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IMPLEMENTATION OF NOKIA MORPH TECHNOLOGY

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Abstract
In business a product could have a shorter life if it can't win the hearts of people and showcase new technology , so take the case of Nokia , who is coming up with the Nokia Morph flexible mobile phone which the company claims the include nanotechnology and would immensely benefit its end-users . The main benefit of Nanotechnology is that its Components are flexible, transparent and extremely strong. The company believes this latest technology would be a distinctive phone by 2015, but a few technical glitches remained to be solved like the use of new battery materials etc. Nokia morph is a joint technology concept, developed by Nokia Research Centre (NRC) and the University of Cambridge (UK). The morph demonstrate how future mobile device might be stretchable and flexible, allowing the user to transform their mobile devices into radically different shaped. It demonstrates the ultimately that nanotechnology might be capable of delivering: flexible materials, transparent electronics and self-cleaning surface. Nanotechnology enables materials and components that are flexible, stretchable, transparent and remarkably strong. Fibril proteins are woven into three dimensional meshes that reinforce thin elastic structures. Using the same principle behind spider silk, this elasticity enables the device to literally changes shapes and configures itself to the task at hand.

Introduction
Launched alongside The Museum of Modern Art "Design and the Elastic Mind" exhibition, the Morph concept device is a bridge between highly advanced technologies and their potential benefits to end-users. This device concept showcases some revolutionary leaps being explored y Nokia Research Centre(NRC) in collaboration with the Cambridge Nanoscience Centre(United Kingdom)-nanoscale technologies that will potentially create a world of radically different devices that open up an entirely new spectrum of possibilities.

Morph concept technologies might create fantastic opportunities for mobile devices:

- Newly-enabled flexible & transparent materials blend more seamlessly the way we live.
- Devices become self-cleaning and self-preserving.
- Transparent electronics offering an entirely new aesthetic dimension.
- Built in solar absorption might charge a device, while batteries become smaller, long lasting and faster to charge.
- Integrated sensors might allow us to learn more about the environment around us, empowering us to make better choices.

Morph could lead to mobile devices that use transparent materials, repel dirt and fingerprints, use solar energy to charge, and use integrated sensors to provide more information about the environment an idea that Nokia introduced earlier with its Eco Sensor Concept that involves a wearable mobile phone and a sensing device that analyzes a person's health and surrounding environment.

Various technology used
Nanotechnology
According to Lynn E. Foster Nanotechnology may one day lead to low cost manufacturing solutions, and offers the possibility of integrating complex functionality at a low price. Nanotechnology also can be leveraged to create self-cleaning surfaces on mobile devices, ultimately reducing corrosion, wear and improving longevity. Nanostructures surfaces, such as "Nanoflowers" naturally repel water, dirt, and even fingerprints utilizing effects also seen in natural systems.

It would also feature self-cleaning to prevent wear and tear based on nanostructures called 'Nano flowers' which do not absorb liquids fingerprints. The Nokia Morph phone would also include a detachable speaker that could clip onto the ear or connect to the phone as a speaker. In addition, the battery is solar powered with built in self-charging high density solar charging modules called 'Nanograss' which are capable of recharging faster than any other battery solution.

TRRAM
Develop a next generation TRRAM (Transparent Resistive Random Access Memory) for the first time in the world. Gweng-Su Rhim and Jae-Woo Park successfully developed a next generation TRRAM (Transparent Resistive Random Access Memory) based on resistance switching of metallic oxides. This result is significant in sense that they developed the first ever transparent memory

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device, which can become the foundation for future transparent electronic technology. Like the USB-typed flash memory, TRRAM is of the same kind with non-volatile memory device which stored data remain undeleted even when the power supply is cut off. But, TRRAM is only composed of transparent electrode and transparent oxide thin film over transparent glass or transparent plastic board, thus making itself appear transparent overall. Additionally, it provides manufacturing process much simpler than that of the existing silicon-based CMOS flash memory and it has an expected life of over 10 years.

Fig. Transparent Resistive RAM

Nanoscale Zinc Oxide

Nokia is exploiting these qualities to achieve strain-based electromechanically transducers ideal for touch sensitive (even direction-sensitive) surfaces. Arrays of ZnO nanowires can be fabricated at low temp.(roughly 70-1000C), providing compatibility with polymer substrates, such as polyethylene terephtalate(PET). By coating a substrate (silicon, glass, or PET) with an array of these ZnO nanowires and nanoparticles are nearly transparent, this technique can be used to develop compliant, touch-sensitive, active matrix arrays that sit on top of displays or other structural elements.

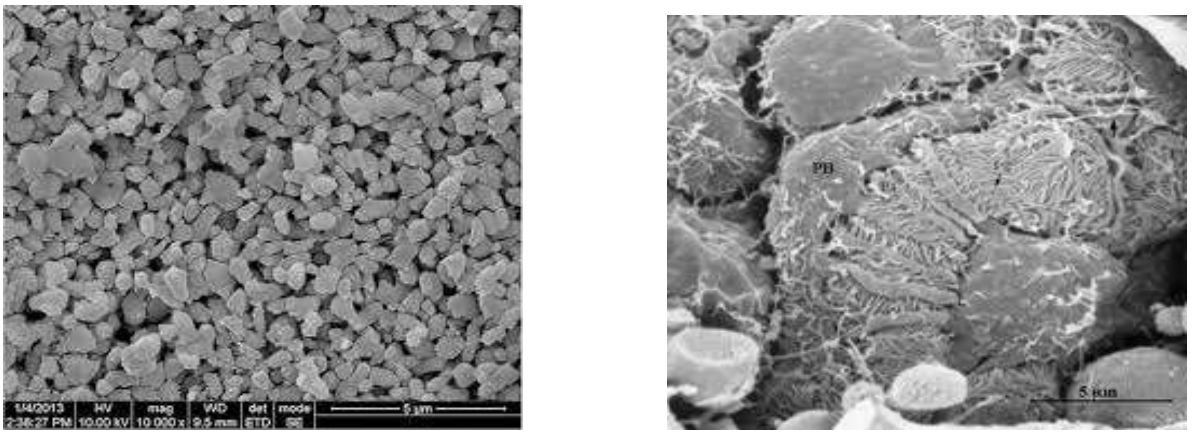

Fig: Scale bar: 5 micrometer

Nano-Enabled Energy

Nanotechnology holds out the possibility that the surface of a device will become a natural source of energy via a covering of "Nanograss" structures that harvest solar power. At the same time new high energy density storage materials allow batteries to become smaller and thinner, while also quicker to recharge and able to endure more charging cycles.

Enhanced energy harvesting and storage

Enhanced energy density batteries:

- Nanostructure electrodes for very low equivalent series R energy sources.
- New electrolyte solutions (ionic liquids) for safe and high power batteries.
- Deformable and bendable structures.

Super capacitors:

- Nano enhanced dielectrics for separator and high power capacitors
- Ultra-thin flexible structures, for ultimately distributed energy storage, and integration with battery structures.

Solar cell research:

The use of solar cells to power mobile phones was first demonstrated in 1997. This has been mostly due to cost and to the limited surface area of mobile devices. New lower-cost materials and photovoltaic devices based on nanotechnology may enable new solar energy solutions for mobile devices, as illustrated in the Nokia Morph concept. Nanograss is used for harvesting solar power. Nokia

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developed a full solid state, flexible Dye Sensitized Solar Cell (DSSC) using ZnO nanostructure that act as photovoltaic's which harvests solar energy.

Energy harvesting from rf using wideband antennas and using nems structures:

- Microwatt level energy harvesting from 'waste' energy in the air
- Charging battery from ultra-low power energy sources, and power management for that
- Harvesting RF energy

Fig. Harvesting Solar Power

Features and characteristics

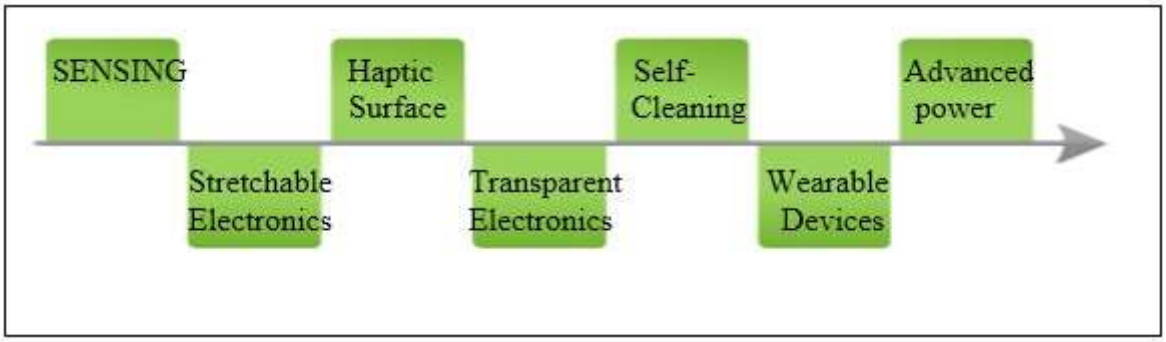

Fig. Representation Of features of Nokia Morph

Sensing

Nanosensors would empower users to examine the environment that includes analyzing pollutions, temperature etc. "Nanosensors" construct a complete awareness of the user context – both personal and environmental enabling an appropriate and intelligent response. In order to improve sensor and signal processing characteristics Nokia introduced NanoWire Lithography (NWL) process that fabricates a large area and self-aligned 3D architectures.

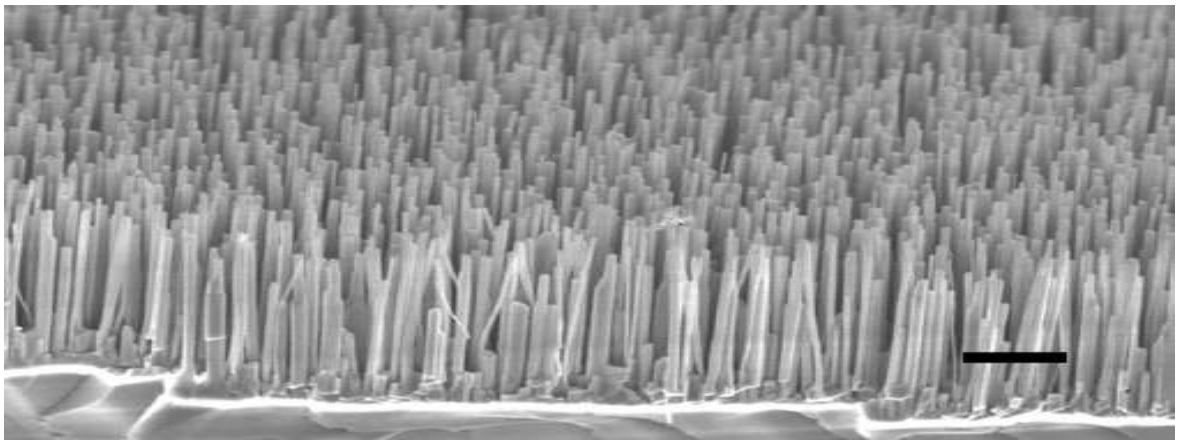

Fig: Sensing Surface

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Haptic Surface

Touch sensitive and responsive [haptic] surface of morph is provided by large area sensing surfaces using piezoelectric nanowire arrays. "ZnO" nano wires are used to produce the piezoelectric nanowire arrays. Buttons on the device surface are real 3D forms.

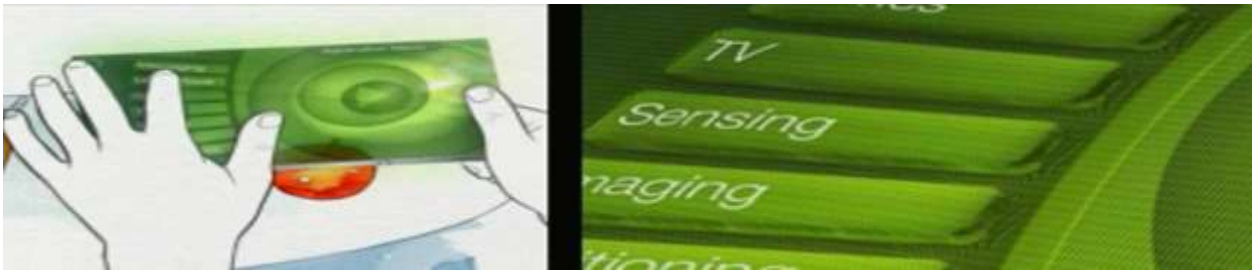

Fig. Haptic Surface

Self-Cleaning

Nanotechnology can be leveraged to create self-cleaning surfaces on mobile devices, ultimately reducing corrosion, wear and improving longevity. Nano structured surfaces such as "Nanoflowers" naturally repel water, dirt and even fingerprints utilizing effects also seen in natural systems. A nanoflower in chemistry refers to compound of certain elements that result in formations which in microscopic view resemble flowers or in some cases trees that are called as nano bouquets or nano trees. Nano structured surface known as nano flowers that naturally repel water, dirt and even finger-prints is used here. Double roughening of a hydrophobic surface, on the submicron and nanometer scale, creates super hydrophobicity. E.g. the dew droplet wouldn't remain on petals or leaf.

Advanced Power Sources

Polymer CNT composites with controlled conduction, nano tube enhanced super capacitors and nano composite solar cells etc acts as the power sources. Energy harvesting from RF using wideband antennas and using nano electro mechanical (NEM) method.

Stretchable Electronics

The nano scale structure of the electronics enables stretching. Stretchable electronics structure allows device form factors. Nano scale internal structures controls the elasticity.

Strength of Spider Silk

A nano scale mesh of fibers similar to spider silk controls the stretching when device is folded. Fibril proteins are woven into a three dimensional mesh that reinforces thin elastic structures.

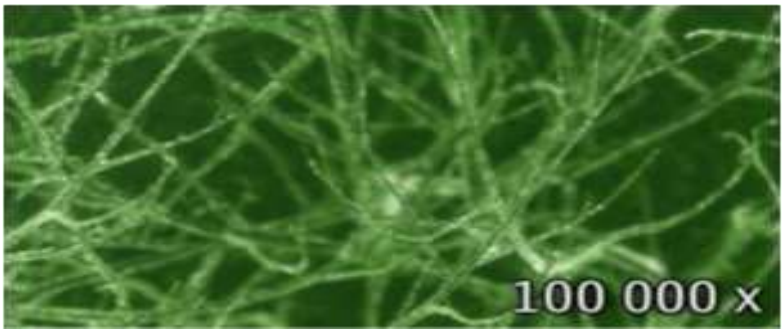

Fig. Stretchable electronics structure

Transparent Electronics

The whole electronic circuit inside morph device is entirely transparent. Nano scale electronics becomes invisible to the human eye.

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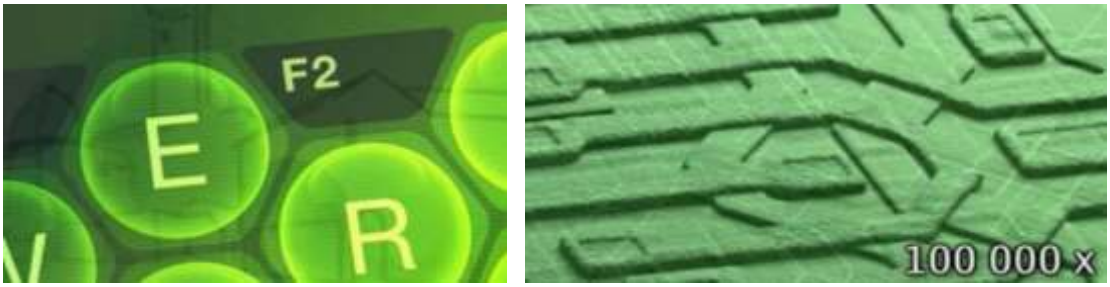

Fig. Circuit of Transperant Electronics

Wearable Device

It can be used as a wrist watch or band.

Fig. Wearable devices

New trends are evolving

Flexible, stretchable, thin, transparent conformal devices- enabled by Nanotechnology. Context aware device adapts and transforms its functionality according to the tasks wearable devices.

- Available always and everywhere
- New intuitive user interface
- Flexible, compliant and even stretchable structures are needed.
- New power source technologies.
- Functional coatings.

Future scope

Nanotechnology is just one key future research area of NRC, but an important one that will give us the freedom to design materials by manipulating atoms and molecules at the nanometer level. It hence has the potential of being both evolutionary and revolutionary when applied to mobile technology. A few years from now, phones will have new and innovative features different to the ones that are widely used today. Nokia Research Center (NRC) is working on technology up to seven years in the future and creating concepts that challenge conventional practices and spark new innovations.

1. The shapes could be made much Simpler like in ring shape.
2. Morph in open mode could act as a Keyboard for PC's.
3. The entire surface will be used for different purposes viz. charging, display, sensors, etc.

Conclusion

According to the developers, using nanotechnology can lead to low cost manufacturing solutions as well as adjustable, empowering devices, bringing us new, versatile possibilities. These mobile devices will be flexible, stretchable and shape changing, so that they can be easily integrated in our everyday routines without special adjustments on our part. Unfortunately, it might take close to decade until the elements of Morph might be available for integration into handheld devices. Nanosensors would raise the awareness of mobile devices users to the environment in a new way. When air pollution or bio-chemical traces and processes are right before our eyes, we will not be able to ignore them. It will also enhance our natural abilities and ease our daily decisions even on small matters such as whether or not to wash a certain fruit before eating it.

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