

# EpiPhone – The Phone for Your Skin

**Areeb Mahmood(Author)**

B.Tech Mechanical

**Ahmad Nadeem(Co-Author)**

B.Sc. (Hons) Computer Applications

## ABSTRACT

Cellphones have become an integral part of our lives. An estimate made in September 2014 suggested that there are about 930.24 million cellphones in India alone. This huge number brings a lot of problems to the consumers like the headache of charging it from time to time and having a constant fear of losing it. We intend to minimize these problems and more through our concept, which involves designing a cellphone specifically for the palm.

This concept involves the fields of nanotechnology, bone conduction and bioelectricity to form the basis of the cellphone. A touch sensitive silicon display that is implanted just beneath the skin which acts as an interface between the hardware involved. Beneath the display is the energy efficient processor and various radios for communication, the latter being complemented through bone conduction technology. Its source of power is the body heat of the user. This concept tries to bring the Internet of Things to the human body.

## I. INTRODUCTION

Nanotechnology is the branch of Science involving the manipulation of matter on an atomic, molecular and supramolecular scale.[1] Nanotechnology is very broad in terms of size. Mostly due to the large fields of possible applications. Fields like surface science, organic chemistry, microfabrication etc. have made widespread use of it.[2]

Nanotechnology has become one of the most emerging technologies of the 21<sup>st</sup> century and is said to aid in developments in various fields which will be beneficial to citizens and improve industrial competitiveness. Due to the vastness of its applications, nanotechnology does not have a specific definition. Nanotechnology makes use of discovered properties of materials in the 1- 100 nm range, also currently the nanometer scale.[3]

The vision of nanotechnology was introduced in 1959 by late Nobel Physicist Richard P Feynman during a dinner talk. He said, “There is plenty of room at the bottom,” [4], proposing the employment of machine tools to make smaller tools, and hence reaching to the atomic level,

which he noted as “a development which I think cannot be avoided”. His suggestion included everything that is now the basis of most Nano-technological applications like Nano devices which can be used to make even smaller devices. And the possibility of making devices that are capable of operations which cannot be done due to human limitations.

Bone Conduction technology is a recent advancement in sound transmission. It involves the conduction of sound through the bones of the skull. This is achieved by the sending vibrations from the cranial bones directly to the basilar membrane instead of the eardrums that occurs in conventional methods. It also does not mask the ear canal, which means it does not block the ambient noise, which is beneficial in many cases.

Bioelectricity includes the science of generation of electricity through natural processes. This, in recent advancements, also includes the generation of electricity from the human body through the body heat.

Indian cellphone market is the second largest in the world. With current estimates suggesting the number of cellphones being north of 930 million.

Particulars	Wireless	Wireline	Total (Wireless+ Wireline)
<b>Total Telephone Subscribers</b> (Million)	930.20	27.41	957.61
Net Addition in September, 2014 (Million)	5.88	-0.12	5.77
Monthly Growth Rate	0.64%	-0.43%	0.61%
<b>Urban Telephone Subscribers</b> (Million)	547.70	21.85	569.56
Net Addition in September, 2014 (Million)	3.02	-0.06	2.96
Monthly Growth Rate	0.55%	-0.26%	0.52%
<b>Rural Telephone Subscribers</b> (Million)	382.50	5.55	388.05
Net Addition in September, 2014 (Million)	2.87	-0.06	2.81
Monthly Growth Rate	0.76%	-1.09%	0.73%
<b>Overall Tele-density*</b>	74.55	2.20	76.75
Urban Tele-density*	142.39	5.68	148.07
Rural Tele-density*	44.32	0.64	44.96
Share of Urban Subscribers	58.88%	79.74%	59.48%
Share of Rural Subscribers	41.12%	20.26%	40.52%
<b>Broadband Subscribers</b> (Million)	<b>60.61</b>	<b>15.13</b>	<b>75.73</b>

Fig-1 Telecommunication statistics of India (Sept. 2014)

They have become an integral part of our lives in the recent years. It has become a critical means of communication and brings the world a tad bit closer.

## II. EPIPHONE

The EpiPhone is the brainchild of the pondering of some issues which were brought upon due to the advent of cellphones in the mainstream market. Issues like fear of loss of the phone, the constantly increasing power requirements of modern phones have encouraged us to think of something that is innovative and futuristic thorough the recent advancements in technology.

The field of Nanotechnology is rapidly growing and recent works have brought many amazing concepts that can be applied in the near future for things in our daily life. It has enabled us to go further in size reduction and making electronics more portable than ever.

Various new studies can be applied to make the phone of the future. Bio-Implants can be used for making devices that remain with us all the time. Bioelectrical advances can solve the battery problems. Smaller and energy efficient processors can be used for the smooth operation of basic cellphone functions like calling and texting.

The EpiPhone is truly personal device as it is closer to than any cellphones ever produced. The Internet of Things (IoT), is slowly becoming more and more popular due to the advancements in internet technology. The EpiPhone brings the Internet of Things to the human body.

## III. WORKING

### A. PROCESSOR

The processor is the brain of the phone, interconnecting the various hardware used. It is the most vital component of the cellphone as it determines the capability of the functioning of the cellphone.

The EpiPhone consists of a tiny, yet powerful nano-processor which is highly energy efficient. It will be contained inside a full Controller Unit (CU). The CU will consist of the RAM, ROM, clock and I/O control unit. A low-power debugging port will also be present on the chip.



Fig-2 the Freescale Kinetis K102, a chip running on the same principles of the chip used in the EpiPhone

### B. DISPLAY

The display will be the main form of interaction between the user and the EpiPhone. It will be made of a flat, flexible, silicon and silicone. This lies benignly between the skin and muscle. And since it does not react to biological components of the human body and won't interfere with the processes that occur inside, it is an ideal choice for the display.

The display is a touch sensitive screen, which is enabled through gestures which are recognized through a sensor placed just beneath the screen. The other hardware is also embedded below the screen.



Figure 3- Display Concept for the EpiPhone [5]

### C. COMMUNICATION RADIOS

The communication radios will receive signals of the registered frequencies from the telecom operators. A cellular chip is responsible for identifying and authenticating the operations.

The Bluetooth radio enables the use of the bone-conduction headsets for taking calls. It will make use of the Bluetooth 4.0 LE (Low Energy) standard that will make it energy efficient.

Both the Bluetooth and Cellular Radio will be enclosed in a silicon cover which will add further protection.

#### D. POWER

The EpiPhone rids the dangers of using current battery technologies that could cause health concerns and the hassle of charging the battery again and again. Instead it will make use of the power of the human body, which is the generation of power through the body heat. This works on the constant power from our body heat which removes the problem of power storage by using a battery thus resulting in a compact form factor. A person at rest can produce 100 to 120 watts of power which is more than enough to power the EpiPhone[6]. The embedded thermoelectric generator converts the thermal energy of the human body to electrical energy.

#### IV. FUTURE ADVANCMENTS

The future holds a lot of advancements that can be incorporated in the EpiPhone making it more capable and useful for mankind. Smaller and efficient sensors could enable monitoring of various parameters of the human body like blood sugar level, blood pressure, etc. leading to better response to medical ailments.

Evolution in nanotechnology can rid the use of bone conduction headsets worn on the outside, instead nanobots can reside directly beneath the cranial bones and send vibrations to the basilar membrane.

Future technology can enable us to turn the EpiPhone into an all-purpose device through which we can do day to day tasks with relative ease.

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