Green IoT : A Literature Review

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ABSTRACT

Green IoT is a new revolutionary technology that has gained popularity in recent years. Internet of Things (IoT) establishes connection between everything in the current world, and thus, energy consumption of IoT devices is a challenging. There are different parts such as power consumption, communications etc. ofIoT devices, where energy conservation is needed to enable a sustainable green IoT environment. This paper will provide an insightful review of Green IoT technology, definitions, key enablers, and its various applications.

Keywords: Internet of Things, IoT, G-IoT, Green IoT, Energy efficient IoT.

1. INTRODUCTION

The "Internet of Things" technology is the fastest growing technology and its gaining popularity. IoT consists of two main elements viz. the internet and things. Internet could be based on wire or wireless communication. Things are mainly objects, like- sensors, those can sense environment [1]. With the readily available internet connections, numbers of internet connected devices are increasing. As number of IoT devices increasing, it needs more energy or resources for its operations. Thus use of energy saving IoT devices is highly demandable. Here Green technology term came into existence. Green technology is also known as clean technology. Examples of green technology include renewable energy systems, like wind, solar etc. They also include smart grids, smart cities, and agriculture. Consumer applications like EV, smart homes etc., are also include in green technology. Green technology is also known for money saving for consumers, as it can optimize energy consumptions.

2. DEFINITION

Green IoT can be defined as follows. "A energy efficient hardware or software procedure abopted by IoT devices to reduce greenhouse effect of any existing technology or to reduce greenhouse effect of IoT technology itself". Green IoT whole life cycle include green designing, green production, green utilization and green disposal or green recycling only [2].

3. G-IoT KEY ENABLERS

Green IoT is not a single technology; it is a group of several existing intelligent technologies. Some of the important Green IoT key enablers are discussed here, those enabled Green IoT technology to come into existence.
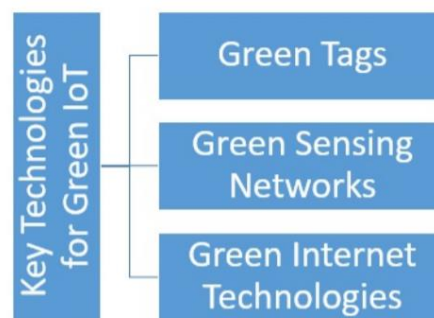
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Fig 1.1 Key technologies or Green IoT [3]

3.1 IP (Internet protocol) –This network protocol was developed in the 1970s. A first remarkable version of IP was IPv4, but as day by day networked devices like sensors, CCTV, smartphones, etc. are increasing, availability of unique IP addresses for each device reduced drastically. To overcome this problem, IPv6 was introduced, which can provide 2^{128} unique addresses. In IIoT technology, every sensor or devices can be assigned a unique IP address, based on the requirement. With the help of these addresses, devices or sensors can communicate to the central server. Communication between sensors and central server could be based on wired or wireless technology.

3.2 Wi-Fi –It is a networking technology that allows high-speed wireless communication between networking devices and can penetrate walls. This technology was invented by Vic Hayes. It is based on IEEE 802.11 standards which came into existence in 1997. It normally uses two bands 2.4 and 5 GHz [4] and generally accepted as a high-speed default connectivity option for IIoT devices. There are many versions of 802.11 launched each with greater speed and range than to its precursor. It is more vulnerable for attack than any wired network.

3.3 Green RFID – Green RFID or green Radio-frequency identification is a wireless method to identify any object with an RFID tag. This system has mainly three components viz. antenna, transponder, and transceiver. Transponder with antenna is known as RFID tag, while the transceiver is a reader, which sends signals to the transponder to activate it. Once activated, the RFID tag can communicate with the RFID receiver. Mainly two types of RFID tags are available active tags and passive tags. Active tags have their own power source while passive doesn't. Active tags are bigger than passive tags due to the battery source. A most general example of RFID tags can be found in shopping malls, where these can be found attached to clothes, grocery items, etc.

3.4 Green cloud computing –Cloud computing provides on-demand computing to users as a service. It can provide platforms, infrastructure, and software as a service [5]. Since sensors have a lack of memory and processing power, cloud computing is used to analyze data, which is received from large numbers of sensors. Cloud computing also supports artificial intelligence for decision making, thus it can reduce human intervention. Cloud computing has many advantages like scalability, faster decision making, faster implementation, easy and global access with proper security.

3.5 AI (Artificial intelligence) –AI is intelligence similar to human or animals, which can be shown by machines. AI can work with different kind of sensors to optimize resources; it can predict situations and can alert users before they occur so the user can take actions to avoid that kind of situation. Health monitors can

detect sugar level, heartbeat, blood pressure, etc. and by using AI, these systems can alert a person before any unwanted situation occurs. Same can be applied in industries for predictive maintenance of equipment. This technology also used in speed recognition, problem-solving, planning, etc.

4. G-IoT APPLICATIONS

4.1 Industries – Industries are a major consumer IoT technology. This technology can sense environment, can monitor various parameters like temperature, levels, pollution, machine faults etc.Sensors can sense environment and controllers can control the flow of any line. Robotics technology can be used where frequent and repetitive task needs to be complete.

4.2 Home automation–Smart homes are homes with smart technology like auto lightening, auto heating, appliances monitoring, surveillance, motion sensors, alarms, access control, etc. Smart homes generally use AI to implement smart technologies. These homes can change the home environment based on the owner's mood.

4.3 Healthcare –Healthcare related IoT devices can tracks and monitors patients and medical equipment[6]. These devices can track user activity include footsteps, hearth beat, exercise record, calorie burn etc. These devices can range from fitness band to pacemaker. Some of smart devices can be implanted in the body for better monitoring of body organs.

4.4 Environment monitoring –IoT devices related to environment monitoring can sense environment for measuring air pollution, weather condition etc. This technology can be used to predicate mansoon, wind direction, temperature, rain etc.IoT devices can monitor pH, nutrients, and fertilizer content of the soil.

4.5 Transportation – IoT technology uses are being expanding in the transportation and logistics. RFID tags amd sensors are being used to trace real time location of vehicles or products. A DNS architecture [7] is developed to increase uses of IoT in supply chain management.

4.6 Smart Cities– A city with interconnected physical infrastructures, ICT infrastructure, social infrastructures and business infrastructures is known as smart city [8]. A city can be smart through a large distribution of IoT devices. Generally smart cities includes everything from smart street light to smart homes.

5. CONCLUSION

G-IoT technology is still in its growing phase and will get popular in every sector in near future. Day by day sensors are becoming smarter and cheaper, this will allow them to be used in every situation.Though this technology is in demand, still it faces some challenges including security, compatibility, privacy, etc.those needs to be rectified. This paper tries to give some insight into this technology including definitions, enablers, and applications after reviewing various research papers and online database.

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