

# A REVIEW OF FOG CLOUD ENVIRONMENT

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**Abstract**— Green IoT system tasked with enabling greener society, internet of things connects everything in smart words, it is more sustainable society through reduction of energy consumption. It is also discuss the life cycle of the green IoT, which contain Green design ,Green production, Green utilization, and Green recycling. Furthermore green IoT technologies are green tags, Green sensing networks, and green internet technologies are discuss. In additional studies of green IoT is 5G and IoT for smart cities are presented and also smart words and also in healthcare and agriculture application. It use two technologies (cloud computing and internet of things ) combination in agriculture and healthcare system. Green IoT is not harmful to internet of things helps integrating and connecting the physical device to the internet with out any environment it is environmentally friendly for that friendly environment we have to achieve to reduce carbon footprint.

**Keywords:** Green wireless networks, Green cloud computing ,Green RFID, Internet of things, Green internet of things ,Green data, Green machine 2 machine, Green communication networks, Pollution ,Hazardous emissions green IoT, 5G, Smart cities, Energy efficiency.

## INTRODUCTION

During the past thousands of years, the energy decay levels have achieve upsetting rates due to large scale of digital connection, number of devices. Experts believes that the fifth generation (5G) of wireless communication (5G) will be available in 2020, and it will be able to handle about 1000 times more mobile data than today's cellular system [3].

As shown in the following figure. 1, fifth generation (5G) network can contain five effective technologies. (D2D) Device-to-Device communication improve the reliability of communication between the users by latency trimming. the role of spectrum sharing (SS) is to keep away low spectrum implementation efficiency and the role of internet of things is to context billions of users in less time. In addition ,Ultra dense networks intricate dense small cell ranging ,in areas where huge traffic. Except that the massive MIMO bears hundreds of antennas and cantaining a high data rate. Computing a 5G networks to eliminate the (CO<sub>2</sub>) emissions these five efficient technologies should allow minimization of energy.

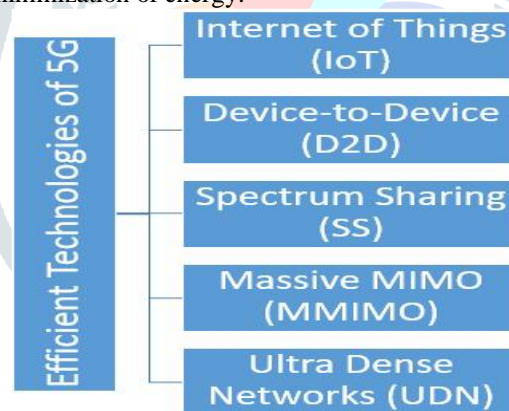


Fig1. Efficient technologies of 5G

In the smart cities, by using internet of things (IoT) object can smartly communicate with people. After noticing

pollution through IoT and natural resource it will make smart cities a greener place. In order to keep the confirmable of the green place in smart cities, the emerging technologies, i.e. green internet of things spontaneously and smartly makes smart cities confirmable in collective manner. Governments and internet of things of corporation around the world are performing a lot of work to contrast the important of energy utilization and carbon product manufacture as well as highlight on the green IoT of cities. furthermore internet of things related smart cities construction are already present in literature. But this type of work contain the concepts of the “green IoT” to produce a green environment which will understand the plan of energy saving in the smart cities. The field agriculture and healthcare applications are current hot discussions topic is about the application of the two trending and popular technologies, is cloud computing (CC) and Internet of things. Agriculture and healthcare field motivated by achieve a conformable world it discuss the various technologies and matter concerning green cloud computing and green internet of things, further improves the discussion with the reduction in energy consumption of the two techniques (CC and IoT) combination in agriculture and health care system. History and the concept of the hot green information and communications technologies (ICT's) which are enabling green IoT will be discussed [1].

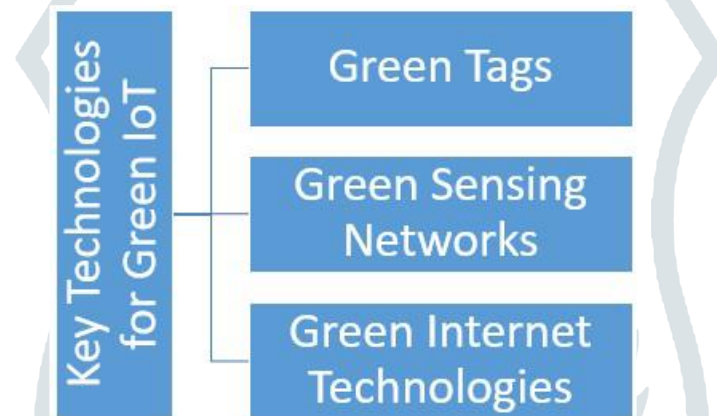
The two emerging technologies in both agriculture and healthcare cases green computing first and later focus on the resent effort done. Furthermore, by using sensor- cloud integration model presenting the green IoT agriculture and healthcare application(GAHA). Finally, list out the advantages, challenges, and further research directions related to green application design.

## LITERATURE REVIEW

Term “Internet of things” was firstly proposed by Kevin Ashton in presentation in 1998 [4]. Where he mentioned that “The internet of things has potential to change the world, just as the Internet did. may be even more so.” In 2001, the MIT Auto-ID centre introduced their IoT vision [5]. In 2005, the IoT term was formally used by the International Telecommunication Union (ITU) [6]. Last decade, internet of things (IoT) has been considered as one of the charming technologies. It allows people and things to be connected anywhere, anytime with anyone and anything, using any links and any service. It offers a platform for sensors and devices to be connected seamlessly within the smart environment in order to provide advanced and intelligent services for human beings. Mark D. Weiser, the father of ubiquitous computing, started it as “it represents a powerful shift in computation, where people live, work, and play in seamlessly interweaving computing environment. Ubiquitous computing postulates a world where people are surrounded by computing devices and a computing infrastructure that supports us in every thing we do [17].

## WORKING OF GREEN IOT TECHNOLOGY

Regarding green IoT, various green technologies should be added such as green RFID tags (radio frequency identification), green sensing network and green cloud computing network. Figure 2 shows the key technologies to reach a green IoT system. Radio frequency identification is a form of wireless communication that incorporates the use of electromagnetic or electrostatic coupling in a radio frequency portion of the electromagnetic spectrum to uniquely identify an object, animal or person. RFID is a small electronic device that includes various RFID tags and a very small tags readers. RFID tags can store information concerning the objects to which they are linked. In general, the sending range of an RFID system is few meters. There are two types of RFID tags: active tags and passive tags. Active tags have batteries to constantly send their own signal, while passive tags do not have their own battery. Rather than a battery, the passive tags require to harvest energy from the reader signal. To reach the aim of green RFID, various research works have been done. As shown in tables.



**Fig 2. Key Technologies for Green IoT**

One of the proposed solutions is to minimize the size of the RFID tags and, thus, reduce the amount of non-degradable material. Also, printable RFID tags are suggested. In addition, various rules are suggested to reach an energy-efficient RFID tag. In addition, a green wireless sensor network (WSN) is a further key technology to authorize green IoT. A wireless sensor network (WSN) contains a huge number of sensor nodes with restricted power and storage capacity. To require a green wireless sensor network, various techniques should be considered.

## GREEN IOT

A beautiful information graphic can contain smart cities and also contain internet of things implementation suggested by Libellium world as shown in figure 3. The Libellium smart world comprising air pollution, forest fire detection, wine quality enhancing, off-spring care, sportsmen care, structural health, smartphones detection, perimeter access control, radiation levels, electromagnetic levels, traffic congestion, smart roads, smart lighting, intelligent shopping, noise urban maps. The internet of things is an ecosystem; it is not only a network to transfer data but also linked with big data and cloud computing to contain intelligence. The information is captured by smart objects; it is able to recognize the behaviour and explain actions without human requiring human-to-human or human-to-computer communication.

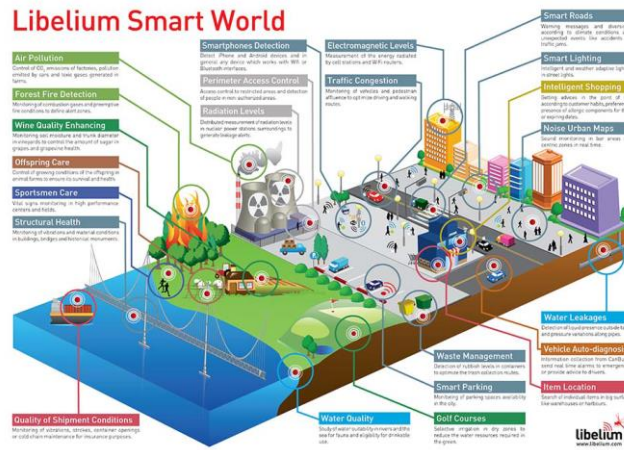


Fig3.Application of IoT: Libelium smart world [7]

Figure.4 represent the life cycle of green internet of things. which takes into consider green production, green design, green utilization. Fig. 4 presents the life cycle of green IoT which takes and finally green disposal and recycling to have minimal or no impact on the environment[8]

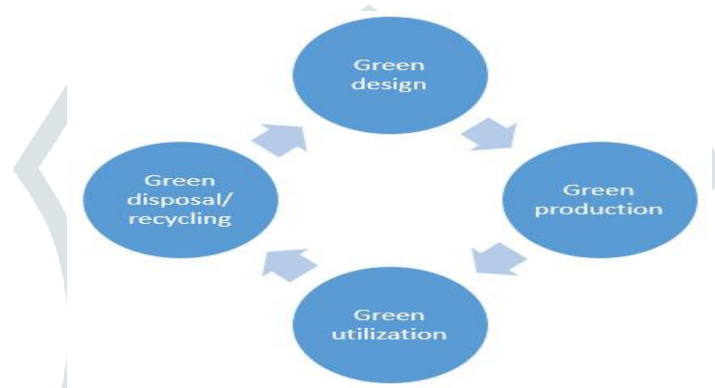


Fig4.Life cycle of Green IoT

Green computing, Green (ICT) information and communication technology as per (IFG) International federation of Green ICT and IFG standard ,green IT, or ICT sustansiability , is the study and practice of environmentally sustainable computing or IT.ICT is an extensional term for information technology(IT)that stresses the role of unified communication and the integration of telecommunications and computers as well as nessessary enterprice software, middleware, storage, and manipulate information. Also , list out the following four complementary paths along to comprehensively and effectively addressed for green computing road:[2]

- 1.Green Use: Reducing the other information and energy consumption of computers as well as using them in an environmentally sound manner.
- 2.Green Disposal: Reconditioning and present old computers and recycling old computers and recycling undesirable computers and other electronic device.
- 3.Green Design : Designing energy efficient and environmentally sound components, computers and servers and culling equipment's.
4. Green manufacturing: producing electronic components, computers, and other associated sub systems with minimal impact or no impact or on the environment.

Green computing width a number of focus areas and activities, as a part of design for environmental confirmable energy-efficient computing, power management ,data center design, arrangement and position ,server virtual, accountable disposal and recycling , regulatory compliance, green metrics, assessment tools, and methodology, environment related danger mitigation ,use of renewable energy source and eco-labelling of it products

**ADVANTAGES OF GREEN IOT**

Till here, we had our set focus on discussing ubiquitous computing, requirements required truly ubiquitous implementation and green computing based on the order to relate them to GAHA. this section we discuss the basic concept of ICT permits green IoT technologies components related to GAHA and also present architecture of GAHA using sensor-cloud integration concept.

**\* GAHA Architecture**

any web connected third party device, sensor, or sensor network through a simple open data API. Sensor-cloud computing is envisioned as one of the permit technologies for agriculture and healthcare monitoring system. Sensor-cloud is new model for cloud computing it use a physical sensor to gather and communicate all sensor data into cloud computing

infrastructure. It also controls sensor data efficiency, which is use for many monitoring application. First we will see sensor-cloud definition as below, according to intelligence[16], “an infrastructure that allows truly pervasive computation using sensors as an interface between physical and cyber worlds, the data compute clusters as the cyber backbone and the internet as the communication medium “ [17] According to microstation sensor-cloud definition “it is a unique sensor data storage, visualization and remote management platform that level range [sic] powerful cloud computing technologies to provide excellent data scalability, rapid visualization, and user programmable analysis. It is originally designed to support long-term deployments of micro strain wireless sensors, sensor-cloud now supports any web connected third party device, sensor, or sensor network through a simple open data API.

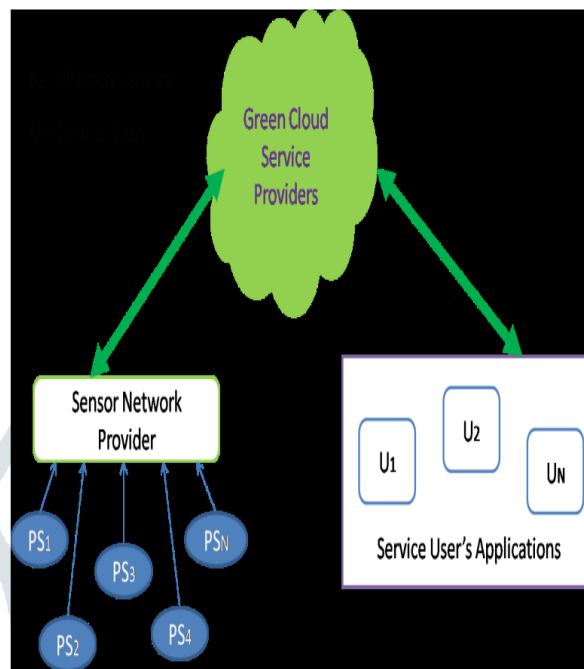


Fig5. Green IoT Agriculture and Healthcare Applications (GAHA) Architect

IV.APPLICATION OF GREEN IOT:

In green internet technology hardware and software should be taken into considered where hardware solution improve device that does not decay energy without a reduction of the performance.

On the other hand, the software solutions offer efficient designs that consume less energy by minimum utilization of the resources. In addition, power saving virtual machine techniques should be implemented. As shown in Fig. 7, with respect to green IoT technology, there are a lot of applications and services. It consists smart cities, smart energy and smart grid systems, smart infrastructure, smart factory, smart medical systems and smart logistics

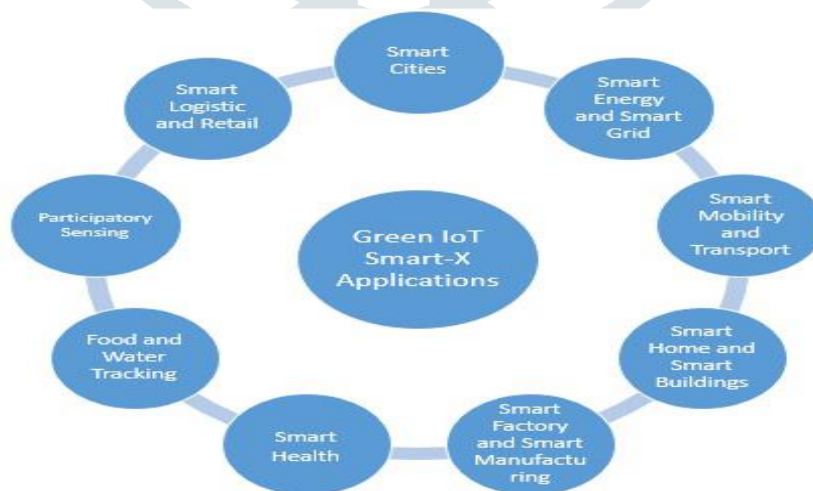


Fig 7.Green IoT Application

Conclusion

In this paper , the green IoT technology had been discussed .the paper motivation behind the green IoT,challenges and benefits ,application of green IoT,It also reviewed the green IoT life cycle as well as contain technologies to achive green IoT system. The role of IoT in 5G and smart cities is also presented.The further more reserchndirection and challenges are also reviewed

and In this paper, we had discussed about ubiquitous computing ,requirements of truly ubiquitous implementation and green computing.

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