A Review: Significant impact and Future Scope of Nanotechnology on communication systems.

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Abstract: *Today, nanotechnology is the most developed and active research field in many fields such as civil engineering, chemistry, electronics and medicine, and materials. In modern science, nanotechnology is seen as the next industrial revolution that can provide more possibilities. In the field of telecommunications, nanotechnology can provide effective solutions for energy-saving computing, sensors, memory expansion, and human-computer interaction. It is more energy-efficient and cost-effective than their current modules. This article outlines many topics related to nanotechnology in communication systems, and briefly introduces the potential applications of various developments in nanotechnology in communications. And the potential of future research that may lead to ways to improve communication systems.*

***Keywords*:** *Nanotechnology, Molecular Nano Technology (MNT), Molecular communication, Nano machines, Nano-communications.*

1. INTRODUCTION

Next-generation telecommunications systems should be based on nanotechnology modules, especially in the fields of electronics and interactive processes. In the mobile communication system, the application of nanoscience is used to execute the control process on the nanoscale which will be on the nanoscale. Nanotechnology, known as molecular nanotechnology (MNT), is based on the structure of matter for one atom, one atom, and one molecule, one molecule. The influence of cellular networks and central networks, combined with their functions and nanotechnology, as well as perfect security and better sensor effects, makes nanotechnology the most important technology in these fields [1].

Another challenge for communication systems based on nanotechnology is the discovery of new nanoscale materials, which are expected to play an important role in the challenges of future communication systems (such as equipment). Short-distance communication, energy-saving computing, high-density storage and logic, and ultra-fast connection. In addition, the use of molecules instead of electromagnetic waves or sound waves to encode and transmit information represents a new communication paradigm, which requires new solutions, such as molecular transceivers, channel models, or nanonet protocols [2].

Molecular transceivers are easily integrated into nanodevices due to their size and range. These transceivers can react with certain molecules and release other molecules after a certain treatment. A new generation of nanoelectronic components are used, such as nano-batteries, nano-memory, nano-level logic circuits and even nano-antennas [3].

This article discusses nanotechnology issues in telecommunications and outlines the future applications and technologies of nanotechnology in telecommunications. The rest of this document is structured as follows: Section 2 deals with nanotechnology in communication systems, which provides detailed information on many nanotechnology issues in nano chemical systems. Section 3 outlines the most important applications of nanotechnology in the field of communication systems. Finally, in Section 4, the future possibilities of nanotechnology in communication systems are discussed.

2. NANOTECHNOLGY

Nanotechnology was first developed in 1965 and includes processing, separating, solidifying and deforming materials through atoms or molecules. This means manufacturing 1 to 100 nanometer devices [4]. Divided into three major areas:

nanostructures, nanotechnology and nanotechnology with typical applications in nano electronics, life sciences and energy. At present, nanotechnology has many applications, as shown in Figure 1, but nanotechnology can be applied in the electrical and electronic fields, i.e. communications, bioengineering, medical electronics and robotics [4].

Figure 1. Nanotechnology Applications [4]

Nanotechnology will enable manufacturers to produce computer chips and sensors that are smaller, faster, more energy-efficient, and cheaper to manufacture than current similar products. About ten years later, in the mid-1990s, micromechanical sensors also became an integral part of automotive technology. In the next ten years, the development of truly integrated sensors based on nanostructures will become part of our daily smart environment [5]. Nanobotics is an emerging field of technology for manufacturing machines or robots. The microstructure of its components is within one nanometer (9-10 meters) or close to nanometer range. Nanorobots refer to the nanotechnology disciplines related to the design and construction of nanorobots, and the maximum device size is 0.110 microns based on nanoscale or molecular components [6].

In communication systems, mobile devices with high-level computing and communication when interacting with other human environments (such as homes, offices, and public places) require smart forms of identification, computing, and communication technologies, especially when these devices are embedded System time [7]. The basic requirement of this type of mobile device intelligence is that the device must be autonomous, reliable, easy to deploy, and can survive without clear management or attention, and the mobility of these devices is also means limited size and limited range of power consumption [8].

Further requirements for smart mobile systems: smart interfaces and interaction with other devices and environments, recognition, context, perception, and higher data rates that require more memory and computing power. All these requirements have led to situations that cannot be solved by modern technology. However, nanotechnology can provide solutions for detection, activation, radio, integrating intelligence into the environment, and energy-efficient computing and storage [9].

3. NANOTECHNOLOGY APPLICATONS

Nanotechnology plays an important role in telecommunications technology and is revolutionizing many aspects of communication technology and productivity. Nanotechnology has a wide range of applications and has affected the telecommunications industry in many ways.

3.1. Wireless technology

This telecommunications company is fundamentally transforming into a new nanotechnology. The impact of nanotechnology on cellular and central network functions, as well as the improvement of security and the best effect on sensors make nanotechnology the largest traditional technology so far [10].

The wireless industry is committed to implementing smart operations to ensure that computers and communications meet their requirements. The emergence of smart technology and nanotechnology concepts on mobile devices will help to embed the device in the human body. A new platform can be created in the future to realize an environment of continuous discovery and computing [10]. Nano devices can be charged to achieve some functions, such as autonomous power supply, environmental sensitivity, or intelligent interaction with other systems [11]. Mobile phones will soon be equipped with advanced carbon nanotubes, which is not enough for nanotechnology [11].

Networks, mobile devices and smart environments should be integrated into human environments such as homes, workplaces or public places, and create a new platform that can be detected and calculated in the nanometer system [12].

3. 2. Internet of Things (IoT) Technology

The Internet of Things (IoT) is an arrangement of physical objects or things related to devices, programming, sensors, and network systems so that you can achieve more important considerations and organization by exchanging data with execution and other related objects [13]. In the near future, there may be side effects that affect you in the future. Bio-nanochips can be prepared to transmit data or information between themselves, machines, or the general population. They learn by claiming illustrations every time they perform a task [14].

Nanotechnology with the Internet of Things will provide nano-scale things that can communicate with people or machines and have good and effective interaction capabilities. In addition, Smart Nano Things provides smart functions to connect everything to the Internet or other nano systems and applications, such as Contact with the human body to provide various other uses will cause important human contact [15]. In addition to many smart applications, such as the manufacture of nanoscale machines connected to the Internet, it can also be controlled remotely.

3.3. Body area network

Body-connected devices can now be coordinated through clothing or the body. Many research groups have done a lot of work in improving smart nano materials and integrating microelectronics technology into clothing or implanting them in the human body [16]. Prostheses and stents are truly used in medicine today. One situation is the sensors of patients with congestive heart failure; these sensors can be placed in the body and interact with each other through nano body communication, as shown in Figure 2 [17].

The integrated sensor with the size of a rice grain can be used to measure many medical parameters in the body, such as measuring the blood flow in the arteries of the human body, and medical and surgical examination of complex important parts of the body. Body can be used in a similar way for neurological or tissue stimulation drug therapy [18].

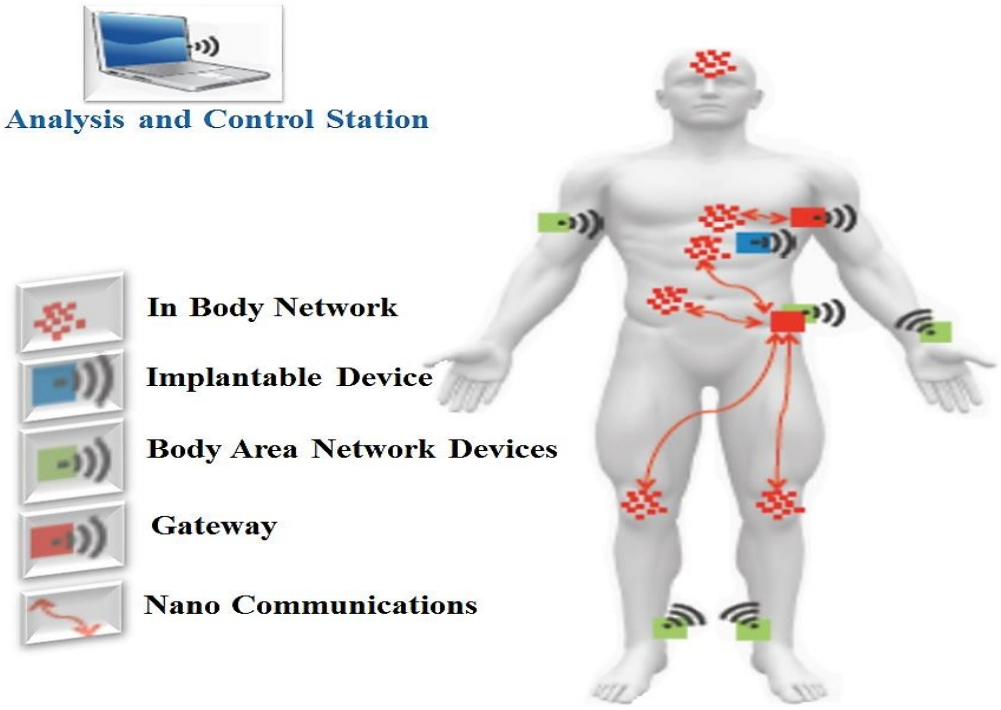

Figure 2. Nano sensors for interbody communications [17]

The promotion of smaller inserts opens up the possibility of in vivo networks (IBN), in which BAN segments shrink and disappear in the body. Sensors and actuators can be recognized by integrated devices that move remotely through the organization [18]. BAN and IBN use different biotechnologies, and more can be expected in the future. Biotechnology is referred to as any technical application that uses biological systems, living organisms or their derivatives to make or modify products or processes for specific purposes. Nanotechnology can be characterized as a branch of nanotechnology, which is related to the use of natural structures (such as proteins, DNA, etc.) as the building blocks of nanodevices (such as nanomotors) [19].

3. 4. Mobile and wireless devices

Wearable computing and identification devices are becoming an important dream of remote enterprises, letting people around know that they are always available and ready to serve customers. These devices can be associated with human environments such as homes, offices, outdoors, and mobile phones. One of the most important requirements for implanting a device into a physical object in the world is that the device can adapt to its surrounding environment. The environment becomes part of the surrounding equipment system. Develop independently and adapt to nature [20].

Nanotechnology can promote the development of new nanodevices and nanosensors that can interact with these organic structures. Nanotechnology can provide opportunities, either as complex as improving the conditions in our natural environment, or as simple as determining whether organic products are healthy [21].

Nanotechnology is another example of the use of wireless devices such as remote sensors. This is a particularly large research area in the advancement of military nanotechnology. Sensors are seen as the key to collecting information on nearby conditions, enemy forces or equipment development, checking for continuous damage, or reducing the feasibility of enemy attacks. The lethality of an attack, for example, by providing data to control the level. They can be distributed in battle to collect information about temperature, weight, vibration, acceleration, lighting, magnetism, or acoustics, and continuously transmit these data.

3. 5. Nano communication and networks

Nanomachines are described as mechanical devices based on nano-sized parts. The term nuclear machine is called a mechanical device, which has nano-scale fragments and the described sub-nuclear structure, exerts its containment limit, can transport, process, communicate, identify or possibly activate another system. Electromagnetic wave communication is the main strategy for interconnecting microelectronic devices. These waves can be transmitted through cables or wirelessly with little loss. Developed nano-scale antennas for very high frequencies. The communication between nanoscale machines is defined by so-called molecular bonds, that is, the sending and receiving of information encoded in molecules. The machine, in which the nanonet of messages is used, is coded with molecules [22].

Coding technology can be regarded as the representation of information in nano-networks, called molecular coding, which uses the internal parameters of molecules to encode information such as chemical structure, relative position or polarization of molecular elements. The recipient must be able to identify these specific molecules in order to decipher the information. This process is similar to the use of encrypted data packets in a communication network, where only the intended recipient can read the information. As shown in Figure 3, molecular coding is used for phenomenon communication, in which only representatives of the transmission species can decipher the transmitted message [23]. Text, voice and video are usually transmitted through traditional communication networks.

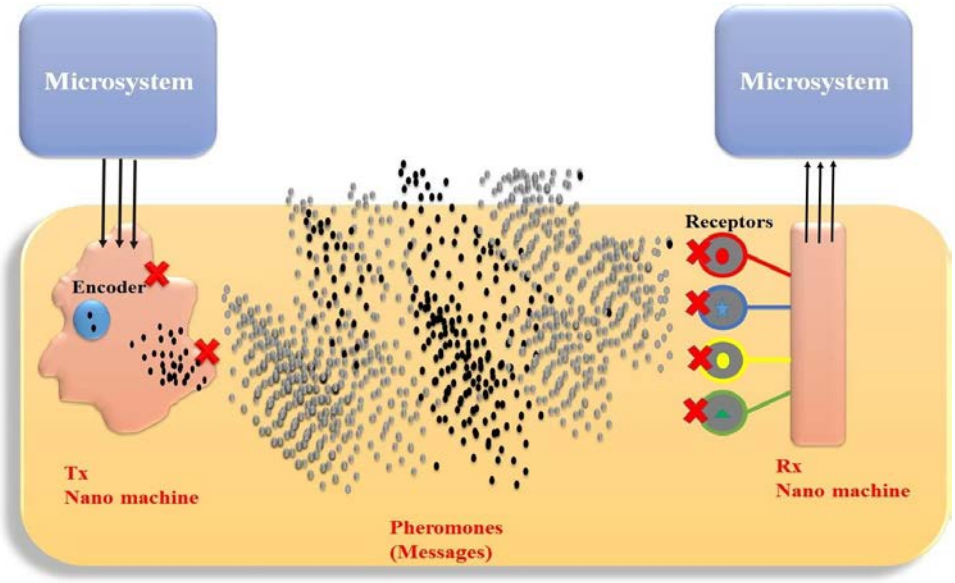

Figure 3. Molecular communication based on pheromones encoding [23]

The communication between nanomachines works just like traditional communication, which means that the system must transmit messages to the receiver through the medium, and the transmitted information must be encrypted at the sender and decrypted at the receiver. But the information in molecular communication is a molecule. This molecular information represents a predetermined external structure that allows the receptor to be easily recognized. It is inactive, which means that molecular information does not tend to occur with other molecules. In response, in addition to molecular information, other information should be easily removed without side effects; they are deciphered on the nanoreceiver [24].

The carrier is a special molecule that can transmit chemotherapeutic signals or molecular structures that contain information. The use of molecules as information carriers in molecular communication has been observed in biological systems. Molecular motors or calcium ions can be used as carriers. Molecule motors such as kinesin, dynein, and myosin are proteins that can use chemical energy to generate motion and are used to

transmit data packets from the transmitter to the receiver. Figure 4 shows a molecular motor in the form of a protein, which converts chemical energy into mechanical work at the molecular level [25].

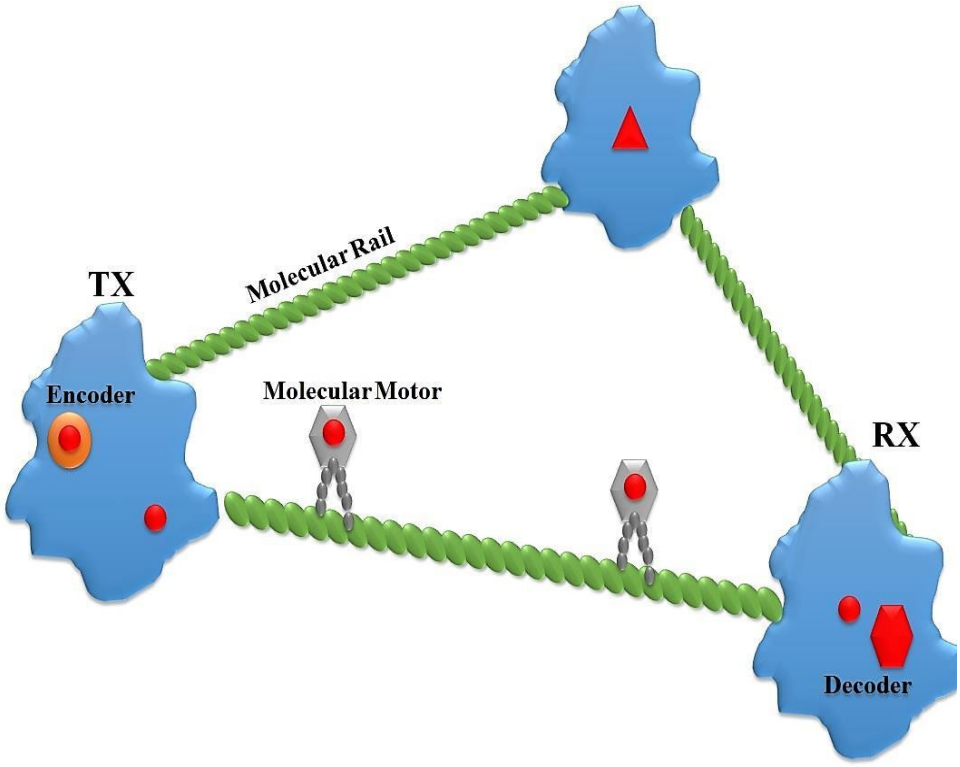

Figure 4. Molecular motors for molecular communication [25]

Molecular motors have the ability to move molecules, and molecular motors move along molecular pathways called microtubules. The transmitter uses calcium ionophores to adjust the ion concentration in amplitude and frequency in order to encode information.

3. 6. Quantum computing

Replacing current computers with more advanced and rapidly developing quantum computers is the most unique innovation that will be responsible for adding new functions and tools for processing and intelligent computing [26]. The computer repeats itself with qubits or qubits, and they can be in states 0, 1 and superposition at the same time. This will make the computer much faster than ever before. The development of quantum computers is still in progress.

3. 7. Information storing and processing

For information processing and transmission, it is expected that the development of electronic, optical and optoelectronic components will bring fast and accurate data transmission equipment. Photonic crystals may be used to develop pure optical circuits as the basis for future light-based information processing. The concept of nanotechnology in data storage in the nanometer range, based on CMOS technology, through the use of quantum strokes and carbon nanotubes, will bring high hopes to the storage of large amounts of data [27].

New technologies such as the multifunctional 3D nanocomputer chip tightly couple memory to minimize information bottlenecks and ensure fast and accurate data processing. As workloads increase, progress may lead to key execution milestones, competition, and the ability to quickly process large amounts of data (known as big data) on traditional chips. In addition, 3D embedded memory and new nanotechnology (such as CNT) are promising steps in this direction create the next generation of ultra-powerful

electronic systems that can handle large amounts of data.

3.8 Nano sensors and nano devices

Nano sensors and nano devices provide new solutions for many aspects such as environmental and biological detection, and provide a high level of detection sensitivity and usability under static or dynamic conditions in many applications such as healthcare, security, and surveillance. For many industrial plants and their global distribution, there is an urgent need to develop new sensors and equipment that can quickly identify and identify sources of pollutants and other hazardous substances at any time [28]. In addition to in-depth concepts, it is also necessary to develop sensors and equipment that can communicate with other machines in the production area to detect various types of fluctuations in the production process.

The nanosensor is a biological, chemical or surgical contact point, used to transmit information about nanoparticles to the macro world. Nano-devices are mainly used for various medical purposes, as a gateway to the manufacture of other nano-products (such as computer chips that work on the nano-scale).The transduction mechanism can be optical , Bulk or electrochemical. In the optical mechanism, many phenomena can be used to detect various chemical indicators, such as luminescence, measuring the concentration of hydrogen peroxide H2O (H2O2) with a luminescence optical sensor, absorption, polarization, and fluorescence. And according to the quality mechanism, communication occurs due to sound waves, micro-balance and resonance [29].

In the near future, nanosensors will provide many new applications, such as creating customized images for viruses and pathogens or creating geographic DNA screening for various single nucleotide polymorphisms (SNPs). By integrating nano-level sensors, nano-processors, optical communications and nano-micro-electromechanical systems, a new generation of nano-satellites can be developed as highly sensitive biological conductors or to monitor hostile environments [30].

4. FUTURE POSSIBILITIES

Nanotechnology has opened up better ways to solve many fields such as telecommunications, biotechnology, medical electronics, and robotics. These are the four main scenarios that may open up business opportunities in the future. The use of nanotechnology is considered to be a new understanding of the incredible opportunities that provide smart streaming. Thanks to the telecommunications revolution, other aspects can be realized, such as revolutions in the computer and network industries, Electromagnetic characteristics, faster and more compact chipsets, non-silicon-based memory and processors, a new scientific computer based on quantum computers, advanced microscopes and manufacturing systems. The future prediction of nanotechnology in telecommunications technology, such as the development of a nano headset, which they can interact like mobile phones and can use voice control technology to connect hearing aids and microphones according to their location . Downloadable ID, shirt or pants for quick access to safe items. OLED innovation is still a natural light-emitting diode, which improves the screen of modern mobile phones and brings innovation in various environments. OLED displays are adaptable, as thin as paper, and can be placed on any surface. By 2025, every living space can be a definite arithmetic. Speculative messaging is considered one of the highest expectations for fast and good communication, and thanks to innovative eye tracking technology and sensor-based headsets that can see the ability to change thinking, it provides a better voice strategy than mobile VoIP . Nanotechnology can add other communication methods that are currently unpredictable and may exceed imagination, because the technology is in the first stage of research, especially in the field of telecommunications research.

5. CONCLUSIONS

Today, the use of wireless communication is rapidly growing and expanding. The basic driving factors behind the use of nanotechnology in wireless devices and systems are huge

because they reduce power consumption and minimize the size of communication components. Nanotechnology is designed to have a significant impact on communication systems, thereby reducing requests for progress meetings, large amounts of information, minimal equipment restrictions and higher-level execution logs. Telecommunications nanotechnology includes the development and future development of nanotechnology related to broadcast communications. Molecular communication is the integration of interactions between biology and biological systems. Nanotechnology makes possible nano- and micro-scale interactions. Computer science is integrated into larger communication and information processing systems. Molecular communication is another aspect of communication technology, which attempts to replicate natural communication protocols and use them for various interesting applications. It has great potential and is at the critical stage of some practical applications that require molecular communication. This can only be achieved through the joint efforts of scientists from various scientific fields, especially in the field of telecommunications. Nanonet is a new idea that will expand the capabilities of nanomachines by connecting nanomachines to the central nanonet and access the Internet to promise a new nanonet environment in the future through the Internet of Things. This article outlines the application of nanotechnology in today's more complex and widely used communication technology. It is expected that in the near future, when the concept of nanotechnology is introduced as one of the technologies used in the development of various telecommunication technology fields, It will become more intelligent.

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