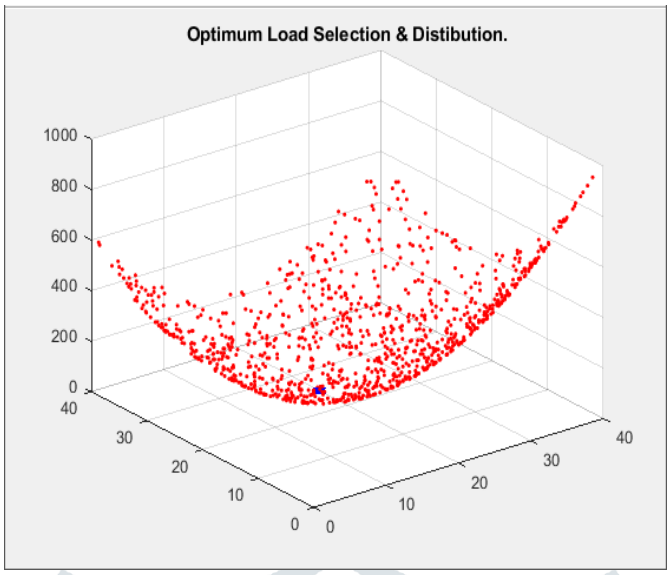

Fig.4 Load selection

4.4 Parameter Result

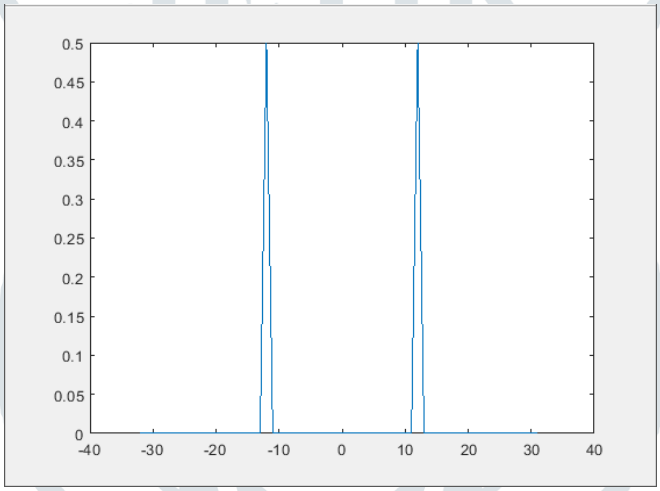

Fig.5 Spectrum Efficiency

V. CONCLUSION

This paper works on hybrid approach for secure data and balance the node for IoI application. So now a days IoT application play a main role for digital world, for secure the large data and manage the large data to use efficient machanism for enhancing current issues. In this paper works on ACO and PSO algorithm for selection of specific node and also use ECC algorithm for secure the data. Using this approaches try to achieve load balancing, time complexity and spectrum efficincy. Achieving the spectrum efficiency is 99.3876 using this approach.

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