International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 03
March 2019

Study on G-IoT for Sustainable World

B.Gnana Prasuna1,M.Sowmya1, P.Prashanti1
B.Gnana Prasuna1,Assistant Professor,Depart Of CSE, SCETW
M.Sowmya ,Assistant Professor,Depart Of CSE, SCETW
P.Prasanthi,Assistant Professor, Depart Of CSE SCETW

Abstract: *Smart world is envisioned as an era in which objects (e.g., watches, mobile phones, computers, cars, buses, electronic gadgets, news papers and trains) can automatically and intelligently serve people in a collaborative manner. Internet of Things (IoT) connects everything in the smart world thus the energy consumption is a challenging task in IoT. This paper provides insight of G-IoT. It also discusses about the various technologies such as green design, green production, green utilization and issues regarding green IoT, which further reduces the energy consumption of IoT. Finally future research directions and challenges in G-IoT are presented.*

Keywords

Internet of Things, Green IoT

1. Introduction

The "Internet of Things" Comprises things that have unique identities and are connected to the internet. The scope if IoT is not is not just limited to just connecting things to internet but allows the communication between the things.

.

IoT radically alters the position of the "Internet" by sweeping up every physical object into the mesh. The vision of the Internet of Things promises to enhance the capabilities of objects and forms a smart environment so that people will benefit from the Internet of Things revolution. As the global population grows, the resources on earth are consumed rapidly. In order to have a sustainable earth, governments around the world put a lot of efforts to advocate the reduction of carbon production and to tackle with global warming. Here Green Internet of Things comes into the delineation.

Green Internet of Things basically focuses on the energy efficiency in the IoT principles. G-IoT is defined as the approach to enhance energy efficient ways in IoT either to reduce the green house effect caused by exiting applications or to eradicate the same in IoT itself. In the first case IoT helps in eliminating the green house effect but in the second scenario, the IoT will be further optimized to stop the green house effect. Within the few years we will be besieged by a massive amount of sensing elements, devices and "things", which will be capable to communicate via IP, act "intelligently", and provide green support for users in handling their projects. These new small objects will also be context-aware and to perform certain functions autonomously, calling for new forms of green communication between people and things and between things themselves, where power consumption is optimized and bandwidth utilization is maximized. With this technology, we can Enhance performance and wellbeing, reduce cost and consumption of energy and to engage more effectively and relatively with its citizens.

With the service of G-Internet of Things we can make

1. Energy efficient and less cost model networks.
2. Rising consumer interest in environment friendly goods and services.
3. Reduced greenhouse effect on earth.
4. Higher expectations of the public on enterprises environmental responsibilities.

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 03
March 2019

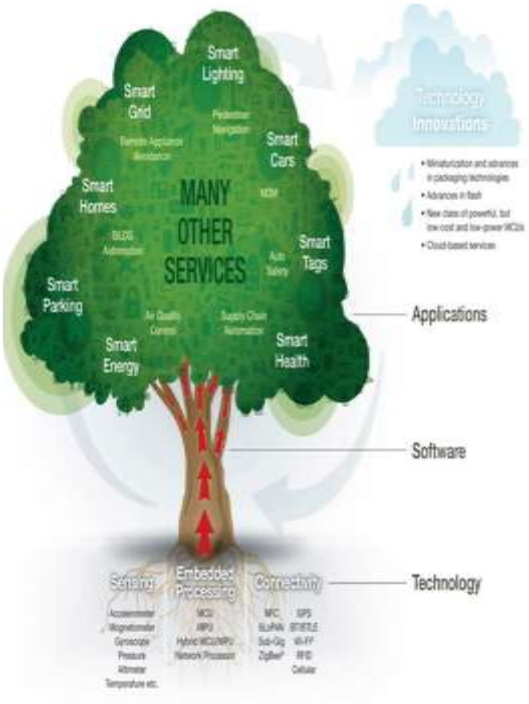

Figure2: Green IoT [11]

2. Observations and Discussions

The authors [1] specially shed light on the Green IoT and its Information and Communication Technologies (ICT). Discussed the applications where we can adopt this Green IoT like Smart Home Automation by making it more convenient and easier to monitor and operate home appliances and systems (e.g., microwave oven, air conditioner, heating systems, etc.) remotely. Industrial Automation to perform the manufacturing task with minimal human involvement. Smart Healthcare to monitor and track the patient health conditions with the help of wearable sensors. Smart Grid to enhance the power consumption by making resources connected to the network and monitoring the usage of electricity and potential failures in systems. Smart City to improve quality of life by using urban informatics and technology to improve the efficiency of services and meet resident's needs by the various interconnected systems to offer the desirable services (e.g., transportation, utilities, health, etc.) to people. Well enlightened the Green ICTs like Green RFID, Green M2M, Green CC, Green WSN, Green Dc and general principle of Green ICT.

The authors [2] have proposed three solutions for power saving issues.

1. They introduced a new sleep sate in idle mode to remove unnecessary activities of low mobility M2M devices. Sleep state in Access Stratum is used to avoid unnecessary AS measurement and filtering activities for serving cell and cell re-selection. A sleep state in Non Access Stratum is used to avoid unnecessary periodic NAS activities, i.e. LAU/RAU procedure for UMTS system and TAU procedure for LTE system.
2. A Three layer paging mechanism is introduced to properly identify the group id of M2M devices and get rid of the false alarm probability.
3. By triggering paging in AS from M2M devices, instant reports can be generated to reduce the power consumption of M2M Devices as well as system resource is thus saved for uplink data transmission required by the network.

The authors [3] suggested that the energy efficiency can be increased by wisely adjusting transmission power (to the minimal necessary level), carefully applying algorithmic and distributed computing techniques to design efficient communication protocols (e.g., routing protocols) and by introducing sleep mode at device side and activity scheduling algorithm to sense the coverage. The Reliability in sensing can be achieved by applying Local vote Decision Fusion algorithm and spatial redundancy technique to improve reliability in Transition. To improve the reliability at Base Stations authors has taken the primary and secondary servers to handle the traffic. Security is achieved by a) early detecting the compromised node by keeping monitoring nodes. b) To handle the false report generation Bandwidth Efficient Cooperative Authentication (BECAN).

The authors [4] addressed the Technical side issues like non interoperability of the heterogeneous technologies currently used in city and urban development's. The solutions currently available for the implementation of urban IoTs are analyzed.
1. Structural Health of Buildings: Proper maintenance of the historical buildings of a city requires the continuous monitoring of the actual conditions of each building and identification of the areas that are most subject to the impact of external agents.
2. Waste Management: Waste management is a primary issue in many modern cities, due to both the

cost of the service and the problem of the storage of garbage in landfills.
3. Traffic Congestion: Traffic monitoring may be realized by using the sensing capabilities and GPS installed on modern vehicles, and also adopting a combination of air quality and acoustic sensors along a given road.

This researcher [5] has deployed a Green campus for efficient usage of labs. The objects of the work include the computers and air conditioners. RFIDs and the ZigBee device with temperature module are used to build up the wireless sensor network. The contributions delivered by this research include: 1) the computer labs can be managed efficiently. More labs will be open only when the demand is increasing. 2) The use of the computers will be monitored at all times. This mechanism decreases the number of idle power-on computers. 3) The air conditioners will be turned on only when the temperatures reach a preset level. As a result, more energy will be saved.

The Authors [6] has done a critic review of IoT and its applications. The main motivation of the authors is to find the need of G-ioT, challenges and benefits of IoT. They also reviewed the life cycle of G-IoT and technologies required to achieve G-IoT. The task of IoT in 5G and smart cities also presented. At the last future scope and challenges of IoT given.

- IoT architecture for better and energy efficient system are
- Green applications which reduce the effect on environment
- Context- aware energy efficient systems
- Devices and protocols which consume less power
- Less rigid infrastructure
- Usage of Energy efficient like solar, wind energy mechanisms
- Encryption and cont discussed.

This paper [7] has done a comparative study on Energy saving methods. Mainly focused on the Base Station Energy consumption as the energy consumed by the BS is more Compared to the sensor node in the network. They have given a tabular summarization of various mechanisms adopted and what inference the authors achieved has shown.

This paper [8], proposed a three layered architecture for IoT with clear responsibilities of each layer making the whole IoT architecture energy efficient. The first layer is Sensing and control layer contain three main components .sensor nodes (SNs) are for gathering the data, energy-saving gateway nodes (eGNs) are for storing the gathered data from SN and also calculate the sleep time intervals of SN based upon the remaining battery level, their previous history and quality of information required for a particular application. The predicted value can be used to boost the utilization of cloud resources by reprovisioning the allocated resources when the corresponding sensor node is in sleep mode. This mechanism improves the efficient energy utilization of resources of IoT and an energy-efficient base station which controls the all the eGN nodes. The second layer is information processing layer this process and analyses the stored data to extract interpretable information. The third layer is Presentation or Application layer provides services and interfaces to users.

The authors[9] has proved that LTE-RACH process is not energy efficient for dense IoT deployment by showing that due to insufficient transmit power eNB cannot distinguish between failures due to collision losses and the unreachability to the eNB. To overcome this authors has proposed a modified power ramping algorithm and Delayed Power Ramping Algorithm for ramping the transmit power in case of RACH process failure.

This paper [10] presents a Mixed Integer Linear Programming model integrated clod computing platform for energy efficient IoT networks. This model consists of four layers. The first layer consists of Iot objects. The second layer consists of relay nodes which aggregates the data gathered from IoT objects. The third layer consists coordinator nodes which aggregates the relay traffic from second layer. Finally the fourth layer consists of gateways which aggregate the coordinated data from third layer. Each element in the upper three layers are capable of hosting virtual machines that could process the traffic aggregated at the element and extract a particular form of knowledge depending on the VM type. Which reduces the traffic at cloud which leads less power consumption?

This paper [11] demonstrates the G-IoT, its services to the society and its potential to transform and bring abundant advantages in diverse sectors. The usage of G-IoT promises sustainable usage of natural recourses in agriculture, forestry, fisheries and aquaculture sectors. On the other hand the sector which consumes the largest amounts of energy such as industries, buildings will befit more by this G-IoT. The authors have done a great work in exploring the appliance of G-IoT in transport, tourism, waste management. And they have exposed the need for green technologies for our safer and better living.

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 03
March 2019

This paper [12] proposes a system model to resolve the Energy efficient challenges of IoT. They proposed a layered system model which involves Physical devices in the lower level for gathering the data. In the next level Embedded web server which host the RESTful web service to communicate with the cloud server for virtualization of objects. This web server bridge the gap between physical devices and virtual objects and schedule the physical and sensor devises. And the last is cloud server which provides the user interface to the IoT through the application server. The main contribution in achieving energy efficiency is devising an algorithm to scheduling the life cycle of different sensors and appliances. The proposed algorithm has three core states of nodes as On-Duty state the nodes (either relay or sink node) will be performing full-fledged capability. Next is Pre-Off state which will be activated after the On-Duty state and this bidirectional can switch state to both On-Duty and Off-duty. During Pre-off state a device can only receive and transmit the only necessary commands from sink node. And the last state is Off-duty state holds three states to save energy like a) Hibernate b) sleep c) Power off. By this it can ensure that less power consumptions with well defined stages.

The summary of the Observations:

S. No	Author	Title	Architecture proposed	Algorithm used
1	Chunsheng zhu,Victor C.M.Leung,Lei Shu, and Edith C	Power saving for Machine to Machine communication in cellular networks[2].	Three layer Paging mechanism.	Sleep state is introduced in AS & NAS.
2	Rongxing Lu, Xu Li, Xiaohui Liang, and Xuemin Shen	GRS: The Green Reliability, and Security of emerging Machine to Machine Communication [3].	Three layered network architecture (M2M Domain, Network domain, Application domain)	Low power operation mode is introduced for energy efficiency and for reliability two servers used and for security: early compromise node detection ,BECAN are used .
3	Hisng-I Wang	Toward a Green Campus with Internet of Things-The Application of Lab Management [5].	Three layered network architecture (User application, data application, sensor node layer).	
4	Navroop Kaur and Sandeep K.Sood	An Energy-Efficient Architecture for the Internet of Things (IoT) [8].	Three layered network architecture (SCL, IPL, AL).	Sleep interval calculation is introduced.
5	Samar Shailendra, Aniruddh Rao K, Bighnaraj Panigrahi, Hemanth Kumar Rath, Anantha Simha	Power Efficient RACH mechanism for Dense IoT Deployment[9]		DPRA (Delayed Powdered Ramping)
6	Zaineb T.Al-Azez, Ahmed Q. Lawey, Taisir E.H. El-Gorashi, Jaaf M.H.Elmirghani	Virtualization framework for Energy Efficiency IoTNetworks [10]	Four layered architecture (IoT objects, Relay, coordinator , gateway nodes)	Mixed Integer Linear Programming in Cloud is introduced.
7	Sarder Fakhrul	A System model for	Three layered	Algorithm to

	Abedin; Md.Golam Rabiul, Rim Haw, Choong Seon Hong	energy efficient green-IoT network	architecture (Physical devices, Embedded web server, Cloud server)	schedule the duty life cycle of nodes

3. Conclusion

This study provides the detailed information on IoT and Green IoT. The need for Green IoT, ways of design and deployment of energy efficient architecture and the implementation technique ideas of energy efficient communication algorithms.

4. References

[1]. Chunsheng zhu, Victor C.M.Leung, Lei Shu, and Edith C, "Green Internet of Things for Smart World",IEEE Access, 2015.

[2]. Hua Chao, Yu Chen, Jinsong Wu, "Power saving for Machine to Machine communication in cellular networks", 2011 IEEE GLOBECOM Workshop.

[3]. Rongxing Lu, Xu Li, Xiaohui Liang, and Xuemin Shen, "GRS: The Green Reliability, and Security of emerging Machine to Machine Communication", IEEE Communication Magazine, April 2011.

[4]. Andrea Zanella, Nicola Bui, Angelo Castellani, Lorenzo Vangelista, Michele Zorzi, "Internet of Things for Smart Cities", IEEE Internet of Things Journal(Volume: 1,Issue: 1,Feb.2014).

[5]. Hisng-I Wang "Toward a Green Campus with Internet of Things- The Application of Lab Management", Procedings of the world congress on Engineering 2013 vol II, July 3-5, 2013, London, UK.

[6]. Mohamoud A.M.Albreem, Ayman A. El-Saleh, Wael Salah, M.Jusoh, M.M Azizan and A Ali, "Green Internet of Things(IoT): An Overview", Proc. Of 4th IEEE International Conference on Smart Instrumentation, Measurement and Applications (ICSIIMA)28-30 November 2017,Purajaya,Malaysia.

[7]. J.Premalatha, U.Anitha, V.Manonmani and P.Ganesan, "Survey on Enegy saving Methods for Green Communication network", Indian Journal of Science and Technology, Vol8(19),DOI:10.17,August 2015.

[8]. Navroop Kaur and Sandeep K.Sood, "An Energy-Efficient Architecture for the Internet of Things(IoT)", IEEE SYSTEMS JOURNAL,1932-8134,2015.

[9]. Samar Shailendra, Aniruddh Rao K, Bighnaraj Panigrahi, Hemanth Kumar Rath, Anantha Simha," Power Efficient RACH mechanism for Dense IoT Deployment",978-1-5090-1525-2/2017 IEEE.

[10]. Zaineb T.Al-Azez, Ahmed Q. Lawey, Taisir E.H. El-Gorashi, Jaaf M.H.Elmirghani, "Virtualization framework for Energy Efficiency IoTNetworks", Procedings of 2015 IEEE 4th International Conference on Cloud Networking. Pp.74-77.

[11]. Maksimovic M., "Greening the Future: Green Internet of Things(G-IoT) as a Key Technological Enabler of Sustainable Development.", Internet of Things and Big Data Analytics Toward Next-Generation Intelligence. Studies in Big Data,vol 30.Springer, Cham.

[12]. Sarder Fakhrul Abedin; Md.Golam Rabiul, Rim Haw, Choong Seon Hong, " A System model for energy efficient green-IoT network", 2015, International Conference on Information Networking(ICOIN),12-14 Jan,IEEE