Minimizing Energy Consumption Using Internet of Things

Abinaya. S, Akshaya. G, Dhivya. J
Computer Science and Engineering
University College of Engineering
Thirukkuvalai
abinayajothilakshmi@gmail.com,
grakshayaharish@gmail.com, dhivya.jp19@gmail.com

Madhan. S
Assistant Professor
Department of Computer Science and Engineering
Thirukkuvalai
madhan444@yahoo.com

Abstract: Now a days using of internet is growing faster. All things are connected using internet. Internet of things means connecting all the devices using internet. These issues become crucial in large scale of IoT environments which are composed of thousands of distributed devices. The more number of distributed systems consumes more amount of energy. This paper is to minimize energy during data transfer and to minimize loss of packets and time delay. In this we are using Ant Colony Optimization algorithm for clustering the data nodes and transferring data with less energy consumption.

Key Terms: *Ant colony Optimization (ACO) algorithm, mobility of nodes, time utilization, energy efficiency, throughput, packet delivery ratio.*

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I. INTRODUCTION

Internet of things is becoming an increasingly growing topic of conversation both in workplace and outside environment. Nowadays IoT becomes omnipresent (i.e.) present anywhere at the same time. It is the process of connecting smart objects and systems with each other over the Internet. Several domains such as cloud computing, ubiquitous computing, service-oriented computing and ambient intelligence are working based on the IoT vision. The smart cities are also building using the concept of Internet of Things. The devices which are in mobility can also be able to connect and transfer the date using IoT. So there is the possibility to increase power consumption due to the usage of large number of connected devices, over the distributed networks.In terms of energy, there is a limited energy storage capacity for the selected services.In some extent, the failure may occur due to the intensive use of batteries and may be terminate at any situation. In sense of the large-scale Iot environment, batteries cannot be easily replaced or rechargeable.

IoT has challenging issues because of its dynamic and stochastic nature. Frequent changes in IoT may be caused by dynamic nature whereas random occurrence of this changes cause stochastic nature. Due to the mobility of users or devices, there may be occurrence of new nodes or loss of nodes. In existing system, the previous work for IoT services composition is based on an Energy-centered and QoS-aware services selection algorithm (EQSA) is proposed. The existing paper is carried out in two phases. The previous works are based on the selection of services and composition of services. QoS can be predicted based on the service selection algorithm. Although QoS has the efficiency there are some drawbacks. Providing Quality of Service to traffic flows on a perhop basis often cannot guarantee end-to-end QoS. Therefore Premium service will work in QoS. The Quality of Service features only measures the HTTP bandwidth at application level. HTTP bandwidth can differ from actual TCP network bandwidth. To overcome this, in proposed system we are used Ant Colony Optimization (ACO) Algorithm.

In this paper, an Ant Colony Optimization (ACO) algorithm is proposed. It is a population-based search technique for the solution of combinatorial optimization problems.

II. RELATED WORK

Ant Colony Optimization technique is used for finding the shortest path to reach the destination (i.e.) behavior of ants seeking a path between their colony and source of food. It is a probabilistic technique. It is a population based meta-heuristic that can be used to find approximate solution to difficult optimization problems. A meta-heuristic is a higher level procedure or heuristic designed to find, generate, or select a heuristic that may provide a sufficiently good solution to an optimization problem, especially with incomplete or imperfect information or limited computation capacity. Meta-heuristic is a algorithmic concept that define heuristic methods for a wide variety of problems and also relevant to combinatorial optimization problems. In most of the application the main problem is that we cannot predict or solve optimality within bounded computation time (i.e.) In NP-hard problem, near-optimal solution in a relatively short time are used to find the approximate solution in large instances. ACO algorithms can solve combinatorial optimization problem (i.e.) both static and dynamic. Static problems are those in which the characteristics of the problem is defined, and do not change while the problem is being solved. The problem instance changes therefore at run time and the optimization algorithm must be capable of adapting online to the changing environment.

To overcome the QoS-aware service selection algorithm, we are formulating Ant Colony Optimization Algorithms. ACO algorithm is developed for routing problems, here we are using ACO algorithm for data network routing. It is used to solve routing problem in telecommunication networks. Network routing refers to transfer necessary information from source to destination nodes. It is good for distributed system which presents high redundancy, fault tolerance, and handle multiple objectives and constraints in a flexible way.

Networks can be classified as either circuit-switched or packet-switched. Packet-switched networks are called data networks, which follow a different route and no fixed circuits. In the concept of IoT, the data nodes are not at constant places. Due to the mobility of nodes, transfer of data from source to destination is achieved by finding the shortest path. For finding the shortest path data network routing algorithm is preferred. Routing refers to the distributed activity of building and using routing tables. The routing table is a common component of all routing algorithms: it holds the information used by the algorithm to make the local forwarding decisions. One routing table is maintained by each node in the network: it tells the node's incoming data packets which among the outgoing links to use to continue their travel toward their destination node. Additionally, the nodes and links of a network can suddenly go out of service, and new nodes and links can be added at any moment. Therefore, network routing is very different from the NP-hard problems. Centralized algorithms can be used in particular cases and for small networks. Centralized systems are not fault-tolerant: if the main controller does not work properly, all the networks are affected. In contrast, in distributed routing, the computation of paths is shared among the network nodes, which exchange the necessary information. The distributed paradigm is currently used in the great majority of networks.

III. ANT COLONY OPTIMIZATION

To find the shortest path from source to destination, ant colony optimization meta-heuristic algorithm is used

Let G = (V, E) be a connected graph with n = |V| nodes. The source node is considered to be S and destination node be D on the graph G. Let as assume the pheromone concentration, **β**i, j is an indication of the usage of the edge i, j. An ant located in node vi uses pheromone **β**i, j of node vj and Mi to compute the probability of node vj as next hop. Mi is the set of one step neighbors of node vi.

$$Pi,j = \begin{cases} \frac{\beta i,j}{\sum j \in Mi\ \beta i,j} & if\ j \in Mi \\ 0 & if\ j \nexists\ Mi \end{cases} \quad \text{(i)}$$

The transition probabilities Pi, j of a node vi the constraint is:

$$\sum j \in Mi\ Pi,j = 1, i \in [1, M] \quad \text{(ii)}$$

The amount of pheromone of the edge e(vi,vj) when moving from node vi to node vj as follows:

$$\beta i,j = \beta i,j + \Delta\beta \quad \text{(iii)}$$

Like real pheromone the artificial pheromone concentration decreases with time:

$$\beta i,j = (1 - q).\ \beta i,j\ ,\ q \in [0,1] \quad \text{(iv)}$$

ALGORITHM FOR ACO

Pseudo code for network routing ACO Algorithm:

Procedure ACO_Meteheuristic
Input: a set of nodes N, and the corresponding distance D
Output: The best solution found s*
1. Choose M <= n = |N|
2. s* = sequential addition (M,N)
3.s_k = NULL
4. n_a = Determine NumberOf Ants()
5. InitializePheromoneValues()
6. while not stop condition satisfied do
7. T = {}
8. For ant = 1 to n_a do
9. T = T∪ConstructCompleteReconstruction(ant)
10. endwhile
11. end for
12. while(not_termination)
13. generateSolutions()
14. daemonActions()
15. pheromoneUpdate()
16. endwhile
17. endprocedure

IV. PERFORMANCE STUDY

Here the performance of ACO algorithm is evaluated in simulation at different scenarios. These scenarios are taken from java window application using the swing and thread concept, which demonstrates the transfer of data packets from source node to destination node with energy consumption, time utilization and throughput without any loss of data. In ACO algorithm, network routing protocol is used.

A:Simulation Environment and Methodology:

The ACO algorithm has been tested in a java window application using Intel core, window 32 bit system. The simulation scenario has number of nodes denoted as n which is green in color. Due to the IoT concept nodes are mobility in nature. Select sender node and receiver node. The data packets are sent, which is verified using verifier. The Geographical Location indicates neighboring nodes. The data are encrypted and send from one node to another. After reaching the node the message will display, whether it is successfully send or not. Then the packet loss is checked, if there is a packet loss means it is indicated by red colored node which act as a Hacker. If the packet loss occurs means it will be indicated as packet loss and it can be recovered using recovery data, then the data is sent another time without any loss of packets. The data sent from source to destination after these checking will display the graph.

B. Simulation Results

1) No. of Mobility Modes Versus Delivery Ratio:

In this first simulation (Fig. 1) we send the message from source to destination via the neighboring nodes. For example: sender node = 2 and receiver node = 15, which indicates the message sent through the nodes via 0, 1, 3, 6 is shown in the below graph.

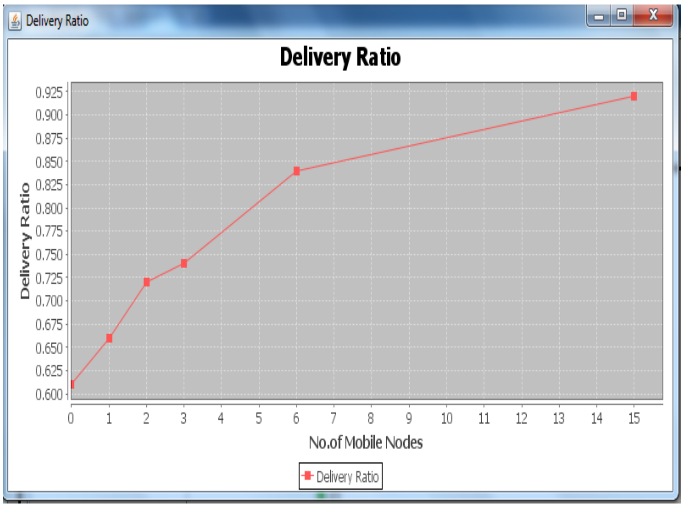

Fig. 1 No. of Mobility Modes versus Delivery Ratio

2) No. of nodes versus Time Utilization:

In this simulation the graph (Fig.2) indicates Ant Colony Optimization and Load Balancing Clustering are used. Blue color indicates the Load Balancing Clustering whereas red color indicates Ant Colony Optimization, in which the time utilization is high when compared with Load Balancing Clustering. So preferably ACO algorithm used which indicated time utilization. When the time can be utilized, energy can be consumed, which increases the energy efficiency.

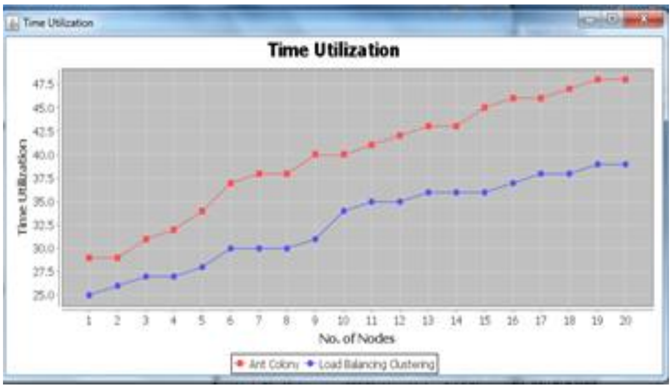

Fig. 2 No. of nodes versus Time Utilization

3) No. of nodes versus Throughput:

In this stimulation the graph (Fig. 3) indicates the QoS services, Time-Efficiency Prediction and QoS Attribute. Time-Efficiency Prediction indicates the reduction in time from one node to another, which also indicates the energy consumption.

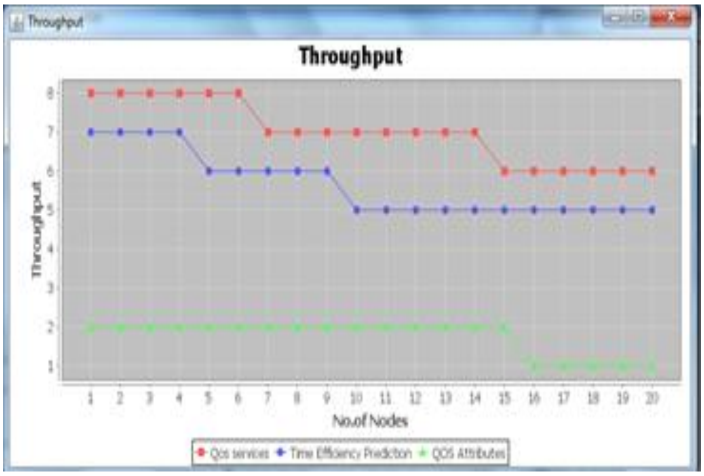

Fig. 3 No. of nodes versus Throughput

V. CONCLUSION

In this paper, Ant Colony Optimization using Network Routing Protocol approach for IoT environment is presented. This paper solved the multi-objective optimization problem. Minimized energy consumption is achieved by this approach. ACO network routing algorithm is scalable in time performance for large scale IoT environments and is able to find very close to optimal solution.

REFERENCES

[1] Mohamed Essaid Khanouche, Yacine Amirat, Member, IEEE, Abdelghani Chibani, Moussa Kerkar, and Ali Ya Chir "Energy-Centered and QoS-Aware Services Selection for Internet of Things" IEEE Automobile Science and Engineering., vol. 13, no.3 July 2016

[2] Vijayalaxmi, Dr.Chandrashekhara S.Adiga, Dr.H.G.Joshi and Dr.Harish S.V "Ant Colony Optimization Technique in Network Routing Problem – A Simulation Study" ICIET 2013 Dec 25-26, 2013 Bangkok(Thailand)

[3] Dweepna Garg and Parth Gohil "Ant Colony Optimized Routing for Mobile Adhoc Networks"

[4] D. Giusto, A. Iera, G. Morabito, and L. Atzori, *The Internet of Things:20th Tyrrhenian Workshop on Digital Communications*. New York, NY, USA: Springer Science & Business Media, 2010.