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INTERNET OF NANO THINGS P.Radha¹, Srinikash.S², Sanjay.B³

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ABSTRACT

The arrival of the Internet of Things has substantially transformed the day to day functionality of each bit of life intensely. IoT has offered many more possible approaches that may possibly help make a strong machine and many more. Several IoT applications have got been defined and deployed in the modern years. As research currently developing in the field of IoT. Nanotechnology has taken essential steps more than to get linked with Internet of Things that may perhaps take energy efficiency, medications and new kinds of branches to complete a new level. Nano cellulose materials have found a great many solutions for just one application, including health, smart society, military, agriculture and other industries. The arrival of the Internet of Things has substantially transformed the day to day functionality of each life's totally new. IoT has offered virtually countless new technologies which may perhaps increase energy efficiency, medications and smart cities.

1. INTRODUCTION

In the upcoming years the evolution that is going to occur in the areas of computing will be entirely beyond the ascendancy of out-of date work station. Sundry incipient technologies are forthcoming to ameliorate and solve as many issues as they can such as security, energy sustainability, privacy and so on. In integration, the advancement of technologies, many contrivances are now being used to make our life's stress free in offices, business, schools, colleges, universities, homes, factories, manufacturing and many more other places where there is a desideratum of technologies. It is estimated that the number of associated contrivances not in millions, but billions of contrivances will be incrementing at the swiftest pace in impending years. Internet of things (IoT) is one of the most subsisting research areas that have open the gateway to many applications in different field. The concept of the cyber world of things was familiarized by Kevin Ashton in the year 1999. The term IOT includes every contrivance is linked to the cyber world [2]. When we verbalize about IoT we verbally express that the physical object's such as mobiles, computers, laptops, perspicacious watches and much more will be associated with the cyber world not just to transfer the data and information but withal to control, monitor, detect, sense and much more. The conception of IoT has gained the attention of numerous researchers, industrialist, enterprise, scientist that they have done and currently making so much progress in the field of IoT and implementing countless applications such as ehealth, perspicacious automobiles, perspicacious home, perspicacious waste

system and anon that incipient domains have come up in front. One of the domain denomination is an Internet of Nano Things (IoNT). The IoNT is incrementing expeditious, prominently ameliorating the mighty IoT. IoNT can be defined as the interconnectivity of microscopic contrivances elongating from one to an inadequate hundred nano meters that can access the cyber world and other communication networks.

2. LITERATURE REVIEW

In this paper, Researchers focus on electromagnetic communication in nanoscale devices by drawing attention Towards Channel Modeling, Information Encoding, and Network Protocols for Nano devices Based on Ion T. The Information and Communication Society (ICT) must offer some new solutions Communication in nanoscale devices and nano networks

3. METHODOLOGY

EVOLUTION OF THE NANO TECHNOLOGY

Thoughts and goals of someone sometimes upwardpush to new science and technology. From that dream and imaginations, a new subject changed into born that's referred to as Nanotechnology, a 21st century Frontline. the first ever idea of nanotechnology became supplied on 29 December 1959 by Richards Feynman in his renowned speech titled" There's lots room at the bottom" at the California Institute of generation. In this address, he described a method that would allow scientists to control and modify individual atoms and molecules. The term "nanotechnology" was first used in 1974, about 15 years after Richard Feynman's presentation, by Norio Taniguchi, a Japanese scientist and professor at the Tokyo University of Science. According to him, "Material manipulation, division, merger, and deformation by one atom or more molecules constitute the bulk of nanotechnology. However, the phrase was not used once more until 1981, when Eric Drexler published his first work on nanotechnology without being aware of Taniguchi's earlier use of the phrase



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In 1980, K. Eric Drexler presented the concept of nanotechnology as deterministic rather than probabilistic, and K. Eric Drexler explored theoretically working with individual atoms and molecules. Two of his influential books. For nearly 50 years, nanotechnology has been the basis for impressive industrial applications and exponential progress. Today, nanotechnology is a multidisciplinary field encompassing the issues of precision machinery, devices, applied physics, physics, chemistry, electromechanical frameworks, and the use of biotechnology and biomedicine for high-value therapeutic or drug applications field. Nanotechnology enables better approaches to desired goals. Both engineers and scientists use different methods and equipment for this. In addition, countless funds were submitted. Innovative research in nanotechnology has the potential to transform traditional practices of strategy, research, and manufacturing of a wide variety of engineered products. Additionally, government agencies, industry, and academia should take steps to provide additional funding for nanotechnology advances.

4. RESULTS AND DISCUSSION

MARKET OF INTERNET OF NANO THINGS

According to various market reports, IoNT was valued at \$6.24 billion in 2017 and is projected to reach \$22.04 billion by 2023, representing a CAGR is equivalent to 22.81%.



In the previous era, the nanotechnology market experienced rapid growth. Since the development of nanotechnology, it has provided effective and efficient solutions for a wide range of applications in biomedical, agricultural, business, and military applications. An IoNT organization can consist of a variety of combinations of nanodevices, nanosensors, and additional machines such as the Internet of Things, sensor networks, cloud computing, and fog computing. The nanosensor market was valued at USD 133.69 million in 2017 and is projected to reach USD 4,621.71 million by 2023, with a compound annual growth rate (CAGR) of 79.83%.



In the huge market of the Internet of Nano-

Things, this revolutionary technology is sure to make a big impact in a myriad of areas. The following are e-Intel Corporation, Cisco Systems Inc., Qualcomm Incorporated, Juniper Networks, IBM in the United States.

Corporation, Schneider Electric, and AlcatelLucent S.A. are major players in the Internet of Nano-Things market. France and SAP S.E. such as Siemens AG in Germany. According to the BCC Nanotechnology report, the global market for nanotechnology products was estimated at 22.9 billion in 2013 and increased by about 26 billion in 2014[9]. The report predicts that the nanotechnology market will reach about 64.2 billion by 2019, with a CAGR of 19.8% from 2014 to 2019.



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The integrated nanomaterials market is expected to grow from approximately \$20.6 billion in 2014 to \$52.7 billion in 2019, at a CAGR of 20.7% from 2014 to 2019 and a CAGR of 16.2%.

NETWORK ARCHITECTURE OF INTERNET OF NANO THINGS

The Internet of Nano-Things is increasing in various fields. The market for IoNT is estimated to grow in the near future. Internet of Nano-Things Nano sensors connect to physical objects to process, collect, and share information with consumers. Nevertheless, new network architectures need to be developed to connect nano machines with existing communication methods. Here are his four mechanisms of the IoNT architecture.

NANO NODES

Nano nodes are nano devices, like sensors and actuators, that can be attached to the human body or any physical network space to collect information. Nodes of this type are considered to be the smallest and simplest nano machines due to their finite energy, low memory and limited communication capabilities. This allows it to only transmit over very short distances and perform simple tasks. Nodes such as biosensors, DNA sensors, and body sensor networks can be integrated into each person's body. What's more, you can customize it with books, pens, goals, and much more.

• NANO ROUTER

Nano routers are larger than nano nodes and can retrieve more assets. Nano routers are useful for compiling and retrieving information from nano sensors. In addition, nano routers also play an important role in monitoring nano nodes through interaction control instructions.

• NANO-MICRO INTERFACE DEVICE

These nano-micro interface gadgets were used to collect and transfer data from various nano routers and transfer them to the microscale and vice versa. The nano-micro interface device is also a hypothetical hybrid device. These hybrid devices can be transmitted at the nano scale using nano communication methods and can also be transmitted over communication networks established using conventional network protocols.

• GATEWAY

A gateway is a micro-scale device that allows remote control of an entire system. These devices can retrieve and transfer data within the network



INTERNET OF NANO THINGS APPLICATIONS

There is no doubt that IonNT will make a big impact About nanotechnology companies. The Internet of Nano-Things has a myriad of applications, including oil and gas, weapons, agriculture, smart cities, and healthcare. In this section, we have only described the main applications of his IoNT that can enhance the benefits of nanotechnology in many fields.

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• GAS AND OIL

Oil recovery can be increased by using nanosensors. Nanosensors can penetrate rock holes and help detect rock-bound oil. However, although there are cross-bore hole imaging and seismic tools that have greater impact in this region, they provide little intensity. In the Internet of Nano-Things, nanosensors cooperate and connect with each other through molecular communication. In addition, collected information can be transferred in real time through adjacent gateways. This allows efficient recording of oil position without the need for an accurate magnetic source and receiver.

• AGRICULTURE

Agriculture has always directly or indirectly provided food for humans and animals. The growing world population has created a need to improve the quality of food produced by farmers. With the help of IoNT, it is possible to improve agricultural productivity and develop numerous precision farming applications. For example, nanosensors and nano-based intelligent distribution systems could help in effective utilization of agricultural natural resources such as water and vitamins.Biochemically through precision agriculture. In addition, there are many types of nanoparticles that have proven effectiveness in combating pests. Plant mold can be controlled using nanoparticles. Additionally, by placing nanosensors in fields to monitor and identify signs of crop viruses, data can be collected and sent to farmers to check crop health. Today, IoNT leverages satellite communications, geographic information systems (GIS), and remote sensing capabilities to enable precision farming businesses that increase agricultural productivity and proficiency.

• ENVIRONMENTAL MONITPRING

In many major cities around the world, air pollution is an important factor that cannot be ignored when designing arrangements for the well-being and safety of local people's lives. Failure to promptly control or monitor this factor may lead to increased mortality or morbidity. One of the recent events in Lahore, where the entire city was shrouded in dark haze, was also caused by an increase in the city's air pollution rate. Therefore, two types of state sensors are used in this area.

- Analytical sensor (GC,UV)
- Gas Sensors (solid state gas sensor)

Surveillance systems can be developed using a GIS-based server and client communication system that can serve different locations and zones throughout a city. Within each zone are nanosensor nodes that determine the zone's air quality and report and evaluate it to a server via a GIS-based system.

• MILITARY

After decades of bridging, lightweight, high-quality polymer materials and composites such as carbon nanofibers, nano-Al2O3, nano-TiO2, poly(methyl methacrylate), polyethylene, and poly(vinyl alcohol) are now gaining momentum. increase. Business in aerospace military/development. Polymers continue to replace heavy metals and metal amalgams, with recent advances ranging from biomaterials and electro-optic devices to energy source sharing and nanotechnology. But engineering and science fundamentals also enable the creation of erodible resistors, compound special obstacles, more durable adhesives, and self-adhesive innovations for the military aerospace and weapons industries. For light individual reinforcement and vehicle insurance, thicker multi-layer bulletproof materials are created, including multi-layer multi-functional defensive coatings. Research is currently focused on low-volume, low-mass nanofibers based on protective polymer thin films, including highly robust and anti-reflection passive chemical coatings for precisely engineered nanosensors with controlled linear and nonlinear immersion properties. is guessing. Work will soon begin to evaluate the ballistic performance of multilayer composite polymers.



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• MEDICAL AND HEALTH CARE

In that regard, scientists also learned about magnetic fields and used the theory of magnetism to move these things. Likewise, using nanotechnology to stimulate sampling and monitor immunity are both promising. To achieve these new findings, microneedle patch biopsy seeks to harvest local immune cells from individual tissue sites. Nanowell micro-engraving technology for detailed analysis of the functional status of living immune cells during recovery. This is done using nanobot technology. Other nanostructured bioagents for treating hemorrhagic shock rely on the creation of structured hemostatic gels to stop blood flow and prevent the subsequent leading cause of death among soldiers from field stab wounds.

SECURITY OF IONT

The Internet of Nano-Things is spreading rapidly, greatly amplifying the power of the Internet of Things. Technology security is the most problematic issue [24]. In the nano-Internet, security plays an important role in providing a safe and accurate communication environment between nano-devices in the nano-network. A nanonetwork consists of nanodevices that are connected to each other to exchange information [25]. Various attackers can exploit weaknesses and vulnerabilities in nano networks to perform malicious actions. This is because current security methods and tools are not suitable for nanodevices present in nanonetworks, and physical layer nanodevices operate in the terahertz band. To protect the IoNT infrastructure, it is essential to develop various security solutions [26]. Below is a proposed solution to secure the Iont.

Infrastructure:-

Data integrity verification using checksum algorithm

- Encrypt information in transit between nanodevices using encryption algorithms
- Use of hiding algorithms to hide sensitive data from unauthorized users.

Additionally, healthcare is one of his primary sources of IoNT data. All patientrelated medical information must be protected from unauthorized use so that people's lives are not endangered. Sensitive data from a patient's personal health monitoring device should be handled with care.

CHALLENGES

The Internet of Nano-Things is recognized as the most scaled-down nanosensor system with tremendous potential to be adopted for real-time applications in many different domains. Scientists and researchers around the world are beginning to shrink micrometer and millimeter sensors to the nanometer scale. The primary goal is to make palm-sized technology small enough to circulate in the human body for accurate and urgent disease detection and direct bonding to manufacturing materials. Similarly, IoNT will bring many benefits in many fields such as medicine, energy, agriculture, and manufacturing. However, all technologies have their drawbacks. The Internet of Nano-Things also has some issues and objections that need to be resolved in order for the IoNT to easily interact with business, education, and many other sectors. As a result of this macro-tonano transition, the major challenges that nano staffing agencies must face are inevitable. Combining all electronic components into a single nanodevice to use, detect and transmit signals is the biggest obstacle. Furthermore, security and privacy have always been one of the biggest challenges and unresolved concerns, not only in IoNT, but in any technology. However, these nanogadgets are toxic and can cause even greater problems [29]. Furthermore, in parallel with work on various applications and extensions of nanotechnology-based IoNT devices, new security and confidentiality tools related to information collected by nanosensors should be discussed. In addition to security, IoNT also has to overcome some practical obstacles, such as: B. Get a reliable, fast wireless network.

5. CONCLUSION

Nanotechnology is an evolving science with vast applications and potential benefits. Nanotechnology foresees a world where innovative products are developed at the microscopic and molecular level. It provides an accurate, cost-effective method for robust renewable energy sources and keeps the air clean. Various researchers, scientists and engineers in the field of nanotechnology around the world are discovering new techniques that use nanotechnology for the benefit of the world. Nanotechnology includes pharmaceuticals, electronics, food, solar cells, batteries,

Chemical sensors, environment, etc. Moreover, the most important benefits of nanotechnology are expected in the medical and healthcare fields, where benefits are often demonstrated. Extending nanomachines with communication capabilities and connecting them to nanoscale devices enables the idea of the Internet of Nano-Things. In the near future, the expansion of nanomachines, nanotechnology, nanodevices, nanosensors, IoT, and IoNT will have a tremendous impact on almost all fields of science and technology, and will benefit the whole world. This article



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provided an in-depth review and overview of nanotechnology related to IoNT. In addition, IoNT's main applications and challenges were identified.

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