Nanotechnology in computer science assignment

Furthermore. Nanotechnology products must provide not only improved performance but also lower cost. 9. 3. 1 Properties at the Nacelles: Magnetic, Mechanical and Chemical Nacelles materials also have size-dependent magnetic behavior. Mechanical properties and chemical reactivity. At en-small sizes (a few manometers). Genetic nomenclatures have a single magnetic domain, and the strongly coupled magnetic spins on each atom combine to produce a particle will. A single “ giant- spin. For example. The giant spin of a ferromagnetic iron particle rotates freely a room temperature for diameters helm’ about 17 manometers. N effect tended super-paramagnets Mechanical properties of unstructured materials can reach exceptional strengths. A 2 NM aluminum oxide is introduced which precipitates into thin films of pure nickel, resulting in) tell strengths increasing from 0. 15 to 5 capitals. Filch is more than thrice that for a hand bearing steel. Another example of exceptional mechanical properties at the nacelles is the carbon annotate which exhibits great strength and stiffness along its longitudinal axis. The preponderance of surfaces is a major reason for the change in behavior of materials at the nacelles.

The atoms IR nonstructural have a higher average energy than atoms in larger structures, because of the large proportion of surface atoms. For example. Catalytic materials ha) c a greater chemical nil) itty pet atom of exposed surface as the catalyst is reduced in size at the nacelles. Defects and impurities may be attracted to surfaces and interfaces, and interactions between particles at these small dimensions can depend on the structure and nature of chemical bonding at the surface. Molecular monolayer’s may be used to change or control sesame properties and to mediate the interaction between inappropriate.

In biology, surfaces and their interactions with molecular structures Contents Search interaction of nanotechnology and biotechnology offers the possibility of chic. Inning new functions and properties with unstructured surfaces. In this surface and interface-dominated regime, biology does an exquisite Job of selectively controlling functions through a combination of Truckee and chemical forces. The transcription of information stored in genes and the selectivity of biochemical reactions based on chemical recognition of complex molecules are examples where interfaces play a eke) role in establishing nacelles behave)our.

Sensors are central to almost all modern control systems. For example. Management. Emission control. Security. Safety. Comfort. Vehicle monitoring and diagnostics. While such traditional applications of physical sensing generally rely on microcosmic sensing do ices, the ad) . NET of nacelles materials and structures has led to new electronic. Photonic. ND magnetic nanoseconds. Because of their small size. nanoseconds exhibit unprecedented speed and sensing its. Extending in sonic cases do” O to the detection of single molecules. For example. Anon’ ire’s made of carbon annotates. Silicon, or other semiconductor materials exhibit exceptional sensitivity to chemical species or biological agents. Electrical current through narrowness can be altered by having molecules attached to their surface that locally perturb their electronic band structure. By means of narrowness surfaces coated with sensor molecules that selectively attach particular species, change-induced changes in rent can be used to detect the presence of these species. This same strategy is adopted FRR many classes of sensing system. 9. INFORMATION TECHNOLOGY Information processing depends on the continued application of Moor’s Law, which predicts a regular doubling of the number of transistors that can be placed on a computer chip. This has produced exponential improvements in computing speed and price performance. Current computer technology is based on the complementary metal oxide semiconductor (COSMOS). The present generation of computer chips ahead) depends on features as small as 7(1 manometers. Foreseeable ads encase in nanotechnology are likely to extend COSMOS technology) out to the) ear 2015. Flowedere. At transistor densities beyond that.

SO real problems begins to arise. One is the dramatic escalation in the cost of a new fabrication plant to manufacture the chips. These costs must be amortized in the cost of the transistors, keeping them expensive. Second. It becomes increasingly difficult to dissipate the heat caused by the logic devices. Lastly. At such small distances, electrons increasingly tuned between materials rather than going through the paths programmed for them. As a exult of these constraints, any contamination of Moor’s law much beyond 201 5 is likely to require the development of one or more new technologies.

Future advances “ ill likely bring us closer to a world of free memory. Ubiquitous data collection, massive serial processing of data using sophisticated software, and lightening fast. Always-on transmission. The advances in computer science combined with a much better understanding of how the human brain works should allow research to develop software capable of duplicating and even import Inning on many aspects of human intelligence. Expert software now outperforms the best humans in a variety of asks simply because it has instantaneous access to a vast store or information that it can quickly process.

Semiconductor experts agree that the ongoing shrinkage in “ conventional-electronic dye, ices will Me% tabs) reach fundamental limits due to quantum effects such as -tunneling- in w Inch electrons Jump out of their prescribed circuit path and create atomic scale interference between do ices. At that point, radical new approaches to data storage and information processing will be required for further ACH encase. For example. Radically new systems have been imagined that are based on quantum computing or bimolecular computing. . 4. 1 Molecular Electronics and Components Molecular electronics. %WI molecular us itches and circuits only a fee atoms wide. Offers the possibility of using molecular components issues to be addressed before this technique can be De% eloped fully. However. En defect-tolerant architecture for computing make highly integrated molecular electronics a possibility. The use of molecules for electronic devices was suggested by Mark Ratter of North Western University and . Aviva Viral of IBM as early as the sass. But proper nanotechnology tools did not become available until the turn of the 21 century.

Wiring up molecules some hat a nanometer wide and a few manometers long remains a major challenge, and an understanding of electrical transport through single molecules is only beginning to emerge. A number of groups hay c been able to demonstrate molecular switches. For example, which could be used in computer memory or logic arrays. Current areas of research include mechanisms to guide the selection of molecules. Architectures for assembling molecules into nacelles gates. And three-terminal molecules for transistor-like behavior. More radical approaches include DNA computing. Here single-stranded DNA on a silicon hip would encode all possible variables values. And complementary strand interactions would be used for a parallel processing approach to finding solutions. An area related to molecular electronics is that of organic thin-film transistors and light emitters. Which promise new applications such as video displays that can be rolled out like wallpaper and flexible electronic newspaper. 9. 4. 2 Nanotechnology Research In IT: Annotates and Narrowness Carbon annotates has e remarkable electronic, mechanical and chemical properties.

Depending on their specific diameter and the bonding arrangement of their carbon atoms. Annotates exhibit either metallic or semiconductors behavior. Electrical conduction within a perfect annotates is ballistic (negligible scattering), with low thermal dissipation. As a result, a wire made from a annotate. Or narrowness can carry much more current than an ordinal.) metalwork of comparable size. At 1. 4 manometers in diameter. annotates are about a hundred times smaller than the gate width of silicon semiconductor devices.

In addition to narrowness for conduction, transistors, diodes and simple logic circuits have been demonstrated by combining metallic and semiconductor carbon annotates. Similarly. Silicon narrowness have been used to build experimental devices, such as field-effect transistors, bipolar transistors. Inverters. Light-emitting diodes, sensors and even simple memory. A major challenge for narrowness circuits, as for molecular electronics, is connecting and integrating these devices onto a workable high-density architecture. Ideally, the structure would be grown and assembled in place.

Crossbar architecture that combines the functions of wires and devices is of particular interest. 9. 4. 3 Carbon Annotates Carbon annotates. Long thin cylinders of atomic layers of graphite. Ay be the most significant new material since plastics are the most significant of today’s materialness. They come in a range of different structures. Allow Inning a wide variety of properties. They are generally classified as single-)) ailed (SENT). Consisting of a single cylindrical wall. Or multiplied annotates (MINT) which has cylinders within the cylinders. When the press mentions the amazing properties of annotates. T is generally SENT they are referring to. The following table summarizes the main properties of SENT: Carbon nu notates and their applications Carbon annotates are perhaps the best Sumo Alicia in 1991. The appearance of Coin is that of large bundles of cylinders, fibers, rods and tubes. tit double nails, open or closed ends and straight or spiral forms of hexagonal carbon rings. A number of research articles published shim that En applications arc being introduced every year. Carbon annotates have unique properties such as structural flexibility, rigidity and strength (stress resistance).

They are about lot) times than steel at one-sixth the weight. They can act as either conductors (metallic) or semiconductors (non-metallic) depending on symmetry. Orientation. Patterning. Truckee (shape and size) and structural properties. They also possess an intrinsic super conductive ninth the capacity to carry an electric current a thousand times better than copper. They are ideally thermal and can behave as electron field emitters.

Applications of CNN structures are in automobiles bumpers and tires, a multitude of electrical and electronic device applications to textiles. According to the INCH. rent CNN uses one principally in sporting goods equipment as the supporting structure of bicycles, self clubs and tennis because of the lighter weight. Stiffness and strength they provide. Although. Not considered a form of graphite. Cants are forms of carbon. Diamonds. Fullness and graphite are the other three. CNN structure have some of the same potential applications that are listed as end uses of graphite. Automobile brake linings and tiles. Batteries fuel cells and other carbon products. With this potential. The use of Cants may often affect the consumption and production of graphite. Bustling for and possibly replacing graphite in some of its end uses. Experiments whine soon n that electron transfer kinetics takes place faster on Cants than other carbon material. With the potential for numerous electronic applications, the use of Cants may ha% e a similar effect of changing the consumption and end use of copper and silicon by the electronics industry,. Examples include CNN interconnects replacing copper interconnects (copper narrowness) on silicon chips. Copper interconnects on silicon chips are getting smaller and thinner. As silicon chip becomes smaller, the efficiency of copper as a conductor drops. Emitting the use of these interconnects. A possible replacement could be metallic single walled CNN structures, which can conduct electricity with no resistance, sometimes called “ ballistic conductivity-. Because of their ability to act as either a conductor or variable socioeconomic torso. CNN structures arc considered a top candidate to replace the silicon in computer chips as N’, ell. When current chip features become too small. In 10 to 15 years. 9. 4. 4 Narrowness Narrowness are sensing wires across a microcircuit channel.

These narrowness by nature had incredible properties of selectivity and specificity.

As particles flow through the microcircuit channel, the nowhere sensors pick up the molecular signatures of these particles and can immediately relay this information through a connection of electrodes to the outside world. These indecisive are man-made constructs made with carbon, silicon and other materials that have the capability to monitor the complexity of biological phenomenon and relay the information, as it is monitored. To the medical care provider. They can detect the presence of altered genes associated with cancer and may help researchers pinpoint the exact location of those changes. 9. NANOTECHNOLOGY RESEARCH: SINGLE-ELECTRON TRANSISTORS At nonsocial dimensions. The energy required to add one additional electron to a becomes significant. This change in energy provides the basis for devising single- electron transistors. At low temperatures. N here thermal fluctuations are small. Various single-electron-devices use unstructured are readily achievable and extensive research has been carried out for structures with confined electron flow. However. Room-temperature applications will require that sizes be reduced significantly to the one nanometer range to achieve stable operation.

For large scale applications with millions of devices, as found in Current integrated circuits. The need for Structures with very uniform size to maintain uniform device characteristics presents a significant challenge. Also. N this and many indecisive being explored. The lack of gain is a serious drawback limiting implementation in large scale electronic circuits. 9. 5. 1 Nanotechnology Research in IT Spittoons Spittoons refers to electronic devices that perform logic operations based on not Just the electrical charge of carriers but also their spin. For example. Information could be transported or stored through the spin-up or spin-doss n states of electronics. This is a En area of research. And issues include the injection of spin-popularized carriers, their transport. And detection. The role of nacelles structure and electronic repertories of the ferromagnetic semiconductor interface on the spin injection process. The growth of new ferromagnetic semiconductors with nacelles control, and the possible use of unstructured features to manipulate spin are all of interest. 9. 5. 2 Novel Semiconductor Devices An example of such des ice is based on spittoons.

The dependence of the resistance of a material (due to the spin of the electrons) on an external field is called magneto resistance. This effect can be significantly amplified (GEM- Giant Magneto Resistance) for unionized objects. For example when two ferromagnetic layers are separated by a non-magnetic layer, which is several manometers like (co-cue-co). The GEM effect has led to a strong increase in the data storage density of hard disks and made the gigabyte range possible. The so-called tunneling magneto resistance (TM) is very similar to GEM and is based on the spin dependent tunneling of electron through adjacent ferromagnetic layers.

Both (MAR and MIR effects can be used to create a non-volatile main memory for computers. Such as the so-called magnetic random access memory or MR.. AM. In 1999, the ultimate COSMOS transistor developed at the laboratory for Electronics and Information Technology in Greenbelt. France. Estes the limits of the principles of the MOSSES transistor with a diameter of 18 mum (approximately 70 atoms placed side by side). This was almost one-tenth the size or the smallest industrial transmitted in 2003 (130 NM in 2003. 90 NM in 2004. 65 NM in 2005 and 45 NM in 2007). It enabled the theoretical integration of seven billion animations on a El coin.

However. The COSMOS transistor. Which was created in 1999. Was not a simple research experiment to study how COSMOS technology functions. But rather a demonstration of how this technology functions. Now that we ourselves are getting even closer to working on a molecular scale. Today it would be impossible to master the coordinated assembly of a large number of these transistors on a circuit and to create this on an industrial level. 9. 5. 3 Nanotechnology Research in IT: Information Storage speed. Solid state electronic memories as well as slower (but generally more spacious) magnetic and optical discs.

As the minimum feature size for electronic processing approaches 100 manometers. Nanotechnology provides ways to decrease further the bit size of the stored information, thus increasing density and reducing interconnection distances for obtaining still higher speeds. For example. The basis of the current generation of magnetic disks is the giant magneto resistance effect. A magnetic read/writes head stores bits of information by setting the direction of the magnetic field in nanometer thick metallic layers that alternate between ferromagnetic and non ferromagnetic.

Differences in spin-dependent scattering of electrons at the interface layers lead to resistance differences that can be read be the magnetic head. Mechanical properties. Particularly trilogy (friction and wear of moving surfaces), also play an important role in magnetic hard disk drives, since

Genetic heads float only about 10 manometers above spinning magnetic disks. Another approach to information storage that is dependent on designing nanometer- thick magnetic layer is under commercial development known as magnetic random access memory (MRS.).

In this a line of electrically switchback magnetic material is separated from a permanently magnetized layer by a nacelles nonmagnetic interlayer. A resistance change that depends on the relative alignment of the fields is read electrically form a large array of wires through cross lines. MRS. will require a relatively small evolution from conventional semiconductor manufacturing. ND it has the added benefit of producing-volatile memory (no power or batteries are needed to maintain stored memory states). Still at an exploratory stage. Tidies of electrical conduction through molecules has e generated interest in their possible use as memory. While still very speculative molecular and narrowness approaches to mentors are intriguing because of the small solute in which the bits of memory are stored and the effectiveness with which biological systems store large amounts of information. 9. 5. 4 Nanotechnology Research in IT: Communications Nacelles structuring of optical devices. Such as v arterial cavity surface-emitting lasers (Vessels). Quantum dot lasers. ND photonic crystal materials is leading to additional advances in communication technology 9. 6. 3 Novel Optoelectronic Devices In the modern information technology, traditional analog electrical devices arc increasingly replaced by optical or optoelectronic devices due to their enormous bandwidth and capacity. Respectively. Two promising examples are photonic crystals and quantum dots. Photonic crystals are materials with a periodic variation in the refractive index with a lattice constant that is half the wavelength of the light used. They offer a selectable band gap for the propagation of a certain wavelength. Hush they resemble a semiconductor. But for light or photons instead of electrons. Quantum dots are nanosecond objects. W hick can be used. Among many other things. For the construction of lasers. The advantage of a quantum dot laser over the traditional semiconductor laser is that their emitted wavelength depends on the diameter of the dot. Quantum dot lasers are cheaper and offer a higher beam quality than conventional laser diodes. 9. 7. 2 DISPLAYS The production of displays with low energy institution could be accomplished using carbon anabases (CNN).

Carbon annotates can be electrically conductive and due to their small diameter of several emission displays (FED). The principle of operation resembles that of the cathode ray tube. But on a much smaller length scale. 9. 7. 3 Quantum Computers Entire new approaches for computing exploit the law s of quantum mechanics for novel quantum computers. Which enable the use of fast quantum algorithms. The quantum computers will have quantum bit memory space terms cubit for several computations at the same time. 9. 7. 4 Computational Design Recently developed experimental tools. Tabby synchrotron x-radiation and nuclear magnetic resonance. Have revealed the atomic structures of many complex molecules. But this knowledge is not enough: we need to understand the interactions of atoms and molecules in the recognition and sometimes the transduction stages of sensing. The availability of powerful computers and algorithms for simulating nacelles interaction means that we can design nanoseconds computationally not Just experimentally. But using the molecular dynamics code and calculations that are already fundamental tools in nanotechnology .

Nanotechnology to Enable A New Kind of Computer Memory A Million Times Faster Published on February 23, 2010 at 8: 01 PM A radical new kind of computer memory will be a million times faster than existing hard-drives, a leading expert in the field of nanotechnology announced today in Sydney. It will use nanotechnology to manipulate data like cars on tiny racetracks. Many IT researchers have predicted the end of Moor’s Law – which essentially says that computers will double in speed every two years. They’ve told us we’ll need light or quantum computers. But Dry Stuart Parking, an experimental physicist at IBM in San

Jose, California, is performing miracles with more conventional electronics. He told the ‘ COIN conference that the “ racetrack memory” chips he and his team are developing will be dramatically faster, more powerful and more reliable than today’s hard disks. “ We want to replace the entire disk drive with a chip that is solid state,” Dry Parking says. “ Basically it’s a disk drive on a chip. It would be entirely reliable, a million times faster and use a lot less energy. ” To make the new racetrack memory, Dry Parking’s team uses nanotechnology to build a forest of tiny metal wires that stand up from a silicon wafer.

You store the data in the magnetic narrowness,” he says, “ and you bring the data up and down the tracks like race-cars. ” The data itself is encoded using a new form of technology called “ spittoons”, which uses one of the fundamental properties of electrons, known as spin. Dry Parking’s team has already transformed computing once before with a combination of spittoons and nanotechnology. About a decade ago they developed a new kind of hard disk reader called a “ spin-valve” or magnetic tunneling Junction.

These readers, made up of metallic sandwiches built from layers of single atoms, increased the storage capacity of hard drives 1000-fold. Most digital data today, such as the information that makes up the internet, is stored in these magnetic hard disk drives. But their rotating disks and moving read/write heads make these drives unreliable and slow. Crashes happen relatively often, sometimes resulting in the catastrophe of lost data. It can also take these drives up to 10 milliseconds to read the first bit of requested data. “ In computers, 10 milliseconds is an eon,” Dry Parking says. A modern processor can perform 20 million operations in that time. ” That’s why computers also use a second type of storage, solid-state memory, for actually doing their computational heir own problems, losing data when the computer powers down or crashes. A third kind of memory can retain data when the power is off. This is used in smart phones and other handheld devices, but there is a trade-off between cost and performance. The cheapest of this kind of memory is a kind called flash memory, which is the basis of flash drives.

But there are problems with this kind of memory, too, as it is slow and unreliable in comparison with other memory chips, and becomes unusable relatively quickly. Racetrack memory could overcome all these problems and, in doing so, transform the computing world, Dry Parking says. It will put a greater richness of information at your fingertips. ” It could also make computers themselves cheaper and more robust, he says. Over the past three or four years, Dry Parking's group have shown in principle that their annotate racetrack chips work. He estimates that it could take another five to eight years before a product will be ready for manufacturing.

Looking even further ahead, Dry Parking will tell the conference about a more futuristic idea he has for using spittoons to build what he calls a " brain in a box" that uses spittoons to mimic the way human brain cells are connected. " It's Seibel that we could build computers that might think like the brain," he said. " But that's a very long way off. " " Stuart Parking and his team's remarkable work is a great demonstration of nanotechnology in action," says Proof. Andrew Dakar, ICON co- chair and director of the Semiconductor Infiltration Facility at NUNS.

Improving Computer Memory with Nanotechnology By Earl Bosses and Nancy C. Emir from Nanotechnology For Dummies, 2nd Edition Researchers are using nanotechnology to create other types of computer memory, attempting to leapfrog flash memory that is dominant in today's marketplace. Various companies and universities are developing four methods of using narrowness or inappropriate to increase the amount of memory stored on solid-state drives. Make memory with memoirs Hewitt Packard is developing a memory device that uses narrowness coated with titanium dioxide. One group of these narrowness is deposited parallel to another group.

When a perpendicular nowhere is laid over a group of parallel wires, a device called a merits is formed at each intersection. A merits can be used as a single-component memory cell in an integrated circuit. By reducing the diameter of he narrowness, researchers believe merits memory chips can achieve higher memory density than flash memory chips. Nowhere race tracks Magnetic narrowness made of an alloy of iron and nickel are being used to create dense memory devices. Researchers at IBM have developed a method to magnetized sections of these narrowness.

By applying a current they can move the magnetized sections along the length of the wire. As the magnetized sections move along the wire, the data is read by a stationary sensor. This method is called race track memory because the data races by the stationary sensor. The plan is to grow hundreds of lions of U-shaped race track narrowness on a silicon substrate to create low-cost, high-density, and highly reliable memory chips. Silicon dioxide memory sandwiches Another method of using narrowness is being investigated at Rice University. Researchers at Rice have found that they can use silicon dioxide narrowness to create memory devices.

The nowhere is sandwiched between two electrodes. By applying a where the nowhere sits between two electrodes becomes a memory cell. The key to this approach is that researchers have found that they can repeatedly change the state of each memory cell between conductive and nonconsecutive without damaging he material’s characteristics. These researchers believe that they can achieve high memory densities by using narrowness with a diameter of about 5 NM and by stacking multiple layers of arrays of these narrowness like a triple-Decker club sandwich.

Annotated to store more data in smaller space An alternative method being developed to increase the density of memory devices is to store information on magnetic inappropriate. Researchers at North Carolina State University are growing arrays of magnetic inappropriate, called annotated, which are about 6 NM in diameter. Each dot would contain information determined by whether r not they are magnetized. Using billions of these 6-NM diameter dots in a memory device could increase memory density. It will be interesting to see how these methods, and the work by existing memory manufacturers to improve existing memory storage devices, pan out.

Which type of memory devices we’ll be using 5 or 10 years from now will come down to the right mix of memory density, power consumption, data read and write speeds, and which technique attracts the funding to build manufacturing plants. HOST: Anna-tech will double hard disk capacity in 10 years Self-assembling molecules to boost drive density HOST, the Western Digital subsidiary formerly known as Hitachi Global Storage Technologies, says it has developed a method of manufacturing hard-disk platters using nanotechnology that could double the density of today’s hard drives.

The new technique employs a combination of self-assembling molecules and nonirritating, technologies previously associated with semiconductor manufacturing, to assemble patterns of tiny magnetic “ islands,” each no more than 10 manometers wide – the width of about 50 atoms. The resulting patterns are composed of 1. 2 trillion dots per square inch, where each dot can store a single bit of information. That’s roughly twice the density of today’s hard-disk media, and HOST researchers say they are Just scratching the surface of what can be achieved. With the proper chemistry and surface preparations, we believe this work is extendible to ever-smaller dimensions,” HOST fellow Tom Albrecht said in statement. The aforementioned self-assembling molecules are so called because they are built from segments of hybrid polymers that repel each other. When coated onto a specially prepared surface as a thin film, the segments line up into perfect rows, like magic. Once so arranged, the tiny alluding blocks can be manipulated using other chip-industry processes to form the desired structures before being impersonated onto the disk substrate.