

An Information Framework for Creating a Green Society Through IoT

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Abstract : The revolutions of “IoT” fuel innovations in every area of human life. The Internet of Things holds big promises for sustainable environment, especially in “Proactive Green Society”. In order to reduce the negative impact of technology on human life and eco-system, it is need arise to deals with challenges. To fulfill the promises, major issues must need to be overcome, particularly regarding privacy and security. This paper explored and investigate the importance of green automation processes in supportable growth and his roles in the applications and progress of people.

Keywords: G-IoT, Green Society, Sustainable development, Applications

I. INTRODUCTION

IoT can be defines as a future where every day things are connected by the Internet. IoT has the capabilities to make our life smarter. IoT coverage is very wide and includes everyday things connected together via internet, with special addresses to allow those interacting with connected network [1]. Once the things connected together, they enable more smart processes and services that support our everyday needs, health, environments etc. These connected things provides us many kinds of services and produce huge amount of data and information.

The main contribution of this paper is to fulfill a smart and sustainable world with focus on G-IoT. Green IoT aims to sustainable smart world by decreasing the energy consumption. For example, electric bulb, AC and heaters etc. can be connected to internet network and can be controlled for optimizing the environment inside the building with minimum power consumption. This progress is opening up huge opportunities for both the individual and economy. However, it also involves risks and undoubtedly represents an immense technical and social challenge [2, 3]. The proposed framework can serve as a foundation for future development and various applications using green IoT.

II. IoT and Greening Technology

Definition of ITU: “A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies” [4-10]. The initial idea of “IoT” is that thing around us could be connected, sense and communicate with each other over to the Internet. Basic objective of IoT are to *identify, sense, communicate, compute, service* and *semantic*. Role of *Identification* to naming and matching services on demand. *Senser* can collect data from objects and sending it to a database, data warehouse and data center etc. The collected information is further analyzed to perform required services. *Communication technologies* connect things together to offer specific services and *computation*, the hardware units and software programs perform this task.

To enable a “sustainable smart world”, the IoT should be characterized by power efficiency. Particularly, since all objects in the smart world are need to be equipped with sensor and communication devices. All these make green IoT which focuses on reducing the energy consumption of IoT a necessity, in terms of fulfilling the “smart world with sustainability”. This will help to reduce the greenhouse effect. The goals of G-IoT is to Reduce (fuels, wastage of clean water), Recycle (batteries, plastic), Refuse (not to use plastic bags), Renew (wind/water/solar power, waste water) and Responsibility (not to waste food, water, electricity). The complete cycle of G-IoT should focus on green design, production, utilization and recycling to have no or very small impact on the environment [5, 7]. The G-IoT impact on sustainable development will depends on government, individual and Industry have to work together [5, 7].

The term G-IoT is established on same devices and architecture as used in IoT, but with ecological and energy saving production to minimize energy usage and gas-pollutions. Therefore, the G-IoT is empowered by “RFID, WSN, cellular networks, M2M, energy harvesting devices and communications, cognitive radio, Edge/Fog/Cloud computing and Big data analysis”. The success of green technology enabled demands mainly depends on security and privacy issues. Therefore, ensured privacy, security and consumer trust are the keys to realizing the full potential of the G-IoT applications [11]. To satisfy the G-IoT goal for energy effectiveness, sensor meeting point should work only when is necessary, use radio optimization techniques and energy-efficient routing techniques, as well as use miniature high-capacity energy storage technologies. Energy can also be saved through Edge/Fog/Cloud computing, namely power-saving virtual machine techniques and diverse mechanism for energy-efficient resource allocation. Alternative computing and virtualization are one of the most effective instruments for more cost-effective, greener computing. By sharing storage capacity with other smaller devices, some purely mobile, are everything that is needed to deal with voluminous data sets. Another goal, decreasing waste and contamination and the utilization of non-renewable materials, implies the significance of material’s and devices recycling and reuse [11].

Besides the creation of numerous benefits for consumers, Green technology is expected to provide important improvements in diverse areas and global economic growth as well [11]. Therefore, the recent significant public and private investments are seen in renewable energy and energy efficient technologies, as well as in other environmental sectors, based on

consumption of environmentally friendly goods and services and waste management and recycling [11]. Hence, the green economy need the co-operation of all working functions in order to achieve positive gain and long-term gift to the environment. Even G-IoT attracts significant interest and it is taken for granted that it will be an important issue for several years to come, the advancements and effects of G-IoT will not depend only on financial resources [11]. Its success and substantial impact on sustainable development will depend on take-up by individuals, businesses and governments, together with legal and institutional frameworks [11]. The security concern is the biggest challenge in G-IoT. The most important challenges relevant to G-IoT are data privacy, data security, technical concerns and security attacks and system vulnerabilities etc. Hence, we have to decrease the possible attacks on G-IoT.

III. G-IOT APPLICATION

Utilization of the G-IOT concept, by designing concept have potential to transform following key sectors to green economy [12]: smart lightings, agriculture, water, fisheries, industry, energy, buildings, transport, tourism and waste.

Smart lighting: Lighting solutions have come a long way, with latest technologies taking centre stage. With options in lighting colours, office employees can set the ambience as per their needs. This helps them become comfortable in their workplace, which, in turn, motivates them to perform better. After long hours of work, if they feel like relaxing, they can dim the lights accordingly. This is called human centric lighting. Sensor based lighting and dimmers can reduce electricity wastage by up to 25%. Similar applications along washrooms and less-used corridors are also possible. Smart lights have been modernized with wireless lighting solutions with reduce installation and maintenance costs. Philips Lighting has developed InterAct Series dashboard of small lighting. This dashboard delivers insights on real-time energy usage and various consumption pattern. This can help to reduce electricity expenses.

Agriculture: Nevertheless, agriculture remains fundamental to economic development and environmental sustainability [12]. Applying the concept of G-IoT can bring significant improvements in a whole agriculture sector and the food supply chain through automation of production, cultivation factors and inputs, precision farming, logistics, traceability, remote monitoring, decision making and forecasts, etc. Technologies like sensor-based, satellite remote sensing, geographical information systems, advanced data analytics and smart information platforms significantly contribute to more productive, sustainable and precise agriculture practices. Access to high-speed Internet and affordable smart devices are prerequisites for making agriculture smart and sustainable (monitoring of plant/crop, soil, climate and insect-disease-weed, livestock feed levels, precision and remotely controlled, automatic irrigation and precision fertilization etc.) [13].

Water: Technologies such as satellite imaging, geographic mapping and sensor web based technologies have a huge potential to be applied in the water management sector. Real-time collected and analyzed data about current conditions enable individuals, businesses and water companies to predict, perform preventing actions and other intelligently made decisions in sustainable water resource management [14]. The proper water management is essential in safeguarding freshwater ecosystems and provides social and economic development. G-IoT vision has potential to significantly contribute to water savings, especially in agriculture, energy, building and industry sectors as well as in ICTs sector [13].

Fishries: G-IoT having potential to secure and re-establish natural ecosystems, by using surveillance, remote monitoring, sensing and anticipation actions makes it the significant tool to improve this sector [15]. In other words, G-IoT together with the large-scale, distributed, low-power, low-cost WSN for aquaculture and fishery has the potential to realize the remote dynamic monitoring and controlling of water quality [13].

Industry: It is forecasted that by 2030, the 4th industrial revolution, namely the IIoT, will transform traditional factories into self-organizing, self-maintaining and flexible factories. G-IoT is very helpful to monitor, manage, optimize and coordinate both creation and use of goods and services. Smart and green manufacturing improves production and quality while minimizes costs, energy and natural resource use along reduced environmental impact. It is predicted that by 2030, smart manufacturing solutions will create 4.2 billion MW energy saved and save 81 billion liters of water, accompanied with reduced 12.08 Gt CO₂ equivalents and significant economic benefits (11.9 billion USD per year in operating cost-savings) [13, 16].

Energy: ICTs are an important enabler in creating a resilient, reliable and secure global energy system. With the help of ICTs, energy efficiency in grids and speeding the energy sector decarbonization can be improved. Smart grids utilization leads to a better balance between energy demand and supply. It is forecasted that smart grids in the future will be composed of micro-grid networks, connected to each other via the Cloud and be able to monitor, run or disconnect themselves and heal, based on the data collected with smart metering devices [17]. G-IoT components together with Cloud-based automated energy management system will improve energy efficiency and consequently reduce carbon footprint [13].

Buildings: Green building is the practice of improving the complete building life cycle, from design, construction and operation to maintenance and removal. Usage of renewable energy, heating by the sun, conserving water, utilization of local/natural resources and recycling materials are examples how people can contribute to green building. Therefore, G-IoT and future technology approach in Internet communication, smart devices and appliances will make buildings smarter and more efficient in term of energy and resource usage make them more sustainable and environmentally friendly [13].

Transport: Through the IoT, any product or vehicle can be connected to another (e.g. Internet of Vehicle) creating a system that enables safe and efficient transport of products by reducing congestion, emissions and resource consumption. Monitoring traffic jams, optimizing the flow of goods and route planning with the help of G-IoT, are just examples how it is possible to minimize transport systems negative influence on the climate and the environment as well as to reduce their dependence on fossil fuels and energy imports [11, 13, 16].

Tourism: The usage of G-IoT can significantly contribute in making tourism smart and sustainable, bringing the huge benefits to its stakeholders as well as the tourists [11]. In order to achieve full potential G-IoT can offer in the smart tourism sector, there are certain implications which need to be addressed. The main concern is the privacy and security of customer's data. An additional concern is a deep system dependence on technology and network services what implies the requirement for trained and knowledgeable staff so that the whole business model can be revolutionized [18]. Green and sustainable tourism can be managed only by using recyclable/renewable technologies, protecting the environment, respecting local cultures, involving businesses staffs and tourists in sustainable practices, reducing energy usage and pollution and conserving cultural and natural assets [19]. G-IoT will evidently play a significant role in achieving economic and environmental benefits in the tourism sector [13].

Waste: Companies around the world are installing IIoT systems in order to more efficiently manage waste. Cloud-based solutions collect data from wireless sensors that measure the container filling level and other multiple sensors and information sources (e.g., GPS—Global Positioning System, smart devices, RFID tags) that provide streams on garbage truck location and traffic congestion and transmit all captured information so that waste management companies can obtain the data they need to analyze, predict and optimize the important services they offer (e.g. optimize garbage truck routes and bin collection times) [20-21]. Evidently, upgrading IoT solutions to G-IoT will lead to much more improved, sustainable and cost-efficient waste management and benefits to many parties, directly and indirectly involved in trash disposal [13].

CONCLUSION

As an inspiring and latest guidance for research concerning smart and green world, this paper has discussed various technologies and issues with respect to green IoT, which plays a significant role in achieving a sustainable smart world and green economy. With proper implementation, G-IoT can be an effective tool to increase greener satisfaction of people as well as business revenue.

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