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ENERGY EFFICIENT APPROACH FOR DATA AGGREGATION IN IOT

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Abstract - *With the emergence of Internet of Thing (IoT), a gigantic rise has been seen in smart applications. IoT is going to be ubiquitous in the near future. Billions of sensors will be installed for the implementation of IoT applications which will generate a massive amount of data. Such massive amount of sensors, data and devices would cost huge amount of money. In addition to the installation cost, energy consumption by the IoT devices emerges as a prominent area of concern. Although IoT applications in themselves are considered to be very energy efficient, however their own energy consumption ratio is very high. Energy efficiency of IoT would make it the long term technology in the upcoming years. Due to small size of the sensor nodes, the energy consumption is the major issue of the network. The LEACH is the energy efficient protocol which can divide whole network into fixed size clusters. In each cluster, cluster heads are selected which can transmit data to base station. The cluster heads are selected in network based on the energy of each node and distance from sensor node to base station. The energy of the sensor node is dissipated when each node receive or transmit data to base station. In the proposed approach, the cache nodes are deployed between the cluster head and base station. The cluster heads will transmit the data to nearest gateway node and then gateway send data to the base station. The simulation of the proposed technique is done in NS2 and results are compared with the existing approach in terms of certain parameters. It is analyzed that proposed technique performs well as compared to existing technique.*

***Key Words*: IoT, LEACH, NS2.**

1. INTRODUCTION

The Internet of Things (IoT) is an emerging paradigm that enables the communication between electronic devices and sensors through the internet in order to facilitate our lives. IoT use smart devices and internet to provide innovative solutions to various challenges and issues related to various business, governmental and public/private industries across the world [1]. IoT is progressively becoming an important aspect of our life that can be sensed everywhere around us. In whole, IoT is an innovation that puts together extensive variety of smart systems, frameworks and intelligent devices and sensors.

Energy consumption by IoT devices is one of the challenges related to environmental impact. Energy consumption is increasing at a high rate due to internet enabled services and edge cutting devices. Moreover, it takes advantage of quantum and nanotechnology in terms of storage, sensing and processing speed which were not conceivable beforehand [2]. Extensive research studies have been done and available in terms of scientific articles, press reports both on internet and in the form of printed materials to illustrate the potential effectiveness and applicability of IoT transformations.

The IoT application may range from a simple monitoring application such as gauging the temperature in a building, to a complex application such as providing complete energy automation of a campus. IoT communications may be required offline, where information is exchanged every day or on demand, or online allowing for real-time control. Building control applications can provide efficient use of the energy in a building while insuring comfort to building occupants [3].

IoT stands for internet of things which is termed by the of the Radio Frequency Identification (RFID) development community in 1999. The application of the IoT is widely used in many applications due to large growth of mobile devices, embedded and omnipresent communication, cloud computing and data analytics. Large numbers of devices are connected over public or private Internet Protocol networks with the help of billions of objects can sense, communicate and share information [4]. The data collected by these interconnected devices continuously, after which it is analyzed to perform action in order to provide a wealth of intelligence for planning, management and decision making. Internet of Things in the upcoming years will be widely utilized in almost every application. The IoT applications provide Internet and various advance software and communication services. Here, the objects can be connected to each other or to the things and can access the media present [5].

2. APPLICATIONS

2.1 Smart city, transport and vehicles:

IoT is transforming the traditional civil structure of the society into high tech structure with the concept of smart city, smart home and smart vehicles and transport. Rapid improvements are being done with the help of supporting technologies such as machine learning, natural language processing to understand the need and use of technology at home [58]. Various technologies such as cloud server technology, wireless sensor networks that must be used with IoT servers to provide an efficient smart city. Another important issue is to think about environmental aspect of smart city. Therefore, energy efficient technologies and

Green technologies should also be considered for the design and planning of smart city infrastructure.

2.2 Agriculture and industry automation

The world's growing population is estimated to reach approximate 10 billion by 2050. Agriculture plays an important role in our lives. In order to feed such a massive population, we need to advance the current agriculture approaches. Therefore, there is a need to combine agriculture with technology so that the production can be improved in an efficient way. Greenhouse technology is one of the possible approaches in this direction. It provides a way to control the environmental parameters in order to improve the production. Automation of industries is another advantage of IoT. IoT has been providing game changing solutions for factory digitalization, inventory management, quality control, logistics and supply chain optimization and management.

2.3. Emerging economy, environmental and health-care

IoT is completely devoted to provide emerging public and financial benefits and development to the society and people. This includes a wide range of public facilities i.e. economic development, water quality maintenance, well-being, industrialization. Environmental sustainability is another important concern. IoT developers must be concerned about environmental impact of the IoT systems and devices to overcome the negative impact. Highly efficient IoT devices to monitor several health issues such as diabetes, obesity or depression. Several issues related to environment, energy and healthcare are considered by several studies.

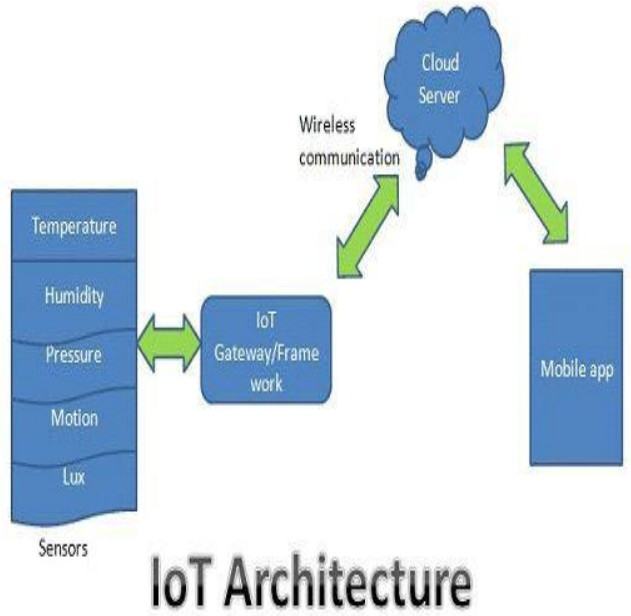

Figure 1: IOT Architecture

3. RESEARCH METHODOLOGY

The IoT network is the self-configuring network in which sensor nodes sense information and pass it to base station. Due to decentralized nature of the network, energy consumption, data aggregation and security are three major issues of the networks. This research work is focused on the energy consumption of the wireless sensor networks. The energy consumption is the major issues of the sensor network due to far deployment and small size of the sensor nodes.

The hierarchal routing protocol is the energy efficient structure free data aggregation protocol which works in the structural manner. The hierarchal routing protocol works in the three phases, in the first phase base station send the hello message to each node in the network.

The node reverts back to base station with their location and other information. In the second phase, whole network is divided into hierarchal structure based on the network density.

In the third phase, the next hop node is selected based on the next node buffer size, residual energy and link strength. In this research work, hierarchal routing protocol will be improved to reduce routing overhead in the network.

The energy consumption issues are raised due to small size of the sensor nodes. The clustering is the efficient approach which increase lifetime of the sensor networks. In the clustering approach, the whole network is divided into fixed size clusters. The cluster heads are selected in each cluster and sensor nodes in each cluster will aggregate data to cluster head. The cluster head will transmit data to the base station.

To increase lifetime of the sensor network, the optimization is proposed in the LEACH protocol. In the proposed approach, the cache nodes are deployed between the cluster head and base station. The cluster heads will transmit the data to nearest gateway node and then gateway send data to the base station. The cache aggregate data from the nearest cluster head. The distance between the gateway node and cluster head is calculated using Euclidian distance formula. The following points of flow chart**:-**

1. The wireless sensor network is deployed with the finite number of sensor nodes and deployed network is divided into fixed size clusters using location based clustering.

2. The cluster head is selected in each clustering using the technique of LEACH protocol in which node which has maximum energy and least distance to the other nodes is selected as the cluster head.

3. The cluster heads aggregate the data to the nearest cache node. The distance between the cluster head and cache node is calculated with Euclidian distance.

4. This step 3 is repeated until required data get aggregated to base station.

4. EXPERIMENTAL RESULTS

The proposed work has been implemented in NS2 and the results have been analyzed against existing technique in terms of packet loss, throughput, and energy consumption.

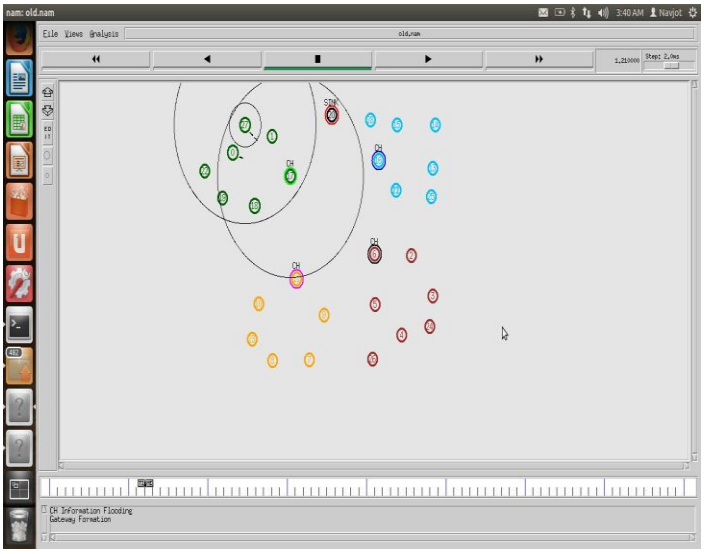

Figure 2: Communication in the network.

As shown in figure 2, when the cluster heads get selected in the network on the basis of distance and energy and cluster heads will aggregate data from sensor nodes. The cluster heads can communicate with each other and information will be received at base station.

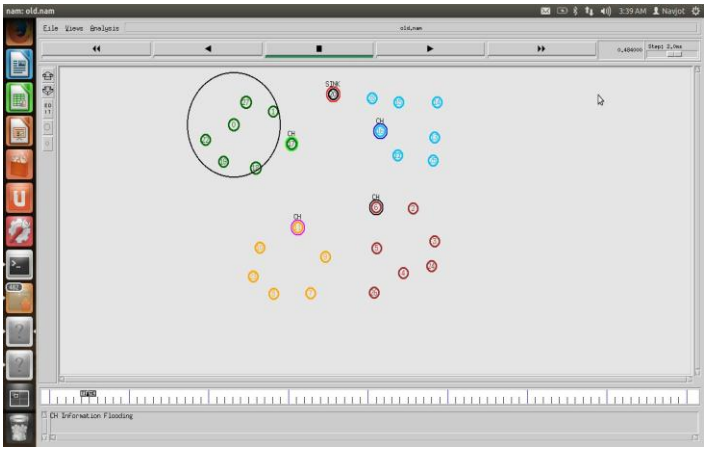

Figure 3: Cluster Head Selection

As shown in figure 3, the network is deployed with the finite number of sensor nodes. The whole network is divided into fixed size clusters and in each cluster, cluster head is selected on the basis of distance.

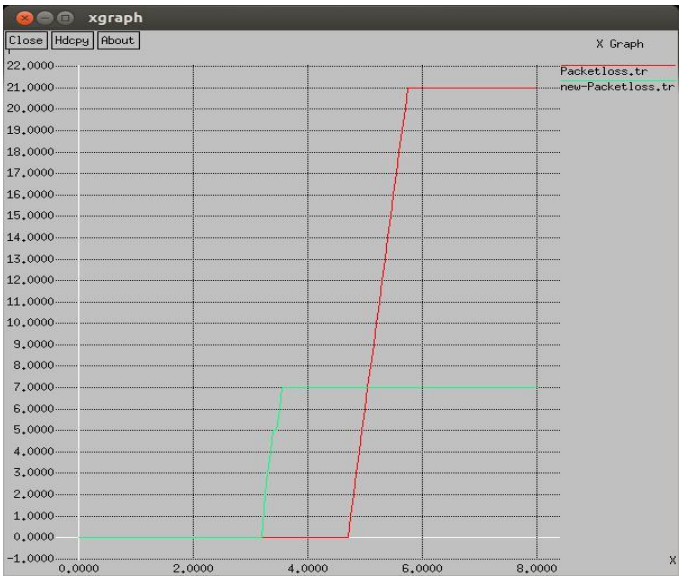

Figure 4: Packet loss Comparison

As shown in figure 4, the packet loss of existing technique in which LEACH protocol is applied will be compared with the proposed technique in which gateways are applied. It has been analyzed Packet loss is reduced as compared to proposed technique.

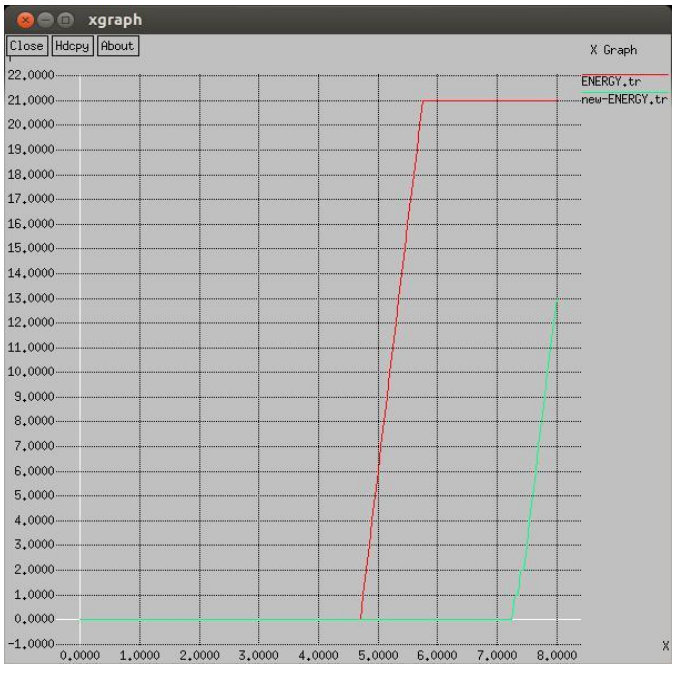

Figure 5: Energy Consumption Graph

As shown in figure 5, the energy consumption of proposed technique is less as compared to existing technique due to the use of gateways in the network.

5. CONCLUSIONS

Recent advancements in IoT have drawn attention of researchers and developers worldwide. IoT developers and researchers are working together to extend the technology on large scale and to benefit the society to the highest possible level. The clustering is the efficent approach which divide whole network into fixed size clusters and cluster heads are selected in each cluster. The cluster heads are selected on the basis of diatence and energy. In the IoT network, IoT gateway is considered as the important component. The sensor node which has minimu diatance and maximum energy is selected as the cluster head. In this research work, the LEACH protocol is improved with the gateway node. The gateway node will aggregate data from the cluster head. The cluster head tramsmit data to base station which is static in nature. The simulation of the proposed and existing technique is done in NS2 and it is analyzed that proposed technique perform well in terms of throughput, packet loss and delay.

REFERENCES

[1]. Dongsik Jo and Gerard Jounghyun Kim, "ARIoT: Scalable Augmented Reality Framework for Interacting with Internet of Things Appliances Everywhere", IEEE Transactions on Consumer Electronics, Vol. 62, Issue. 3, pp. 334-340, August 2016.

[2]. Xinlie Wang, Jianqing Zhang, Eve. M. Schooler, "Performance evaluation of Attribute-Based Encryption: Toward data privacy in the IoT", Communications (ICC), 2014 IEEE International Conference, vol. 19, issue 3, pp. 56-88, 2014.

[3]. J. Gubbi, R. Buyya, S. Marusic, M. Palaniswami, "Internet of things (IoT): A vision, architectural elements, and future directions," Elsevier Future Generation Computer System, Vol. 29, issue 4, pp. 23-66, 2013.

[4]. Mohamed Abomhara and Geir M. Koien, "Security and Privacy in the Internet of Things : Current Status and Open Issues", In Privacy and Security in Mobile Systems (PRISMS), pages 1–8. IEEE, vol. 7, issue 6, pp. 18-3, 2014.

[5]. Ahmad W Atamli and Andrew Martin, "Threat-Based Security Analysis for the Internet of Things", In Secure Internet of Things (SIoT), vol. 4, issue 1, pages 35–43, 2014.

[6]. Luigi Atzori, Antonio Iera, and Giacomo Morabito, "The Internet of Things: A survey", Computer Networks, vol. 8, issue 6, pp. 18-30, 2010.

[7]. Sachin Babar, Parikshit Mahalle, Antonietta Stango, Neeli Prasad, and Ramjee Prasad, "Proposed security model and threat taxonomy for the Internet of Things (IoT)", In International Conference on Network Security & Applications (CNSA), volume 89, pages 420–429. Springer Berlin Heidelberg, vol. 4, issue 1, pp. 25-30, 2010.

[8]. Yogeesh Seralathan, Tae (Tom) Oh , Suyash Jadhav, Jonathan Myers, Jaehoon (Paul) Jeong+, Young Ho Kim and Jeong Neyo Kim, "IoT Security Vulnerability: A Case Study of a Web Camera", International Conference on Advanced Communications Technology(ICACT), IEEE, vol. 13, issue 9, pp. 16-30, 2018.

[9]. Chalee Vorakulpipat, Ekkachan Rattanalerdnusorn, Phithak Thaenkaew, Hoang Dang Hai, "Recent Challenges, Trends, and Concerns Related to IoT Security: An Evolutionary Study", International Conference on Advanced Communications Technology(ICACT), vol. 7, issue 4, pp. 14-33, 2018.