International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 09 | Sep 2019 www.irjet.net p-ISSN: 2395-0072

ENERGY EFFICIENT TECHNIQUE TO REDUCE ENERGY CONSUMPTION IN IOT

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Abstract - *The Internet of Things (IoT) is an innovative paradigm that promises to offer us enhanced consciousness of our environments through the overview of communication, processing, and sensing abilities in everyday objects. All objects, which is now "Smart" manner, it will support to providing an augmented reality involvement and its machine-to-machine interactions with other smart objects with the web services in the Internet Cloud. IoT is a new technology and it allows object to be sensed remotely across existing network infrastructure. IoT enables to connect all the devices in smarter way. The web enabled devices collects, send and act on data in IoT. To make the IoT paradigm a reality, an interoperable, efficient and flexible Internet Protocol is a key requirement. The embedded sensors, communication hardware and processors are obtained from the devices around it. IoT has some disadvantages such as security, economy, development issues, privacy, interoperability, legal, regulatory and rights. IoT routing protocols come across several difficulties akin to bandwidth, delay, jitter, overhead, etc. However the main key issue is energy consumption. The objective of this paper is reduce energy consumption based on packet size. Accordingly this paper proposes to increase the lifetime of nodes in the networks.*

***Key Words*: Internet of Things, Routing, Energy Consumption, WSN, Energy Efficiency**

1. INTRODUCTION

The Internet of things is the network of physical devices, home appliances, automobiles, and other items embedded with sensors, electronics, actuators and software. IoT defines a system where items in the sensors and physical world involved to these items, are linked to the internet via wireless and wired internet connections. The IoT is the interconnected of individual identifiable embedded computing devices within the existing Internet infrastructure. The heart of the embedded system is a RISC family microcontroller like PIC 16F84/Atmel 8051/ Motorola 68HC11 and so on.

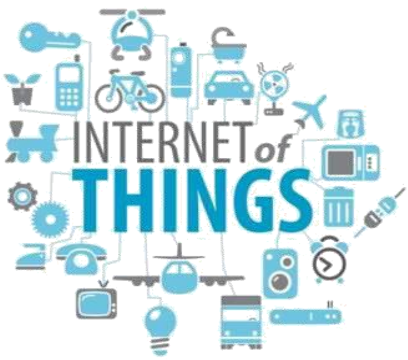


Fig -1: IoT connect smart devices

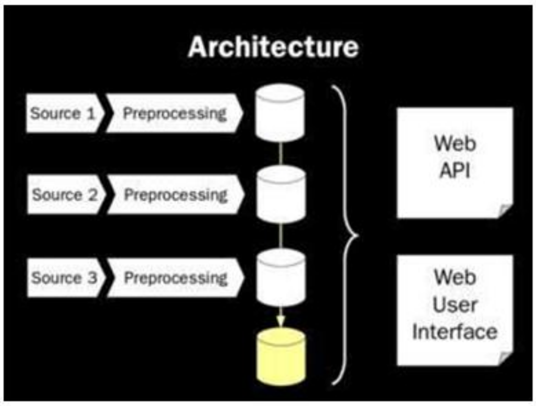


Fig -2: IoT Architecture

1.1 IoT Routing Protocols

Routing is a header that has attracting the research community in last years and extreme works have been devoted to this field. The routing process generally manages forwarding on the basis of routing tables, which preserve a record of the routes to diverse network for places. Routing tables may be almost by an executive, learned by observing network traffic or built with the assistance of routing protocols.

Fig -3: IoT Routing Protocols

Traditional routing protocols for Ad hoc networks may fall into three categories:

- Pro-active Routing Protocol
- Re-active Routing Protocol
- Hybrid Routing Protocol

1.1.1 Pro-active

Pro- active maintain the routing table and it contains table driven routing protocol, and it maintains fresh lists of destinations and their routes the network. The protocol is an optimization of classical link state routing algorithm and uses the basic concept of MultiPoint Relays (MPRs). This protocol is more favorable for traffic patterns where a large subset of nodes is communicating with another large subset of nodes, and where the source and destination pairs are changing over time. Thisprotocol is predominantly suited forlarge and dense networks.

1.1.2 Re-active

Reactive Routing protocol is also called On-demand routing algorithm. It finds a route on demand by flooding and route request packets. If that address is present, then the destination sequence number in the table is compared to the destination in its routing table, and if it cannot reach the destination through that route, it will increment the destination ordering number and sends a route request. Therefore, the destination ordering number indicates the route freshness.

1.1.3 Hybrid

Hybrid protocols combines the benefit of Pro-active and Re-active routing, however it does not maintain a route between all pairs of network node in continuously.

2. LITERATURE REVIEW

IoT has many issues such as Routing, Security, and Quality of Service (QOS). The routing of data from source to destination is a fundamental of component of any large scale network. IoT supports various types of communication such as device to human, device to device, and human to device. Routing in the network made up smart objects has unique characteristics. These characteristics controlled to formation of a new WG known as ROLL, whose aim is to specify a routing protocol for low power and cost networks known as RPL.

The major challenges that can rise in the routing process of IoT: Heterogeneous devices, Intermittent Connectivity, Deployment of nodes, diverse networking, context awareness, Security, and fault tolerance. In the development of any IoT application security and testing frameworks play an important role. It help us to create more secured and attack proof in Internet of Things enabled devices and application. The issues are IoT Security –Data Encryption, IoT Security-Side-channel Attacks, and IoT Security –Data Authentication.

In Quality of Service is the description or measurements of the overall performance of a service. Such as telephony or computer network or cloud computing, several related aspects of the network service such as Packet loss, bit rate, transmission delay, throughput, jitter and availability. QoS has two types: Quantitative issues are bandwidth, delay, overhead, jitter and energy. Qualitative issues are security and reliability.

Table-1: Comparative Analysis of Energy Consumption and Existing Techniques

S.no	Title of Paper	Author Name & Year	Technique Used	Merits	Demerits
1.	A Survey Of Energy Efficient Iot Network In Cloud Environment [1]	Walid K A Hasan1, Johnson Agbinya2, Yacho Ran3, Gui Yun Tian3. 2018.	Cloud to enhance performance	Reduce the Energy and Power Consumption. Enhance the Cloud Environment in IoT.	compatible range for each environment. The environment to duplicate the model
2.	An energy-aware service composition algorithm for multiple cloud-based IoT applications [2]	Thar Bakera, Muhammad Asimb, et al. 2017.	Fewer Services	Reduction in data Interchange. Reduce the Energy Consumption and carbon footprint.	Packet Size
3.	Fuzzy Logic Based Energy Aware Routing Protocol for Internet of Things [3]	S Sankar, P Srinivasan. 2018.	Fuzzy logic	Calculating the quality of parent node among its preferred parent node using fuzzy logic	Fuzzy logic is not accurate and rigorous
4.	Energy Efficient Internet Of Things Based On Wireless Sensor Networks: A Study [4]	Nilofer Saik1, Krishna Patteti2 1Assistant Professor. 2018.	Radio Frequency Identification (RFID)	Green Networking is the research objective of this paper	It also affects some of the fruits grown near the RF tower areas
5.	A LQI-Based Ranging Technique in ZigBee Sensor Networks [5]	T. Yang, Q. Yang, and L. Cheng. International Journal of Sensor Networks. 2015.	Zigbee, wireless sensor networks, distance estimation	The average ranging error is less than 1m, confirming that the proposed technique is able to achieve higher ranging accuracy	Mainly include short range. Low complexity and low data speed.
6.	Energy Efficient Encryption Scheme for Integrating Wireless Sensor Networks with Internet [6]	V.Gayathri1, Y.S. Kumarswamy2. 2019.	3Data Encryption Standard (3DES)	The Energy expenditure for data packet encryption can be further Reduced. Enhance the Quality of Service (QoS) in IoT.	Data packet encryption.

3. OVERVIEW OF ENERGY CONSUMPTION

- IoT while maintaining a low cost and high level of precision simplifies the process of energy monitoring and management.
- Organizations are provided with a strong means of managing their consumption by cost saving and output optimization through the IoT system's depth of analysis and control.

In IoT Energy efficiency is the goal to reduce the amount of energy required to provide products and services. There are many motivations to improve energy efficiency. Reducing energy use reduces energy costs saving to user if the energy savings offset any additional costs of implementing an energy-efficient technology. Energy reducing use is also seen as a solution to the problem of reducing greenhouse gas productions.

Energy efficiency and renewable energy are said to be the twin supports of maintainable energy procedure and are high priorities in the supportable energy hierarchy. Organizing to the International Energy Agency, improved energy efficiency buildings, transportation, and industrial processes could reduce the world's energy needs in 2050 by one third, and help control global emanations of greenhouse gases.

The ultimate aim of the research work is to concentrate on the minimum energy of a scheme that can perform quick, and efficient in IoT. [1], Integrating fewer services can result in a reduction in data interchange, which in return helps in reducing the energy consumption and carbon footprint. [2], Recently, many research works has done on energy aware routing in RPL, which minimizes the node energy consumption, to improve the network lifetime. [3], An Efficient networking plays a crucial role in the IoT to reduce power consumption and operational costs, lessen pollution and emissions and make the most of surveillance and environmental conservation. [4], The calculated distances from LQI data are close to the true values, except for some rare cases where LQI fluctuate severely.[5]

In many countries energy efficiency is also seen to have a national security useful because it should be used to reduce the level of energy imports from foreign countries and may slow down the rate at which local energy source are reduced. Improving energy efficiency and reducing energy demand are widely considered as the most auspicious, cheapest, safest, and wildest means to moderate climate change. The International Energy Agency (IEA) and other are placing increasing primacy on plummeting energy demand, the European Commission has proposed long-term targets for energy demand reduction and countries during the world are introducing a range of policies to deliver those reductions.

4. ETREC

Proposed suggests reduce energy consumption based on packet size, the source node broadcasts RREQ to its neighbor node to forward data packets until it reach the destination. For example the source node S send RREQ to its neighbor node such as A, B and C. likewise all the nodes are send RREQ to its neighbor node based on packet size. After sending RREQ it calculate the node energy, path energy and packet size. Then select the path which has minimum packet size, this path is categorized into three types such as low, medium and maximum. After that set the priority of packets, finally the node will check whether the path is low, minimum and medium based on packet size. If the path packet size is low, the source node forward the data packets. Else if the path is medium, it will store the routing table for certain interval time. Next, if the packet size is maximum, it will drop the RREQ. These process is continue until the data packets are transferred.

Fig shows an example of proposed method that has ten nodes, such as S, A, B, C, E, F, G, H, I and D. Here source node is S and destination node is D. Other nodes are intermediary nodes. The Proposed technique is used to choose the low energy consumption path among the multiple paths.

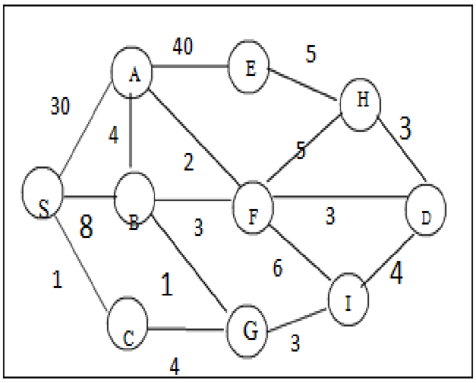


Fig -4: Scenario of PROPOSED Technique

Begin

1. Determine the path from S to D to forward the data packets *If* (node is source) *Then*

Broadcast RREQ to its neighbors

Else (Rebroadcast the RREQ until it reaches the D) ***Then***

similarly find all possible paths between S and D using RREQ and RREP

2. Compute the Nodes Energy (NE), Paths Energy (PE) and Size of Packets among the available paths

3. Classify the size of packets in terms of low, medium, maximum

4. Set path = low (for low packet size) Set path = medium (for medium packet size) and Set path

= high (for maximum packet size)

5. *If*(NE<Size_of_Pkts&&PE<Size_of_Pkts&& priority == Low) ***Then***

{
Forward data packets through low energy consumption path

}
Elseif (NE<Size_of_Pkts&&PE<Size_of_Pkts&& priority =Medium) ***Then***

{
Forward data packets through medium energy consumption path

}
Else if (NE <Size_of_Pkts&&PE<Size_of_Pkts&&priority == Maximum) ***Then***

{
Forward data packets through maximum energy consumption path

}
(NE<Size_of_Pkts&&PE<Size_of_Pkts&&priority==Maximum/Medi um/Low) ***Then***

{
Forward the data packets through maximum energy consumption path }

Endif

Endif

6. Repeat the steps 2-5 until the data packets are transferred

End

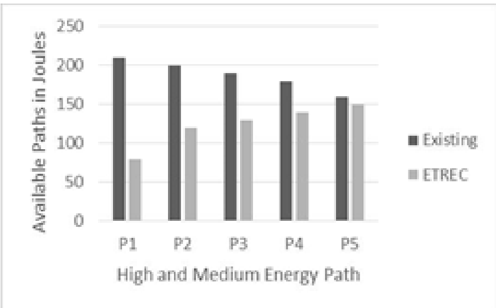
4.1 CALCULATION

The research technique PROPOSED, which is used to reduce energy consumption based on packet size, it has been calculated by the formula given below.

$$\mathbf{Ec(t) = N^{p}t * a + N^{p}r * b}$$

Table -2: Number of Available Paths in PROPOSED

S. No	No. of available paths	Paths in joules
1	S→A→E→H→D	150 J
2	S→A→F→H→D	130 J
3	S→A→B→F→I→D	200 J
4	S→C→G→I→D	120 J
5	S→A→F→I→D	150 J
6	S→B→F→H→D	190 J
7	S→B→F→I→D	210 J
8	S→A→B→F→H→D	180 J
9	S→B→G→I→D	160 J
10	S→B→F→D	140 J
11	S→A→F→D	80J



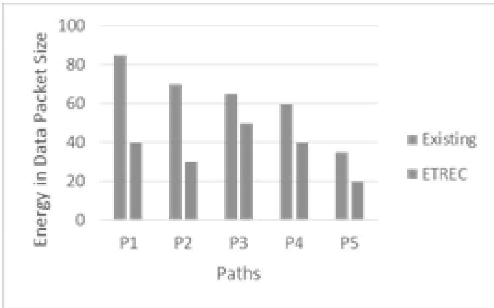
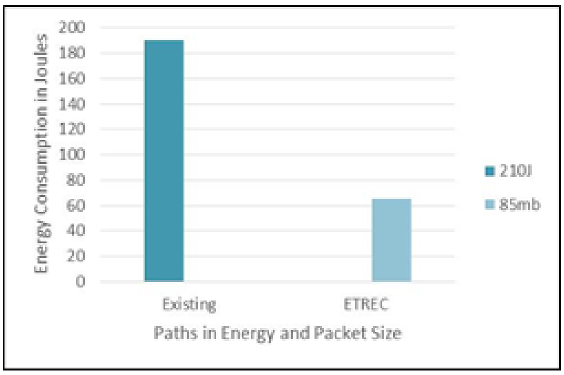


Chart -1: Energy in High and Medium

Chart -2: Energy in Data Packet Size

In existing take the maximum energy path such as 210J and minimum packet size such as 85mb. In proposed technique 1J is equal to 1mb, hence 89J is equal to 89mb, and finally Chart-3 shows that minimum amount of energy for send RREQ to the destination.

In existing take the maximum energy path such as 200J and minimum packet size such as 70mb. In proposed technique 1J is equal to 1mb, hence 69J is equal to 69mb, and finally Chart-4 shows a minimum amount of energy for send RREQ to the destination.



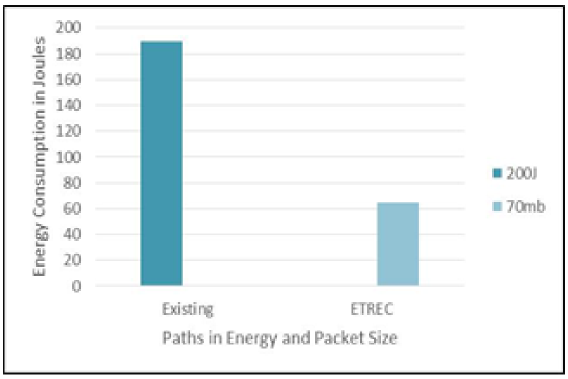


Chart -3: Energy in First High Joules and Packet Size

Chart -4: Energy in Second Maximum Joules and Packet Size

5. SIMULATION RESULTS

The simulation results are carried out in Network Simulator 2.34 (NS-2.34). The scenario consists of 7 mobile nodes as illustrated in Table 4.2. For minimizing the RREQs, PROPOSED routing algorithm is used. The fixation of nodes is defined by the user. In PROPOSED technique has many paths and these paths are compared with packet size, finally it reduce energy consumption. And compared with these results in NS2 tool. User only defines the nodes to compare with NS2 tool and check with their paths in the network.

Table -3: Simulation Parameters for PROPOSED

Parameters	Values
Number of Nodes	7
Area Size	500 x 500
MAC Protocol	802.11
Radio Range	250m
Simulation Time	100ms
Traffic Source	FTP
Packet Size	512 Bytes
Mobility Model	Random Way Point
Speed	2,4,6,8 and 10m/s

A comparison of networks, computed based on the PROPOSED, is shown in figure 4.2. In the first level weights are assigned based on the user or network providers. Here seven number of modes are used such as 0, 1, 2, 3, 4, 5, and 6 and we used MAC Protocol such as 802.11. Then all the nodes are compared with packet size for reduce the energy consumption and finally this simulation results gives better result.

6. CONCLUSION

This chapter concludes the thesis and proposes future aspects for research, based on the ideas and the theoretical analysis which was done in order to validate and proof of the proposed concepts. This thesis resolved the Energy issues in IoT and proposes PROPOSED based on Packet Size.

6.1 FUTURE RESEARCH DIRECTION

As the future research work, Time can be reduced during the path comparison, it could be more efficient to improve PROPOSED techniques. The cost is taken to consideration and can be reduced for efficiency. As an enhancement in the future work it can concentrate more on security and authenticity.

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