The Impact of Nanotechnology on Mobile Phones and Computers

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Abstract: This paper presents an introductory concept of nanotechnology and an insight on how this technology has tremendously improved the capability of mobile phones and computers. In this paper, the author uses windows versions for computers and mobile phones (Nokia) as a case study to buttress his points.

Keywords: Nanotechnology, Semiconductor Devices, Mobile Phones, Nokia, Computers, Windows.

1 Introduction

Science could be seen as the area of study that formulates ideas and hypothesis, which may be subjected to confirmation, by either experimental research or theoretical findings. Technology on the other hand involves using scientific ideas to manufacture/create machines, devices and other materials for the benefit of man. The combined use of technology and science by scientists and researchers over the years has opened an interesting multidisciplinary research field universally known as "nanotechnology."

"Nano" is a Greek word used to describe the length scale of one billionth of a metre expressed as 10^{-9}m. "Nano" covers the category of materials or semiconductor-based devices with thickness within the 1-100nm region. The technology, which encompasses semiconductor devices and other materials within the dimensions of a few nanometers, is therefore described as nanotechnology. However, recent development by researchers and scientists to manufacture very small and fast electronic systems such as the computer, mobile phones, televisions and other electronic devices actually led to the birth of nanotechnology. Nanotechnology can be defined as the design, production, characterization and application of structures, systems and devices by controlling the manipulation of their sizes and shape at the nanometre scale (atomic, molecular and macromolecular scale) that churn out structures, systems and devices having at least one novel/superior characteristic or property [1-6]. Nanotechnology is the ability to manipulate and create matter at the molecular level which makes it possible to create materials with improved (or, more accurately, altered) properties, such as being both lightweight and having ultrahigh strength, and greater capabilities such as in heat and electrical conductivity [7, 8]. In both definitions above, we obviously observe that nanotechnology is mainly concerned with manufacturing miniaturized and portable materials with greater strength and efficiency.

In this short review communication, focus will be on the explanation of how nanotechnology has influenced the speed and efficiency of computers (based on windows operating systems) and mobile phones (Nokia) respectively.

1.1 The Main Goal of Nanotechnology

Presently, small, efficient and high performance devices are being introduced very often into the electronics market. These devices have actually proved to be more reliable in processing data than previously manufactured ones. The main goal of nanotechnology is therefore to fabricate or manufacture devices on a much smaller scale (either molecular or atomic scale) with high performance and efficiency in the analysing and processing of data.

2 The Different Models/Series of Computers and Mobile Phones

In 1965, Moore asserted that the fastest computer, which will be available for sales at a particular point in time, doubles in speed every eighteen (18) to twenty two (22) months. The implication of Moore's law is obvious today when we consider

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the fact that presently manufactured computers appear to process data faster than previously manufactured ones. Going through the models/series of computers such as mainframe computers, windows 95, windows 98, windows 2000, windows XP, windows vista, windows 7, windows 8, windows 8.1 and now window 10 versions, it is known knowledge that the speed of each of these computer versions in processing data increases in that trend. For instance, windows 8.1 computer version processes data faster than windows 7, windows vista, windows XP operating system and earlier versions. Another good illustration in this category is mobile phones. Mobile phones produced presently also process data faster than earlier versions. Taking Nokia phones for instance, the Nokia E-series phones process data faster than Nokia C-series phones. So also, the Nokia-Lumia phones process data faster than Nokia E-series phones. Presently, we have the android smart phones, which process data at a faster rate than the normal conventional phones. Thus, it is obvious that the dawn of nanotechnology has greatly improved technology and science in our world.

2.1   Nokia Mobile Phones

At the mention of the word "technology" in Nigeria, the first thing that comes to the mind of an average Nigerian youth is either a mobile GSM phone or a computer or even both. Before the year 2001 (about 14yrs ago) when GSM phone was introduced by former President Olusegun Obasanjo in Nigeria, making phone calls was not an easy task. Very few individuals could boast of landlines (telephones) in their homes. Those who could not afford ownership of landlines often spend hours on the queue waiting to make use of designated phone booths. This resulted in very high phone bills, as there was no other alternative. Due to outrageous phone bills and very few landlines (telephones) in the country, the idea of a phone was limited to contacting people on important issues only [9]. Coming to the year 2015, the usage of phones has gone beyond making phone calls. Smart phones manufactured presently help individuals to be updated about happenings in the universe with just a click, as no one needs to tune either the radio or the television sets to get information. The introduction of news apps by various news outlets give these youths the pleasure of knowing "what's up" in the world just by a simple click [9]. Thus, mobile phones have become a real companion to an average Nigerian youth today. It is based on this premise that mobile phones giant (Nokia) has introduced a number of phone brands into the mobile GSM phones market throughout the world. Nokia aims to implement nanotechnology to create impressive mobile phones in future that can do everything from tapping directly into your brain to capture your memories to serving as a second pair of eyes [10].

The first Nokia mobile GSM phone available in the Nigerian mobile phones market was "Nokia 3310." The basic functions of this phone at that time include the required ability to make and receive calls and also for sending and receiving of text messages. These were the two common functions of the GSM mobile phone at the point of entry into the Nigerian mobile phones market. On a physical evaluation, it is observed that the components used for the manufacturing of Nokia 3310 made the device somewhat heavy despite that it does not possess much functions. After the Nokia 3310 made sway in the Nigerian mobile phones market for a while, Nokia once again introduced the Nokia 1100 series into the Nigerian mobile phone market. The Nokia 1100 mobile phone was a bit lighter in mass than the Nokia 3310 and had an additional feature in which a form of touch light was incorporated into the device. Just after the Nokia 1100 was getting out of sales, the Nokia 2300 mobile phones made wave in the Nigerian mobile phones market. The Nokia 2300 series had all the features possessed by both Nokia 3310 and Nokia 1100. However, a striking difference between the Nokia 2300 and the previous ones (Nokia 3310 and Nokia 1100) was that the Nokia 2300 had a radio function incorporated into the device and also the mass was a bit reduced than the previously manufactured ones. However, not long ago, Nokia introduced a number of mobile phone brands into the Nigerian mobile phones market. These brands include the Nokia C series, Nokia E series, Nokia N series, and Nokia Asha series and so on. These series of Nokia phones possesses several functions which include browsing the internet effectively, storing music, videos and pictures via a micro-SD card (otherwise known as memory cards). These memory cards exist in different sizes ranging from 1 gigabyte (1GB) to as much as 20 gigabyte or even more. With this, large files could be saved/stored using the mobile phones, which was hiltherto impossible. They can also be used as cameras, stopwatch, alarm clock, for checking of dates (via an installed digital calendar) and so on. The functions of these devices are so numerous. For instance, the Nokia C3 has Bluetooth, packet data and wireless local area network (WLAN) connections respectively and a 2 megapixel camera and can serve a lot of purposes. The Nokia N95 launched in 2007 has a lot of multimedia functions such as the Global Positioning System (GPS), 3G and Wi-Fi connectivity, 5-megapixel camera with a light emitting diode (LED) flash and a television (TV) out. The Nokia N8 is composed of a touch screen, a 12-megapixel camera which is capable of recording a high definition (HD) video in 720p. The Nokia N8 can also be employed for video conferencing with its camera located on the front of the device. Even though this new generation of Nokia phones possesses so many functions than the earlier versions, we obviously observe that these devices are lighter in mass and portable than the Nokia 3310 and Nokia 1100 respectively. These devices are also faster in terms of processing data. Voice calls made using recently manufactured Nokia GSM mobile phones are often clearer than the earlier versions of Nokia phones. However, it is also a known fact that pictures taken with a Nokia device having 5-megapixel camera appears clearer than the pictures obtained with another Nokia device having 2-megapixel camera. All these improved functions noted are possibly due to nanotechnology, which involves trying to reduce the various sizes of devices and at the

same time making them more efficient than the earlier versions. Very recently, the Nokia GSM Lumia series was introduced into the GSM mobile phones market. This series include the Lumia 520, Lumia 620, Lumia 720, Lumia 820 and Lumia 920. The Nokia GSM Lumia smart phones all possess the windows 8 operating system (OS). With the acquirement of Nokia by Microsoft Company, the new Microsoft Lumia 535 has been introduced into the GSM mobile phones market. The new Microsoft Lumia mobile device has many functions, which include a 5-megapixel camera and a 5-inch display which is protected with a Gorilla Glass 3. With this device, it is now possible to make/effect video calls using Skype. One can also use this device to explore Microsoft office package such as MS access, MS word, MS excel and MS PowerPoint documents and OneNote notebooks in any location one may be. This is possible because the device is pre-installed with Microsoft Office suite.

Table 1 gives a brief summary of the functions of selected Nokia phones in order of year of manufacture.

Table 1: Selected Nokia GSM mobile phones and salient features common to them.

Nokia Mobile Phones	Main Characteristic Features and Functions
Nokia 3310	For making calls, sending and receiving text messages. Approximate mass is 133kg.
Nokia 1100	For making calls, sending and receiving text messages, also functions as a touch light.
Nokia 2300	For making calls, sending and receiving text messages, also functions as a touch light and has an FM player.
Nokia C3	Bluetooth, packet data and wireless local area network (WLAN) connections respectively and also a 2 megapixel camera. Built-in digital calendar, it can be used to video events and also for voice recording. It has an FM player and a media player.
Nokia N8	Has a touch screen, a 12 megapixel camera. It can also be employed for video conferencing with its camera located on the front of the device.
Nokia Lumia 520	8GB internal Storage, supports up to say; 64GB MicroSD Slot, 4.0-inch IPS Touch Display, 5MP Camera having 720p HD Video autofocus, Windows Phone 8 OS, 1GHz Dual-Core Processor, 512GB RAM Micro SIM, Wi-Fi Hotspot, GSM/EDGE 850/900/1800/1900MHz, WCDMA 900/2100, 850/1900/2100 HSPA+ up to 21Mbps Internet Explorer 10, Mix Radio, Digital Compass, MS Office, DirectX 11, Chat, E-mail, & Social Networking, GPS, Music/Video Player, Bluetooth 3.0. Approximate mass is 124kg.
Nokia Lumia 720	Windows Phone 8 OS, 1GB RAM, 1.5GHz Dual-Core Processor, Micro SIM, 32GB built-in, Office Apps: (MS Word, MS Excel, MS PowerPoint and One Note), 3G/3.5G (UMTS/HSDPA), 4G, Hotspot (Wi-Fi), Bluetooth 3.1, Voice command/dial, Twitter, Facebook, LinkedIn, GPS Navigation, Nokia Maps, Wi-Fi Positioning, SMS/MMS, email/push email/IM, MP3 WMA Music player, Video player (such as Mpeg4, 3GP, HD, WMA), WLAN, Photo/Video editor, Internet Explorer 10 Browser.
Nokia Lumia 920	Windows Phone 8 OS, 1GB RAM, 1.5GHz Dual-Core Processor, Micro SIM, 32GB memory built-in, 7GB SkyDrive, MS Excel, MS PowerPoint, MS Word, One Note, Digital compass, 3G/3.5G (UMTS/HSDPA), 4G, Wi-Fi (Hotspot), Bluetooth 3.1, Voice command/dial, LinkedIn Integration, Twitter, Facebook, GPS Navigation, Nokia Transport, Nokia Maps, Wi-Fi Positioning, SMS/MMS, email/push email/IM, Music player (such as WMA, MP3, AMR-WB, etc), Video player (including 3GP, WMA, HD, Mpeg4), WLAN, Photo/Video editor, Internet Explorer (10) Browser.

2.2 Windows Computer Versions

In the manufacturing of electronic devices, an important component is always taken into consideration. This component is described as a switch. A computer is made up/consists of millions of electronic switches, which are actually interconnected together. In present day computers, these electronic switches are simply referred to as transistors. These switches help to process information within the central processing unit (CPU) of the computer. The integrated silicon chips developed in the 70s have been of tremendous importance in the manufacture/fabrication of present day computers and they are referred to as integrated circuits (ICs). The development of integrated circuits (ICs) actually allowed the construction of so many numbers of transistors on a single piece of silicon, which actually is the material out of which IC's are made [11]. These ICs play a fundamental role regarding the functioning of present day computers. Silicon chips are used in the manufacture/construction of these transistors because they are considerably cheap and are easy to process. However, as with every material, silicon possesses some shortcomings. As reduction in the size of transistors is achieved in order to increase their speed, certain problems arise leading to, among other things, an increased energy consumption and large variation in the transistor properties [11]. To overcome these shortcomings, a carbon nanotube is used in place of silicon, and when this is done, it is capable of making the transistors smaller and faster in processing information. A carbon nanotube is a carbon material (tube-shaped) that is measured in nanometre scales [5]. With the improvement of nanofabrication techniques, researchers have used this material to create/fabricate electronic components including transistors, diodes, logic gates and relays and these electronic components can be directly applied in making advanced computer [5].

Due to the miniaturization of the computer, it is obvious that a single hand can carry present day computers whereas, some 50 years ago, a computer could be as large as the size/dimension of a large room. These large computers known as mainframe computers often produces heat, consumes more electric power and are often very slow in processing and analyzing data. The mainframe computers are also characterized by very small storage capacity. However, with the discovery of nanotechnology, the shortcomings of the mainframe computers appear to have been taken care of as computers can now process information within seconds, require less electric power for functioning and are easily carried from one spot/location to another. We shall now briefly x-ray the different available versions of windows computer systems.

The introduction of windows 8 computer version was accompanied with a number of changes, which include the start-up screen display which displays some programs, a novel and various platform which helps in developing settings and apps between devices. Windows 8 version also comprise of a Windows store (which is an online store) developed for aiding downloading or even purchasing any available new software. The windows 8 version also contains security features like in-built antivirus software. It is to be noted that windows 8 has a maximum RAM of 512GB.

On the 14th of May 2013, windows 8 upgrade known as windows 8.1 was introduced officially by Microsoft. This upgrade took care of series of issues experienced in windows 8 environment. In windows 8.1 version, the start button located on the desktop was restored making it visible to the naked eye. This improved version supports 3D printing.

Comparing windows 8.1 version and earlier versions such as the windows 95, windows 98, windows 2000, windows XP, windows vista and even windows 7 and the windows 8, the windows 8.1 version processes data faster than the earlier versions. For instance, when you try to open a web page with the same network connection simultaneously with either of the versions, it is observed that windows 8.1 version responds faster than any other versions. This is as a result of the miniaturization of the components of the windows 8.1 system compared to the earlier versions. A physical examination of windows 8.1 system and earlier versions indicate that windows 8.1 computer system appears to be lighter in mass than any of the earlier versions. Regarding size, computers come in diverse sizes ranging from 50GB to 1TB. Present day computers are often larger in terms of memory storage, faster in processing of data, have clearer picture quality and so on.

A flowchart of the development of computers over the years is presented in figure 1.
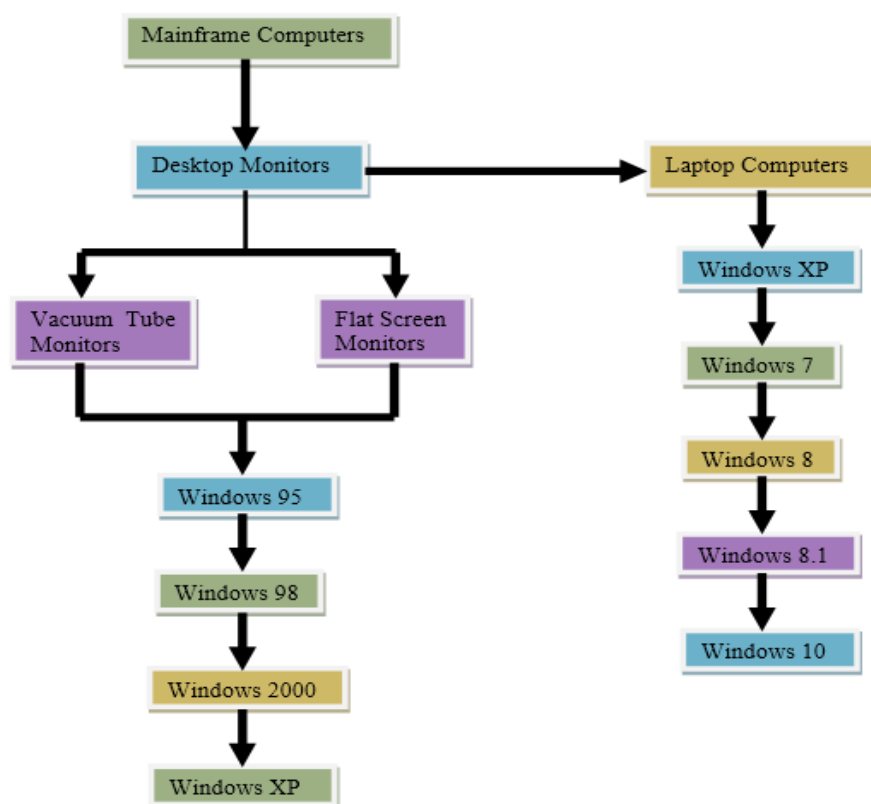
Figure 1: A simple flow chart showing the trend of the development of computers over the years.

3 Applications of Nanotechnology

Due to its fast growing importance, nanotechnology is relevant in a number of ways. Some of these are as follows:

(a)   Applying nanotechnology to electronics helps in shrinking the size of chips and helps to enlarge memory. Presently, researchers and scientists are working vigorously in developing organic computers, which is believed to store and process data just like the human brain without the intervention from other electrical devices or components.

(b)   Nanotechnology enables delivery and release of drugs to an exact location within the body with precise timing to offer the most effective treatment, and this is achieved by fastening the drug to a very tiny carrier (gold-coated or silica nanoshells) which has been pre-treated to locate a particular area of the body and be attached to it [12].

(c)   Carbon nanotubes are presently being employed in manufacturing tennis rackets so as to make them more flexible.

(d)   Nanotechnology has been employed in the fabrication/manufacture of knee implants, which can be employed for knee replacement surgery.

(e)   Presently, vehicle manufacturers employ nanotechnology in manufacturing vehicles parts.

(f)   Nanotechnology is already being used in products in its passive form, such as sunscreens and cosmetics, and it is very much expected that in the upcoming decades, new phases of products (enhanced electronic equipments and improved batteries), will be developed and will have extensive/far-reaching implications [13].

4 Benefits of Nanotechnology

With the emergence of nanotechnology, the following are some benefits that are obtainable and evident.

(a)   Faster Rate of Processing Data

Present day computers and mobile phones process and analyze data faster than earlier versions. At the nanoscale the operation of the devices is more stochastic in nature and quantum effects now become the rule rather than the exception [14].

(b)   Increased Memory Space for Devices

Earlier versions of GSM mobile phones are not capable of storing data for up to 100MB. However, with the dawn of nanotechnology, devices can now hold or store data up to 80gigabytes and even more. Memory cards presently are been designed which can even store data for up to 250GB. In the case of computer hardware, we have   CD-ROMs that have data capacity of about 4.7GB as against the conventional floppy disk, which has limited data storage capability of about 256MB.

(c)   Lighter Mass

The coming of nanotechnology has really helped in miniaturizing the electrical components of modern electrical gadgets and this in turn has proved resourceful in diminishing the mass of these devices. Hence, these devices can be easily carried from one spot/location to another without much stress.

(d)   More and Improved Functions

From our discussions above, it is very obvious that nanotechnology has contributed a lot in making devices (such as Nokia mobile phones and computers) to have more functions incorporated into these devices and even improved on previous versions. From table 1, we clearly observe that Nokia has introduced some smart phones into the mobile phones market. These phones tend to have more and improved functions than earlier versions of the   Nokia product.

5 Conclusion

In this short communication, an introduction to nanotechnology and an insight on how this technology has tremendously improved the capability of mobile cellular phones and computers is presented. The author used windows versions for computers and Nokia mobile cellular phones as reference/case study to explain some points. Analysis showed that nanotechnology proved very useful in many ways and offers many benefits, which include processing data at a faster rate, increased memory space for devices and so on.

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