

## Energy Efficiency in Internet of Things

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### Abstract

The term Internet of Things is integrated of various technologies like wireless technology, sensor technology , and network technology and many more, by which globally connected real- time application can be developed through various objects like sensor, devices ,etc . where connection take place between devices is known as machine-to-machine (M-M). IoT having very complex nature and plays its vital role in many areas like medical era, industrial field, to make everything smart as smart city, as smart environment and so on . In IOT as the involvement of human decrease , less energy consumed by direct connection among devices. This paper introduce detailed and comparison study on various energy efficient method proposed by different author .

**Keywords -energy efficiency, Internet of Things(IoT) , M2M(Machine-to-Machine).**

### 1. Introduction

With the incessant developments in technology, Technologies help humans to provide better and safer environments for healing, to take care of aging and sick people, and to avoid accident and injury. Fourth, most people desire companionship. Email, internet phones and social networks connect people. Finally, people want to feel special or be respected. Personalized services and products have become very popular. Many of the above human desires can be further fulfilled by emerging M2M and related technologies.[1] For the same example given earlier, imagine that you were to give a speech in another city and you got stuck on the highway. With the improvement in M2M technology, your calendar an your car can communicate. [2]If you are expected to be late, your smart phone will send a message to your audience automatically telling them approximately how much time they have to wait. Or even better, the calendar planner can look up the traffic condition in advance and suggests what time you should leave.

Sensors can monitor the traffic conditions along the routes to your destination so that you are able to select the best route to get to the venue on time. There are many similar examples. The nexus of human needs and emerging computing and sensor technologies is bringing about a new digital revolution .

The size of the device goes decrease with varying large functionalities. The devices become sleek , easily portable and lightweight day-by-day. Mobility devices are frequently used in today's era with the wireless technology. As the integration of various technologies like sensor technology, network technology, etc plays vital role in real life applications where many devices are interconnected with each other globally to provide the specific information at right place. The technology where devices are connected directly to another devices without involvement of human is called Machine-to-Machine (M2M) technology.[3] It is another name of Internet of Things (IoT). Hence the reduction of human participation will stimulates the energy

efficiency operation. As the result of less consumption of energy will provide less energy bills in various automation like domestic automation, business automation and many more. To reduce the consumption of energy, better opportunities are required to understand. In this paper, studying the various energy efficiency solution provided by various method using different technologies. IoT contributed to control global energy problem and plays vigorous role for smart grid, as it managed the resources efficiently to reduce the consumption.

The initial idea of IOT was proposed by MIT Auto-ID Labs [4], which originated from the requirement of logistics. ITU Internet Reports indicated the heading towards a "ubiquitous network society", one in which networks and networked devices are omnipresent. In the future, everything from tires to toothbrushes will be in communication range, heralding the dawn of a new era, one in which today's Internet (of data and people) gives way to tomorrow's Internet of Things.

## 2. Related work

Qi, proposed the novel RRC protocol which used in the LTE network for MTC devices, where a process used to get the new RRC protocol and improve the optimization of the parameter like latency, delay etc to reduce the energy consumption. [5].

Zhou proposed multi-query aggregation technique where EnerGy-eEfficiency index tree (EGF tree) formed having hierarchal structure where the grid divide into sub-regions for simultaneous operation and then merge for final result to get the efficient energy. [6]

Qiu used GEAR protocol to attain improved distribution of energy and conservation effects as by measure the received packet rate and node failure. here energy remain balance by decompose into sub-regions and data transfer through multiple path simultaneously by which energy will save and will consumed by nodes and increase its life. [7]

ZHU measured the bit error and packet delay to reduce the noise and interference during the transmission of the packet. various schemes like DDT, CSS used to get the energy efficient based upon the OR-rule and AND-rule to compute the bit in the receiving or sending the data packet. [8]

## 3. Factor Affecting Energy Consumption in IOT:

In this section, some parameters which affect the energy:[9]-[10]

- 1 Coverage area: the region which cover the range of a node to do some activity like transferring or forwarding the required detailed in the network, a device having larger range will transfer easily with less consumption of energy.
- 2 Scalable: as the devices are more scalable will consume less energy while enhance their network with more number of nodes, as no need to re-build the structure.
- 3 Fault Tolerance: - WSNs are inherently prone to failure due to for example lack of power, physical damage or environmental interference. Despite of the numerous amounts of sensor nodes in some applications, the failure of certain number of sensor nodes can greatly reduce and affect the performance of the whole network. For example, packets needed to be routed through longer path; a whole network is divided into two parts. Thus, routing protocols should take into consideration some fault tolerance mechanism in case of unexpected failure. For example, giving more priority to routing path with more remaining energy or quickly detecting the failure of certain nodes to recommended alternatives routing paths.
- 4 Energy Consumption without losing accuracy: - Energy consumption is a big concern in WSNs due to sensor nodes limited supply of energy. Thus the routing protocols are requiring maximizing the energy-conserving form of communications and computations to prolong the battery lifetime. However these types of communications and computations still provide needed accuracy of routing protocols. The second aspect of energy concern in WSNs is to maintain the accuracy of routing protocols in presence of low power sensor nodes. As sensor nodes can act as senders, receivers or routers. A malfunctioning of some sensor nodes due to power failures can cause topology changes or miscommunication or miscalculation in constructing routing paths. Thus routing protocol should be aware of and prepare to handle this possible problem.

## 4. Comparison and Analysis

In this section, the comparative analysis of different energy-efficient methods is done, with the tool used in their perspective work, and the parameters based on which their experiment work take place with their brief explanation of respective method shown below in tabular form:[5]-[8]

TITLE	DESCRIPTION	PARAMETER USED	TOOL
Semi-Persistent RRC Protocol for Machine-Type Communication Devices in LTE Networks	Reduce the energy consumption and signaling overhead by using Semi-persistent RRC state transition (SPRS T)	delay tolerance, overhead ratio, latency.	stand alone simulation.
EGF-tree: an energy-efficient index tree for facilitating multi-region query aggregation in the internet of things	Grid divide into sub-regions then , sub result merge to form final output tree (divide and conquer theory ) to get the energy efficiency.	Weight,energy, path, skewness,overlap degree	matlab
An Efficient Multi-Path Self-Organizing Strategy in Internet of Things	By using GEAR protocol , fault tolerance will increase, probability of failure node will reduce and also reduce the energy consumption hence network's lifetime will increase	Simulation time, packet loss, rate node number, residual energy	Ns2 simulation
ERDT: Energy-Efficient Reliable Decision Transmission for Intelligent Cooperative Spectrum Sensing in Industrial IoT	Measure the bit error and packet loss to reduce the data discrimination during the transmission.	Packet loss, bit error , energy consumption, probability	Detailed simulation

## 5. Conclusion

Main enabling factor of this promising paradigm is the integration of several technologies and communications solutions. Identification and tracking technologies, wired and wireless sensor and actuator networks, enhanced communication protocols (shared with the Next Generation Internet), and distributed intelligence for smart objects are just the most relevant. As one can easily imagine, any serious contribution to the advance of the Internet of Things must necessarily be the result of synergetic activities conducted in different fields of knowledge, such as telecommunications, informatics, electronics and social science. And by using various resources efficiently, can reduce the energy consumption . Hence cost can be decrease and life can be increases.

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