NOKIA MORPH TECHNOLOGY

Veenita Mathur[1], Jaya Raj[2], Keerti Chouhan[3], Vinita Thanvi[4]

[1]Jodhpur National University, Jodhpur, India, [2,4]Lecturer, Computer Department,
Mahila P.G. Mahavidhayalay, Jodhpur, India, [3]Lecturer, JIET College, Jodhpur, India
rishiveenita@gmail.com, jaya_raj09@ rediffmail.com, keertimec@gmail.com, thanvivinita@gmail.com

Abstract

Nokia Morph is the codename for the next generation smart phones that will feature flexible and stretchable OLED display. These displays can be folded easily and can fit easily in day to day life. Think of Morph as a snapshot of a new kind of mobility, made possible by a personal device that intelligently bridges local and global information. By sensing ambient elements, physical objects, and your individual context, the device adapts its form factor and functionality accordingly. Its appeal is undeniable: a wearable device that changes shape, detects toxins on your food, draws power from the sun, and repels a drop of honey. Morph isn't a product you can buy tomorrow, but it isn't science fiction either.

Keywords-*component-Nokia Morph, Nano grass*

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1. INTRODUCTION

The "Nokia Morph" is a theoretical future device based on nanotechnology that might enable future communication devices. It is intended to demonstrate the flexibility of future mobile devices, in regards to their shape and form allowing the users to transform them according to their preference. It describes how future mobile devices might be stretchable and flexible, allowing the user to transform their mobile device into radically different shapes. It demonstrates the ultimate functionality that nanotechnology might be capable of delivering: flexible materials, transparent electronics and self-cleaning surfaces. Nanotechnology can also be used to create self cleaning surfaces on next generation smartphones that will naturally repel water, dirt and even fingerprints from the screens. With the use of Nanotechnology in future screen displays will become a natural source of energy that harvest solar power. In addition to the advances above, the integrated electronics shown in the Morph concept could cost less and include more functionality in a much smaller space, even as interfaces are simplified and usability is enhanced. All of these new capabilities will unleash new applications and services that will allow us to communicate and interact in unprecedented ways."Fig.1"

Figure 1 Morph

2. HISTORY

Morph, a joint Nanotechnology concept developed by Nokia Research Center (NRC) and the University of Cambridge (UK) was launched alongside the "Design and the Elastic Mind" exhibition, on view from February 24 to May 12, 2008 at The Museum of Modern Art (MoMA) in New York City. Morph feature in both the exhibition catalog and MoMA's official website. Since the KOREAN ADVANCED INSTITUTE OF SCIENCE AND TECHNOLOGY(KAIST), developed a Transparent Resistive Random Access Memory (TRRAM), the idea of morph technology seems to be growing and Nokia Research Center collaborated with Cambridge University Nanoscience Center and initiated to develop this fairytale concept a reality and researches are still undergoing. Nokia also added a concept video regarding morph on YouTube which received 2.3 million viewers on its initial week. This technology enabled phones are expected to reach the global markets around 2015.

3. MOBILE GATWAY

The mobile device works at the center of our everyday life, interconnecting local intelligence-temperature changes, air pollution, our heart rate-with needed information and services. Mobile devices together with the intelligence that will be embedded in human environments – home, office, public places – will create a new platform that enables ubiquitous sensing, computing, and communication.

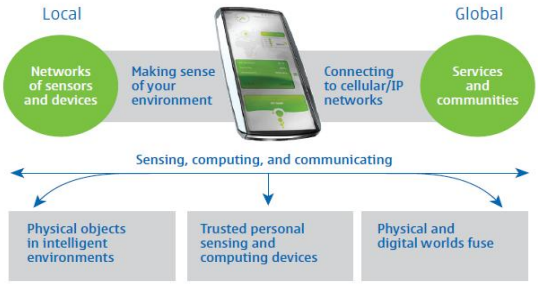

Figure 2 Mobile Gateway

Core requirements for this kind of ubiquitous ambient intelligence are that the devices are autonomous and robust. They can be deployed easily, and they survive without explicit management or care. Mobile devices will be the gateways to personally access ambient intelligence and needed information."Fig. 2"

4. SPECIFICATION OF NOKIA MORPH

- Network Configuration: 2G
- 2G Networks: GSM 850/900/1800/1900 MHz
- Display: Touch Screen
- Display Type: Li-Ion
- Dimensions: 110x49x19 mm
- Bluetooth: V2.0
- Keyboard: QWERTY
- Connectivity: Wi-Fi, Bluetooth v2.0
- Accessories: Charger, Hands free, USB Cable
- Memory: Flash
- Other Features**:** Camera, FM radio, mp3 Player, games

This description can make this device either a phone or a type of phone accessory. Either way, it is pretty futuristic. While the patent hasn't been granted yet, it is a pretty cool look at what the distant future of mobile technology could potentially look like.

5. EXPERTS OPINION ABOUT MORPH

- Dr Bob Iannucci, Chief Technology Officer, and Nokia commented***:-"Nokia Research Center is looking at ways to reinvent the form and function of mobile devices; the Morph concept shows what might be possible".***
- *Professor Mark Welland, Head of the Department of Engineering's Nan science Group at the University of Cambridge and University Director of Nokia-Cambridge collaboration added: "**Developing the Morph concept with Nokia has provided us with a focus that is both artistically inspirational but, more importantly, sets the technology agenda for our joint nanoscience research that will stimulate our future work together."***

6. VARIOUS NANOTECHNOLOGIES USED IN MORPH

Definition: - ***"The science, engineering and technology related to the understanding and control of matter at the length scale of approximately 1 to 100 nanometers".***

A. *Molecular Nanotechnology*

Molecular nanotechnology (MNT) is the concept of engineering functional mechanical systems at the molecular scale. [1] An equivalent definition would be 'machines at the molecular scale designed and built atom-by-atom'
Molecular nanotechnology is especially associated with the molecular assembler, a machine that can produce a desired structure or device atom-by-atom using the principles of mechanosynthesis.

B. *Advanced Power Sources*

Each and every mobile phone requires a power source. But in the case of morph it has got not one but many power sources. They are-

1) *Density Batteries:* It has got an enhanced energy density battery that is quicker to recharge and is able to endure more charging cycles. Batteries charge with Faradic charge transfer processes, in which electron transfer takes place at the electrode surface. The growing need for portable energy storage density brought about by miniaturization and the slim form factor requirement is driving the current development of lithium batteries. For a lithium battery, the standard material for the negative electrode is graphite.

2) *Super capacitors:* The supercapacitor, also known as *ultra capacitor* or *double-layer capacitor*, differs from a regular capacitor in that it has a very high capacitance. A capacitor stores energy by means of a static charge as opposed to an electrochemical reaction. Applying a voltage differential on the positive and negative plates charges the capacitor. This is similar to the buildup of electrical charge when walking on a carpet. Touching an object releases the energy through the finger.

3) *Solar Cell Research:* The use of solar cells to power mobile phones was first demonstrated in 1997. These early trials and the resulting development have not yet resulted in any significant consumer applications. 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 developed a full solid state, flexible Dye Sensitized Solar Cell (DSSC) using ZnO nanostructure that act as photovoltaic's which harvests solar energy."Fig. 3"

4) NEMS Method: Energy is also harvested from RF using wideband antennas or by using nano electro mechanical

(NEM) method. Microwatt level energy is harvested from waste energy in air.

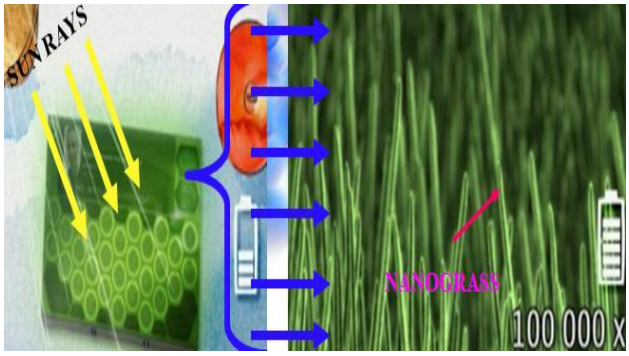

Figure 3 Harvesting Solar Power

C. *Nanograss*

Nanograss is a method to control the behavior of tiny drops of liquid using silicon surfaces resembling a lawn of evenly cut grass with "blades" that are each only a few nanometers in size. Bell Labs the research and development arm of Lucent Technologies researchers discovered it in 2004. A voltage builds up an electrical field at the tips of the nanograss, and that changes its wettability through an effect called electro wetting. That could allow the electrodes and electrolytes in a battery to remain separated until the battery is needed, extending its shelf life indefinitely. Conventional batteries discharge at the rate of 3% to 5% a month, even when not in use. Nanograss batteries will cost less and have far higher power-to-weight ratios, researchers predict.

D. *ZnO Nanowires*

ZnO exhibits an unusual combination of properties, including uniaxial piezoelectric response and n-type semiconductor characteristics. Nokia is exploiting these qualities to achieve strain-based electromechanical transducers—ideal for touch-sensitive (even direction-sensitive) surfaces. Arrays of ZnO nanowires can be fabricated at low temperatures (roughly 70-100°C), 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, the electrical signals on the surface can be activated by mechanical force.

E. *NANAWIRE LITHOGRAPHY on silicon*

To improve sensor and signal processing characteristics, nanotechnology can yield innovative fabrication techniques that exploit the building-block nature of nano components. Scientists at Nokia Research Center and the University of Cambridge have demonstrated versatile new Nanowire Lithography (NWL) process for fabricating a range of ultra small, large-area, and self-aligned 3D architectures. Nanowire lithography (NWL) uses nanowires (NWs) as etch masks to transfer their one-dimensional morphology to an underlying substrate. The method relies on electrochemical deposition and selective chemical etching.

F. *3D Architecture Using Nanowire Lithography*

Scanning Electron Mcroscope (SEM) image of deep nanowalls fabricated using nanowire lithography. The nanowire masks were initially dispersed from solution, and two of them were randomly assembled to form the € (euro) symbol. The symbol was then carved into the Si wafer using Deep Reactive Ion Etching (DRIE).

7. UNIQUE FEATURES OF MORPH

Morph phones are developing towards being trusted personal intelligent devices that have new fundamental capabilities:

- to sense and interact with the local environment via embedded short-range radios, sensors, cameras, and audio functionality;
- to function both as servers for global and local internet services and as clients for global internet services;
- to serve as gateways that connect local information and global Internet-based services;
- to carry the digital identity of the user and to enable easy-to-use secure communication
  and controlled privacy in future smart spaces;
- to make sense of and learn from both the local context and the behavior of its user, and optimize its radio access, information transport, and device functionality accordingly.

Features of Morph phone that make it unique are:

G. *Transperant*

The whole electronic circuit inside Nokia Morph is entirely transparent. Nanoscale electronics becomes invisible to human eye. The major platform for transparent electronics came into existence with the introduction of Transparent Resistive Random Access Memory (TRRAM) developed by KAIST.

H. *Transformable*

A transformation is defined in mathematics as a process by which a figure, an expression, or a function is converted into another that is equivalent in some important respect but is differently expressed or represented. In a similar way a transformable device has its own character but its functional and morphological appearance can be adjusted according to the context. The Morph device can essentially be transformed in many different ways: e.g., into a graphical user interface, or a mechanical configuration to increase the availability of applications and services. The user interface of the device can adapt to the needs of the user in terms of both its functionality

and its appearance. Transformability can be used to enable ease of use of the device, applications, and services."Fig. 4"

Figure 4 Various Modes of Morph

I. *Stechable and Flexible*

Stretchable electronics concerns electrical and electronic circuits and combinations of these that are elastically or in elastically stretchable by more than a few percent while retaining function. For that, they tend to be laminar and usually thin. Nokia are developing thin-film electronic circuits and architectures supported on elastomeric substrates which are robust enough to allow multi-directional stretching. Fibril proteins are woven into a three dimensional mesh that reinforces thin elastic structures."Fig. 5"

J. *Haptic Surface*

Touch sensitive and responsive (HAPTIC) surface of Nokia Morph is provided by large area sensing surfaces using piezoelectric nanowire arrays. ZnO nanowires are used to produce the piezoelectric nanowire arrays. Buttons on the device surface are in real 3D forms.

K. *Sensing the Environment*

Future environments and future devices will have capabilities to sense and analyze their measured data and make decisions based on the analysis. These capabilities will be based on sensors of varying levels of complexity. Meaningful sensors are always connected to a system with signal and data processing capabilities Nokia Morph can interact with the surrounding environment and is capable of providing key information for anything from temperature changes to pollution i.e. Morph can sense its surrounding. Nanosensors are used for this purpose and it empowers users to examine the environment around them in completely new ways, from analyzing air pollution, to gaining insight into bio-chemical traces and processes. 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.

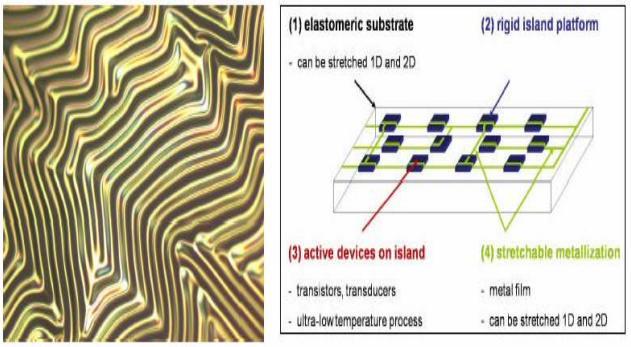

Figure 5 Stretchable Electronics of Morph

L. *Self-Cleaning*

Nanotechnology also can be leveraged to create self-cleaning surfaces on mobile devices, ultimately reducing corrosion, wear and improving longevity. Nanostructured surfaces, such as "Nanoflowers" naturally repel water, dirt, and even fingerprints utilizing effects also seen in natural systems. We all have seen a water droplet that beads up on a lotus leaf, it is due to the hydrophobic nanostructures and this principle is known as super hydrophobicity. The surface of Nokia Morph is similar to this.

M. *Intelligent Radio Surface*

Nanotechnology, with its methods for designing material properties, is displaying a totally new parameter space for electronic design, and this will inevitably change the current view of radio hardware in the long run. The most obvious potential of nanoelectronics lies in the size and scalability it will offer for RF architectures. Nanoelectronics may bring a change with its new domain of operation in which electrical quantities are no longer related to feature sizes in the same way as in macroscopic devices, and massively parallel RF computing becomes feasible. Ultimately, nanotechnology will change the physical form of radio equipment.

N. *Wearable Device*

Can be used as a wrist watch or band. In the Morph vision, the surface of the device—in fact, the entire device—is sensitive to both touch and movement.

8. ANALYTICAL STUDY OF MORPH

We analyze the features of the Nokia Morph with other Nokia advanced mobiles .We also compare the Nokia Morph Eco-friendly features with other mobiles that also have these. result is that Nokia Morph have some capabilities that are distinct from others. These areas-

- Stretchable And Flexible Electronics
- Self-Cleaning Surfaces
- It can sense it's surrounding environment
- Transparent Electronics
- It draw power from the sun for recharging
- Transparent Electronics.

CONCLUSIONS

Think Morph as a snapshot of a new kind of mobility made possible through nanotechnology and along with Nokia Research as their slogan says "Thinking, understanding and creating mobile innovations for cultures all over the world". Even as nanoscience is changing what's possible in a mobile device, the advantages it yields—faster, cheaper, smaller, more robust, more powerful—will overhaul the role of the mobile device in our world. Our challenge is to understand technologies today that will still make sense in 2015 or 2020—especially as new technologies lead to sometimes surprising applications.

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