

Encroachment of Nanotechnology in Ubiquitous Computing

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Abstract— Ubiquitous Computing (also known as Pervasive Computing) can be considered as creating a computer system being perfectly entrenched, properly suitable and genuinely natural which accomplishes each and every single requirement of the end user, whatsoever he or she is anticipating to do with it[1]. And most importantly because of its intelligent sensor atmosphere, it is providing further amenities which are extremely helpful making individual's life expectancy relaxed and extra contented. Nanotechnology, being an integral part of Ubiquitous Computing, can be generally demarcated as a zone of investigation and scientific advance heading towards the exploitation of the innovative attributes of substance at the nanoscale, and quite largely the design and creation of scientific instruments with nanoscale components and peripherals.

Keywords-Nanotechnology; Ubiquitous Computing; Nanoparticles; Nanomaterial; Environment.

I. INTRODUCTION

Our everyday life expectancy is now getting occupied by ubiquitous computing and Ubiquitous systems gradually. Such systems are not much costly, neither these are having high power requirement, thus showing their sensitivity towards becoming an economic and power savvy system [2]. And this is possible because of a revolutionary technology known as Nanotechnology. There are several nanotechnologies available which not only fulfill the performance requirements, but also efficient enough to diminish the ingesting of costing and power. Although a noteworthy progression has been made in various nanoscale device technologies in the previous few years, but still the overall system and circuit designing methodologies for such technologies in their embryonic stage. Nanotechnology is not only just about fraternization of nanoscale substantial collectively, in fact it necessitates the capability to comprehend as well as to accurately manipulate and govern the substantial in a beneficial manner [3].

In this research paper, authors are making efforts to put together the exhilarating chastisements of Nanotechnology in Ubiquitous Computing. The authors will try to showcase how various Nanotechnologies and Wireless Technologies may be of service to ubiquitous computing.

II. UBIQUITOUS COMPUTING OVERVIEW

Ubiquitous Computing imposes uncommon technical restraints such that in terms of connectivity or computational control and energy resources. These systems are significantly very much different from the goals of the standard principle of security facets in distributed system [4]. Ubiquitous Computing may have hundreds or in fact thousands of tiny independent yet connected machines dispersed in the atmosphere everywhere.

In the traditional and outdated (well, not yet but very soon) systems, the management turn out to be more and more thought-provoking and problematic, thus by creating the biggest requirement, for the enormous assortment of such machines is, to diminish the prearrangement expenses and preservation expenditures as well. The operational environment is not same for the mobile devices, so it is essential for these devices to be inevitably acquaint to such divergent environments. Unfortunately, the present-day protocols are not providing the features of scalability and flexibility, and the networks these days are also not static. An ad hoc style of arrangement is followed by the anonymous machines and services, once these are joining with each other in the network. Also, a specific task can be accomplished by Intelligent sensors, which are working in a quite similar style as of human being [5].

A. Advantages of Ubiquitous Computing

Ubiquitous computing is providing a lot many advantages to the architectural aspect which will in turn embedding all such advantages into the buildings themselves. Before we deliberate the advantages, it is worth putting a note here that ubiquitous computing has started to be considered as the trend of the near future by giving

the society a lot many new architectural functionalities [6]. Here are the topmost 7 advantages of ubiquitous computing specifically related to how this wonderful technology influences the architectural aspect of a building and the life of inhabitants there:

1) Emergent Behavior

There can be seen buildings having additional shapes and functionalities of being more dynamic and locomotive. Now the buildings seem to become more accustomed by showing behaviors which portrays the result of the amalgamation of the constructed designs of such buildings and the movements these buildings have. With the intention of running proficiently and artistically, all such buildings will eventually acquire the skills of learning at their own.

2) Convergence

In such hi-tech surroundings it is going to be a provision of interconnected digital technologies there, and a new type of distribution will be permitted by such interconnectivity which in turn will aid to eradicate numerous ordinary and routine responsibilities. One more thing to add here is, because there will be shared digital sites, from where the data will be drawn, it will cause smaller number of faults, and it is a more comfortable approach rather than having abundant facsimiles of the data which need to be kept updated on regular basis.

3) Information Processing

The information processing is going to be achieving a completely novel connotation, as the building's constructional plans and the architectural schemas are going to be a type of complex nervous system. To eradicate the need for humans to provide continuous input alterations, such building architectures will start creating a meaningful sense of data rather than just masticating the data.

4) Imperceptible

Smart surroundings are going to be entrenched with the computing technologies that is going to be typically almost invisible. All such surroundings will be having an architecture gaining several additional proficiencies, and of course without much visible untidiness.

5) Enhancing Experience

A kind of smart and hi-tech environment(s) is going to be crafted with the actuators and sensors because of the ubiquitous way of embedding of the computers in the foresaid environment(s) itself. In such buildings the architectural space is going to be slanted towards a specific target where the major concern will always be to fulfil the requirements of the inhabitants.

6) Decision-Making

Smart surroundings will aid inhabitants in their day-to-day living by making them enable to enhance their choice making capabilities. A decent architectural design will make such "Smart" surroundings supportive at crucial moments inside the architectural experiences. And all such surroundings are going to be more proactive than submissive [7].

7) Socialization

There will be more societal communications with the building architecture and, because of the embedding of hi-tech user interfaces within the building architecture, such intelligent building will exhibit a more societal rejoinder from the inhabitants living there in such hi-tech buildings [8].

III. NANOTECHNOLOGY

Nanotechnology can be considered something to be scientific, engineered, and technologically practiced at the scale of about 1 to 100 nanometers, which is popularly known as nanoscale. Nanotechnology is in fact, the learning and implementation of enormously trivial objects/substances, and eventually all these are being used or can be utilized transversely in entirely the additional science arenas [9]. This staggering piece of technology possesses the expertness to perceive and to operate on discrete constituent part (i.e. atom) and molecules. Now in this modern age the scientists and researchers are working deliberately hard to discover an extensive diversity of ways to create and manufacture the substances at nanoscale, so that the splendid benefit of their improved attributes can be utilized for the welfare of human society.

A. Structure of Nanotechnology

The structure of nanotechnology is based solely upon the nanomaterial. The definition of these nanomaterials may be stated as the materials whose typical dimension measure falls inside the nanometric reach, or in other words we may say that, in the range between one and quite a lot of hundreds of nanometers (preferably between 0 to 100nm) [10]. Fundamentally there are considered to be two approaches for synthesis of nanomaterials and the fabrication of nanostructures: Top Down Approach and Bottom Up Approach.

1) Top Down Approach

In the Top Down Approach, a big sized substance is shredded or cut in sequential manner, so that it can provide nanoparticles. This approach is as equivalent as to constructing a marble stone sculpture and it involves a considerable large amount of wastage during the synthesis process. Generally, it is used to create nanofibers.

2) Bottom Up Approach

In the Bottom Up Approach, the construction of the nanomaterial starts from the bottom itself as in the order of atom through atom, molecule through molecule and/or cluster through cluster. This approach is as equivalent as to constructing a home and the amount of wastage in this approach is quite less as compared in the Top Down Approach. This is the approach used currently in nanomaterial synthesis, but has a limitation over the size of the nanostructure to be built by the nanomaterial made by this process.

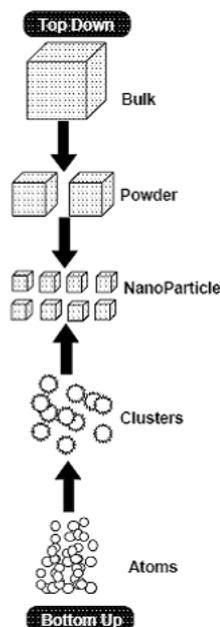


Figure 1. Approaches used for Nanomaterial Synthesis in Nanotechnology

B. Applications of Nanotechnology

Although the Nanotechnology has a very vast area of its applications, yet we have tried here to identify some of the major categories and/or areas, where this brilliant technology can be and/or is being used. And the list includes:

1) Medicine

Scientists in the research labs are putting all their best efforts to create tailored nanoparticles, those will be having size of a molecule, and will also be able to transport medications straight to the contaminated cells in the body of the patients. Such technique can greatly diminish the damage to the patient's vigorous cells, while applying some treatment over the contaminated cells, exactly as opposite as it does in the chemotherapy, for example.

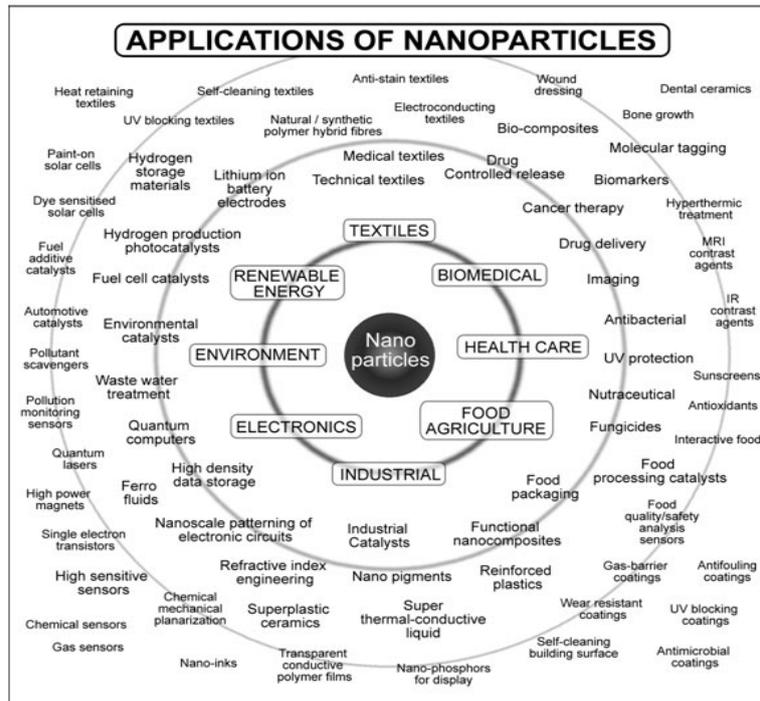


Figure 2. Applications of Nanoparticles in Nanotechnology

2) Electronics

With the help of Nanotechnology, the mass and electricity consumption of electronics peripherals can be condensed, and there is a huge possibility, which says that, this may, in turn, augment the proficiencies in such peripherals.

3) Food

Nanotechnology can be a great influential technology in the numerous facets of science discipline related to food, which may include the methodology used for growing and packaging of the food. Organizations are investing heavily in the research labs to create the nanomaterials for the same and these are going to provide a great significant change in the sense of taste as well as the security and safety measurements of the food.

4) Solar Cells

It is a great breakthrough, which proved an economical quotient and it is, that the organizations have successfully created nanotech solar cells which can be fabricated at an effectively cheaper price as compared to the traditional solar cells.

5) Batteries

As we know that the batteries are considered as a vital resource for energy backup. Keeping this in mind the organizations are nowadays using nanomaterials to create such power backup batteries. In fact, the big thing is that only one of such batteries can last up to tens of years and the additional battery can be meanwhile charged. And it's needless to say that such nanotechnological batteries will be having the feature of getting recharged faster as compared to the traditional batteries.

6) Space

Space flights can be made a lot more real-world with the help of this important nanotechnology. Now the spacecrafts can be made a lot lighter in weight and also there is a possibility for a cable for the space elevator. All this is possible because of the progressions in the nanomaterials. This can also make the travel costing, of approaching orbit and roving in the space, to a significant lesser amount, because the quantity of fuel required by the space rocket is abridged to a significantly lesser volume.

7) Fuels

With the help of nanotechnology, the problem of related to the scarcity of gasoline, petrol and diesel can be worked upon competently, and this can be done producing the fuels using cheaper mediocre raw resources, thus making the whole process cost-effective and resourceful. It can also aid in accelerating the average of locomotives [10].

8) Better Air Quality

There are catalytic agents being practiced to transmute fumes into non-poisonous gasses and these fumes are coming out from vehicles and/or manufacturing factories. This is made possible because of the nanoparticles being utilized to make the catalytic agents which are having a larger surface area helping it in interacting to the reacting substances, and such catalytic agents are thus performing better than those catalytic agents made of bigger particles [11]. Effectiveness of the catalytic agents are increased because of their larger surface area which helps these agents to interact with more substances at the same time.

9) Cleaner Water

Nanotechnology can be a very helpful technology to provide remedies to very big various problems related with the quality of water. One of the such biggest encounter is to get rid of manufacturing plants wastes from groundwater. The polluting substances can be transformed into no harm substances using nanoparticles via a chemical reaction [12]. The ground water, contaminated with harmful substances, can also be cleaned with this wonderful technology at a quite lesser cost, making it an economical solution for this big problem.

10) Chemical Sensors

Highly efficient and significantly economic chemical sensors can be designed with the aid of nanotechnology. Such nanotechnology established sensors can be made up of several types of detecting components having small sized nanoparticles which permits the sighting of chemical fumes having an extremely low concentration.

11) Sporting Goods

The market of sports gears and accessories is quite large and the nanotechnology can make it to grow even on a larger scale by nanotechnological applications [13]. The nanoparticles can be intelligently fused into the sports gears which makes these gears more efficient and player friendly.

12) Fabric

Everyone's life has some direct and/or indirect application of products made up of fabric. There are hundreds, even thousand types of fabric quality are available in the market. The nanoparticles can be infused into the fabric at the time of sewing itself and this definitely provide enhancements into the fabric attributes [14]. This significant upgradation to the fabric properties can be achieved without making any noticeable change in mass, depth, and/or durability of the fabric.

IV. CONCLUSIONS

In this paper the authors, have put their genuine efforts to enlighten the significance of persuasion in Nanotechnology which is considered to be one of the fundamental and brilliant aspect of Ubiquitous Computing Systems. The basic fundamental concepts and the advantages of Ubiquitous Computing are explicated first by the authors. Followed by which, the Nanotechnology has been described with its architecture showing how it actually works. The major application areas of nanotechnology are being enlightened in the last section showing how exactly this astounding piece of technology can be utilized in the everyday human life.

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