Internet of Nano Things-The Next Big Thing

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Abstract:
The growing and constantly emerging technology trends has increased the use of devices day by day and hence the efforts have been made to connect every devices with each other through internet which is being called as Internet of Things. Precisely, Iot is inter-networking of physical devices, buildings and other items. A basic definition of Nanotechnology is the study and manu–facture of extremely minute machines or devices ranging from 1 to 100 nanometres. Nanotechnology has provided efficient solutions to various applications in biomedical, industrial, agricultural military applications. Nanosensors are any biological, chemical, or surgical sensory points used to convey information about nanoparticles to the macroscopic world. The interconnection of nano devices and nanosensors with Internet has led to development of next generation standard based on IoT called "Internet of Nano Things" (IoNT). The main objective behind this paper is to give an in-depth view of Internet of Nano Things (IoNT) , its architecture, advantages ,challenges , application areas to help enhance the researches and look out the prospects about how we can overcome the challenges and make the use of Internet of NanoThings in diverse areas.

Keywords: Internet of Things (IoT), NanoTechnology ,Internet of Nano Things (IoNT), Nanosensors, Nano-machines, Sensors, Body Sensor Networks, Nano Communication, Wireless Networks.

I.INTRODUCTION

The number of connected devices is expected to increase at a rapid pace in the coming years. To enable interaction among these devices, communication is required between real world physical elements; adopting the Internet of Nano things (IoNT) will facilitate communication over Internet for these devices. The Internet of Things (IoT) [1, 2] is regarded as new revolution that is picking up huge popularity in the world of modern wireless telecommunications. Internet of Things represents a general concept for the ability of network devices to sense and collect data from the world around us, and then share that data across the Internet where it can be processed and utilized for various interesting purposes. Nanotechnology is enabling the development of devices in a scale ranging from one to a few hundred nanometers. A nanomachine is defined as the most basic functional unit, integrated by nano-components and able to perform simple tasks such as sensing or actuation. Coordination and information sharing among several nanomachines will expand the potential applications of individual devices both in terms of complexity and range of operation [3, 4].Things such as smartphones , tablets , RFID (Radio Frequency Identification) , NFC (Near Field Communication) , sensors , actuators , etc play a vital role in interacting and communicating with each other to do desired tasks.IOT concept was proposed by Ashton [5] in 1999.Rapid development and intense research is going under the process in fields such as e-health, e-industry, e-agriculture , smart cities , etc by using the wireless communications .IoT has started making a significant changes in everyone's life by connecting their devices which they use in day to day life such as washing machines , tv's , watches , etc . It has tons of data which has to be processed and stored through virtual storages such as Cloud computing which helps in storing, analyzing, monitoring and communicating the data among various devices. A new technology named as Internet of Everything has emerged by combining various domains such as Wireless Body Area Networks (WBAN) and Internet of NanoThings (IoNT) . Internet of Nano-Things (IoNT) will comprise of miniature sensors connected to each other via Nano networks to obtain data from objects. So, in turn Internet of Nano things will open new doors of research in the area of Nano Sensors, Nano communication and Nano Devices. The concept of Internet of Nano Things (IoNT) was proposed by Ian Akyildiz and Josep Jornet [6] in the paper "The Internet of Nano-Things". He presented major research challenges in terms of channel modelling, information encoding and protocols for nano networks and proposed Internet of Nano-Things (IoNT).

II.OVERVIEW

According to the various researches going on it has been envised that there are two main alternatives for communication in the nanoscale, namely, molecular communication and nano-electromagnetic communication. Molecular communication is defined as the transmission and reception of information encoded in molecules [7,8] In it , Sender Nano machines encode information into information molecules (e.g. DNA, proteins, peptides).Information can be transmitted within a DNA component. Ability to create communication systems and networks using biological components and processes that are found in nature. Routing at micro gateway in molecular Nano networks is query based. Nano-electromagnetic communication is defined as the transmission and reception of electromagnetic (EM) radiation from components based on novel nanomaterials [9, 10]. The unique properties observed in these materials will decide on the specific bandwidth for emission of electromagnetic radiation, the time lag of the emission, or the magnitude of the emitted power for a given input energy.

III.NANO-MACHINE ARCHITECTURE

Nano-machine include at least one segments coordinated with each other in fluctuated levels of many sided quality and run from straightforward scaling down machine to top of the line and advanced nano-mechanical technology. The following are the components which make up a Nano-Machine:

Control Unit: Control unit works as the heart and focal sensory system for nano-machine and does the assignment for executing every one of the guidelines to play out the wanted errand. Control unit likewise controls all other parts of nano-machine and furthermore go about as capacity unit for sparing every one of the information from nano-machine to be utilized by clients.

Communication Unit: This unit does the errand of sending and accepting of data at nano-level.

Reproduction Unit: Reproduction unit performs creation of every segment of nano-machine utilizing outside components and amass them adequately to make up the nano-machine.

Control Unit: It does the assignment of controlling all the parts of nano-machine. It gathers vitality from different outside sources like temperature, light and so forth for next errand of utilization and dispersion.

IV.GLOBAL MARKET

According to the current statistical surveying reports by experts, IoNT market is required to develop from $4.26 billion in 2016 to $9.69 billion by 2020, at an expected Compound Annual Development Rate (CAGR) of 22.81% from 2016 to 2020. A portion of the significant players in the IoNT market are Intel Enterprise, Cisco Systems Inc., Qualcomm Incorporated, Juniper Networks and IBM Corporation in U.S., Schneider Electric and Alcatel-Lucent S.A. in France, and SAP S.E. what's more, Siemens AG in Germany among others.

V.NETWORK ARCHITECTURE

Internet of Nano Things (IoNT) is picking up the pace in rapid areas. Regardless of the application areas, the following components are the trump part of Architecture of Internet of Nano Things:
1. Nano-Nodes: Nano-nodes are regarded as the smallest and simplest nano machines which perform various tasks like computation and transmission if the data over short distances and have less memory. Considering Body Sensor Networks, Biological sensors fitted in Human Body are considered as Nano-Nodes.
2. Nano-Routers: Nano-routers have large computational power as compared to nano nodes and they act as aggregators of information coming from nano-nodes. Nano-routers also play crucial role in controlling nano-nodes by exchange control commands.
3. Nano-Micro interface gadgets: These gadgets perform the undertaking of accumulation of data originating from nano-switches and transmit it to the microscale and bad habit versa. They go about as cross breed gadgets to convey in nanoscale utilizing Nano correspondence systems and likewise with conventional correspondence systems with established system conventions.
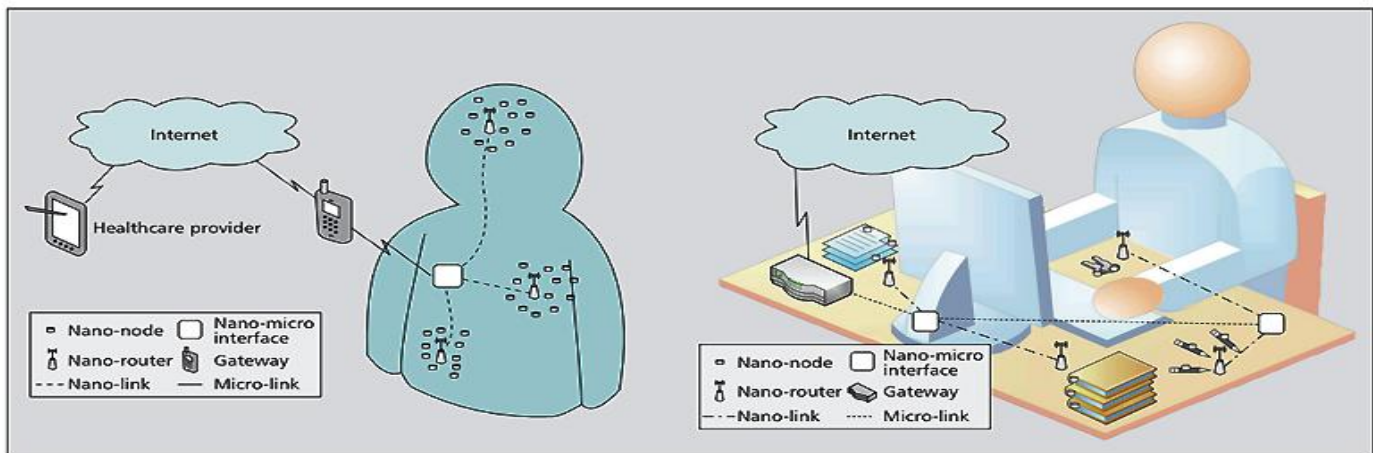4. Gateway: It enables the remote control of entire nano things network over the Internet.

Figure 1. *Network architecture for the Internet of Nano-Things: a) Intrabody nanonetworks for healthcare applications; b) The interconnected office.*

VI.APPLICATIONS

The most refined and propelled techniques are utilized by IoNT for information accumulation, which empowers IoNT to broaden its base from existing applications to extensive variety of new and propelled applications when contrasted with IoT. In the Figure 1. Regular Architecture and Common Components making up Internet of Nano Things (IoNT) is highlighted. Medicinal services Monitoring/Nano-Sensor Based Body Sensor.
Network [11, 12]: The First and the premier application where IoNT can be seen nowadays in certifiable is Body Sensor Network (BSN) containing in-body nano sensors assuming a critical part in gathering and observing patient's organic movement and different points of interest. Nano sensors being utilized in BSN gives ongoing information on a wearable gadget being utilized by the specialist for getting convenient data with respect to patient's wellbeing Enviormental Monitoring: With the utilization of nano sensors in Environmental observing by means of sending out in the open areas like Railway Stations, Bus Stops, Airports, Hotels what's more, Restaurants and other Public spots, live and constant checking of Traffic, Air Pollution, Temperature Checking is accomplished all the more productively. Exactness Agriculture [13]: The utilization of IoNT in farming will prompt improvement of a few accuracy cultivating applications and with the live execution of Nano-Sensors based Nano gadgets will prompt effective condition checking, trim development and even creature checking. With the improvement of Wireless Nano Sensor Organize (WNSN) different farming exercises can be performed like Grass Monitoring, Animal Health and Feed Administration, Agriculture Field Condition Monitoring and Compelling checking of utilization of Pesticides and Insecticides in the Agriculture field. Other Possible Applications in Real World: Considering IoNT points of interest, sooner rather than later IoNT can likewise be connected by Military for Battlefield Monitoring, Development

of Nano-Robotics and Nano-Drones, Space Based Applications, Industry Production and some more.

VII. CHALLENGES OF INTERNET OF NANO-THINGS

IoNT is viewed as the most scaled down nano sensor systems having the capacity to be thusly adoptable in constant applications in differing fields. However, despite the fact that of having huge amounts of cutting edge focal points, IoNT additionally endures with a few issues and difficulties which should be tended to so that IoNT can end up plainly key some portion of humankind in close future with no hiccup. Specialists must address the issues in regards to setting administration, security and protection, benefit organization and disclosure. Aside from taking a shot at looking into on different application ranges and improvement of Nanotechnology based IoNT gadgets, new security and protection instruments should be tended to with respect to the information being gathered by nano sensors. Administrations ought to likewise be upgraded and new benefit situated designs should be proposed to make nano sensors and nano systems perfect to hold huge amounts of extensive assortments of information.

VIII. CONCLUSIONS AND FUTURE SCOPE

The improvement of Nanotechnologies, nano machines,Web of Things (IoT), Internet of Nano Things (IoNT) will greatly affect propelled improvement in nearly each field in not so distant future. Specialists are presently working being developed of nano machines containing IoNT for live organization in differed territories in not so distant future. In this paper, in profundity audit as to Internet of Nano Thing (IoNT) is displayed which is viewed as next developmental stride in universe of nanotechnology notwithstanding nano machines, applications and research ranges. The improvement of nanomachines with correspondence capacities and their interconnection with smaller scale and large scale gadgets will empower the Web of Nano-Things. This new systems administration worldview will have an extraordinary effect in nearly each field of our general public, running from healthEnd-to-end unwavering quality in nanonetworks and the Internet of Nano-Things needs to be ensured both for the messages going from a remote war room to the nano-hubs, as well concerning the parcels originating from the nanomachines to a typical sink. In this article, we have presented the reference engineering for this new worldview and examined the best in class of research on electromagnetic nanonetworks. Numerous specialists are right now occupied with building up the equipment hidden future nanomachines. The novel properties of the nanoscale and the nature of nanonetworks require new arrangements for correspondences that ought to be given by the data and correspondence society. Among others, novel nano-recieving wire outlines, nanoscale channel models, data encoding also, tweaks for nanoscale systems, and conventions for nanonetworks are commitments anticipated from the ICT field. In the near future, work would be done on developing own IoNT based Nano Sensor Network for Industry or Agriculture for various monitoring activities.

IX. REFERENCES

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