International Journal of Emerging Technology and Advanced Engineering
Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 2, Issue 12, December 2012)

Emerging Trends in Information Technology

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***Abstract*— In recent years, we have seen a surge of new concepts in the field of Information Technology. Technologies are getting outdated in just a few years or even months. This paper presents some of the emerging trends in Information Technology namely Visual Information Gratification, Silent Sound Technology, 4G and Cell-All.**

***Keywords*— 4G, augmented reality, cell all, silent sound technology, visual information gratification**

I. Introduction

Centuries ago, communication was possible only via land mail. Then arrived the famous invention of Alexander Graham Bell - the telephone. But the telephone was strictly used for making voice calls. It is no match for the most remarkable invention in the field of telecommunication - the cell phone. The advent of cell phones has created a revolution in the world of telecommunication. Decades ago, to take a picture, people used to go to a studio. In the last century, cameras became popular. But today, chances are our cell phone is called a "smartphone" and came with a three-to-five megapixel lens built-in, and not to mention an MP3 player, GPS, or even a bar code scanner. Thanks to wireless data connection, it will update us when we get a new email; it will give us weather information, stock prices, and even give us a heads up on an upcoming calendar appointment.

II. Visual Information Gratification

After a decade of near-obsessive Googling, instant access to information with the right (textual) input is now expected, a way of life. The next frontier is visual info-gratification: users accessing information about objects encountered in the real world**,** in more natural ways and while on-the-go**,** simply by pointing their smartphones at anything interesting. And just as 'going online' is no longer limited to sitting in front of a computer (at a desk!), discovery will no longer be tied to text search. People will be able to immediately find out about anything they see or hear, even if they don't know what it is or can't describe it in words.

2013 will be about instant visual information gratification.

With textual search and textual information now being available to most people most of the time, the race is on to add a (useful) real world element – and by 'real world' we mean the world of objects and people.

A. Technologies

Visual Information Gratification is fuelled by the following technologies.

QR Codes: A QR Code is a two-dimensional barcode that can link to multiple kinds of data, including URL links, addresses, and text. QR stands for Quick Response. To access these QR Codes, all we need is a smartphone with a QR Code Reader installed. With the smartphone, we can scan a QR Code using the camera on the phone. From there, the code directs us to a piece of information, usually online. Each QR Code gives different data.

Figure1. QR code

While conventional bar codes are capable of storing a maximum of approximately 20 digits, QR Code is capable of handling several dozen to several hundred times more information since QR Code carries information both horizontally and vertically. QR Code has error correction capability. Data can be restored even if the symbol is partially dirty or damaged. QR Code is capable of 360 degree (omni-directional), high speed reading. QR Code accomplishes this task through position detection patterns located at the three corners of the symbol. These position detection patterns guarantee stable high-speed reading, circumventing the negative effects of background interference.

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Though QR Code usage isn't widespread, it is becoming increasingly popular. The relevance of this trend lies in the fact that common people will get acquainted with the idea that they can reveal extra information, entertainment, anything by just looking at an image through their phones. This also means that they will come to expect that every product – beginning with the major brands – will tell something about itself through visual recognition. No longer is this feature an exclusive experience for geeks and avant-garde users, who are willing to take a side step and dive into technical steps to get extra info.

Augmented Reality (AR): Augmented reality (AR) refers to the addition of a computer-assisted contextual layer of information over the real world, creating a reality that is enhanced or augmented. Various forms of augmented reality, starting with early head-mounted displays, have been around for more than 30 years. *[1]*Over that time, increased bandwidth and smart phone adoption, as well as a proliferation of AR browser applications, have helped AR evolve from a family of cool gadgets on the periphery of graphics and visualization technologies to an increasingly central player in the technology landscape.

Figure2. Augmented Reality

One of the most promising aspects of augmented reality is that it can be used for visual and highly interactive forms of learning, allowing the overlay of data onto the real world as easily as it simulates dynamic processes. A second key characteristic of augmented reality is its ability to respond to user input. This interactivity confers significant potential for learning and assessment. To date, most AR apps have relied on a phone's GPS and compass sensors to 'guess' what a user is looking at, but newer and more powerful visual search AR technologies are beginning to appear.

Tagging: People usually put mental tags on just everything they see, and this approach is in some way realized by the new point-know technologies. They recognize and put a tag on a range of visual and audio items by 'grasping' invisible markers.

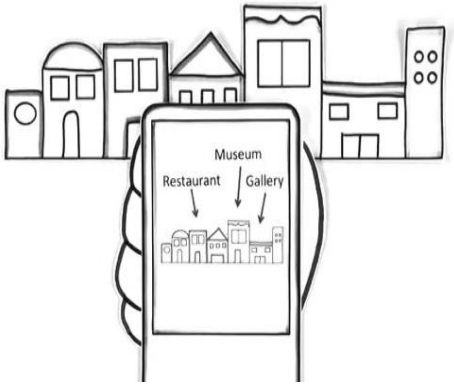

Figure3. Tagging

In a virtual tagging system there is no physical tag at a location. Instead, a URL as a meta-object is associated with a set of geographical coordinates. This technique is called object hyper-linking.

Visual Search: Visual search is the method of providing information by searching images of objects or the objects themselves. Image recognition technologies attempt to identify the actual object in the viewfinder in order to search or deliver more content. So pointing one's camera at an image of an apple will have the same result as pointing it at the real thing.

B. Applications

Some of the applications which use visual information gratification are explained below.

Google Goggles: In December 2009, Google launched a new application called Google Goggles for Google Android mobile phones that will allow people to search for more information about a famous landmark or work of art simply by taking a photo of that object. When an image is captured, Google breaks it down into object-based signatures. It then compares those signatures against every item it can find in its image database. Within seconds, it returns the results, ordered by rank. Some results are returned before the photo is snapped, thanks to seamless integration of GPS and compass functionality.

Adidas Originals: The Adidas Originals iPhone application allows us to take a photo of any Adidas sneaker and scan the current stock, finding the closest match and offering product information and related content at our fingertips.

Amazon Flow: Using continuous scanning technology, users can point at a book, game, food item, etc. and information appears instantly, including reviews and purchasing information.

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It seems that in a matter of a year, a user will be able to discover important information about almost any object, the price comparisons, reviews, content, etc. by just pointing at it with a smartphone. This field is enormous and a scope of opportunities the 'smartphone pointing' can provide is yet to be discovered. Who knows, maybe in the future, the technology will not need our finger to make a snap on a screen, but just a motion of our eyes or even a single thought. It will certainly come into sense in a few decades.

III. Silent Sound Technology

When we receive a phone call in a crowded place or a noisy street, we may not be able to hear the person at the other end of the call. When we are at work, we do not want to be caught while on the phone. Also, we are concerned about saying our password or other important details over the phone, fearing that other people might hear it. The Silent Sound Technology comes to our rescue.

A. Working

Even if we do not produce any sound, the person at the other end of the phone will be able to hear us. The Silent Sound Technology senses lip movements and translates it into a computer-generated voice for the listener at the other end of the phone. Silent Sound technology aims to notice every movement of the lips and transform them into sounds, which could allow people to make silent calls without bothering others.

B. Technique

Silent sound technology can be implemented using electromyography.

Figure4. Electromyography

Electromyography: Electromyography is the process of monitoring tiny muscular movements that occur when we speak. The monitored signals are converted into electric pulses that can be turned into speech, without a sound uttered. *[2]* An electromyography detects the electric pulses generated by muscle cells, when these cells are electrically or neurologically activated. Electrodes are glued onto the skin and the activity of the muscle at is observed. Since skeletal muscles differ in the inner structure, the electrodes have to be placed at several locations to obtain an accurate signal. By this way, communication can be made without producing sound.

C. Applications

Native speakers can silently utter a sentence in their language, and the receivers can hear the translated sentence in their language. That is, it acts like a translator. As of now, this translation technology works for languages like English, French and German, except Chinese, where different tones can hold many different meanings. May be in five years, it might also be available in Indian languages like Tamil, Telugu, etc. Silent Sound Technology can be very helpful to people who have lost their voice due to illness or an accident.

The engineers have got the device working to 99 percent efficiency, so the mechanical voice at the other end of the phone gets only one word wrong out of 100. Presently, electrodes glued to the face are being used to sense movements, but more practical methods are being researched.

Silent sound technology is expected to be in the market in five to ten years. And there will be a time when the following phrase becomes prevalent – 'Silence is the best answer for all situations - even our mobile understands'.

IV. 4G

A. History

4G refers to the fourth generation of mobile technology. The first two generations were analog cell phones (1G) and digital phones (2G). The First-generation was introduced in 1981 and the second in 1992. The third-generation mobile networks, or 3G, was introduced in 2001. India entered the 3G arena in 2008. MTNL became the first 3G Mobile service provider in India. 4G was introduced in 2010. It is yet to be introduced in India.

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B. Technologies under 4G

A number of pre-4G devices have been on the market starting as early as 2006. Though these devices are not up to 4G standards, they are considerably faster than the 3G standard. In December 2010, the International Telecommunication Union, which is managed by the United Nations, determined that some of the pre 4G technologies already on the market could label themselves as 4G even though they did not quite reach the levels required by the standards. The technologies that fall in the 4G categories are UMTS, OFDM, SDR, MIMO and WiMAX to some extent.

LTE Advanced: LTE refers to Long-Term Evolution. As the name suggests, it has matured over a long time to a state where changes in the specification are limited to corrections and bug fixes. The LTE format was first proposed by NTT DoCoMo of Japan and has been adopted as the international standard. One of the important LTE Advanced benefits is the ability to take advantage of advanced topology networks; optimized heterogeneous networks with a mix of macrocells with low power nodes such as picocells, femtocells and new relay nodes. The next significant performance leap in wireless networks will come from making the most of topology, and brings the network closer to the user by adding many of these low power nodes - LTE Advanced further improves the capacity and coverage, and ensures user fairness. LTE Advanced also introduces multicarrier to be able to use ultra wide bandwidth, up to 100 MHz of spectrum supporting very high data rates *[3]*.

UMTS: UMTS refers to Universal Mobile Telecommunications System. UMTS supports maximum theoretical data transfer rates of 42 Mbit/s. Users in deployed networks can expect a transfer rate of up to 384 kbit/s for R99 handsets, and 7.2 Mbit/s for HSDPA handsets in the downlink connection. These speeds are significantly faster than the 9.6 kbit/s of a single GSM error-corrected circuit switched data channel, multiple 9.6 kbit/s channels in HSCSD and 14.4 kbit/s for CDMA One channels. Since 2006, UMTS networks in many countries have been or are in the process of being upgraded with High Speed Downlink Packet Access (HSDPA), sometimes known as 3.5G. Currently, HSDPA enables downlink transfer speeds of up to 21 Mbit/s. Work is also progressing on improving the uplink transfer speed with the High-Speed Uplink Packet Access (HSUPA). Longer term, the 3GPP Long Term Evolution project plans to move UMTS to 4G speeds of 100 Mbit/s down and 50 Mbit/s up, using a next generation air interface technology based upon orthogonal frequency-division multiplexing.

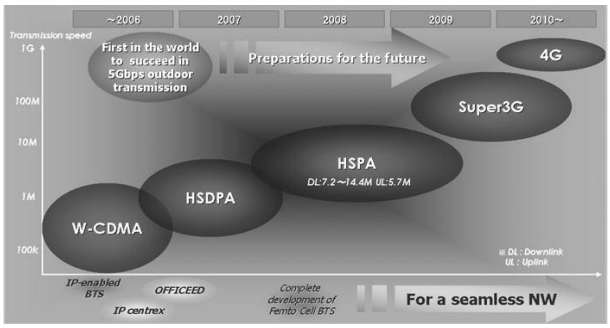

Figure5. 4G

WiMAX: WiMAX refers to Worldwide Interoperability for Microwave Access. WiMAX can provide at-home or mobile Internet access across whole cities or countries. In many cases this has resulted in competition in markets which typically only had access through an existing incumbent DSL (or similar) operator. HTC announced the first WiMAX enabled mobile phone, the Max 4G, on November 12, 2008. *[4]*The device was only available to certain markets in Russia on the Yota network. HTC and Sprint Nextel released the second WiMAX enabled mobile phone, the EVO 4G, March 23, 2010 at the CTIA conference in Las Vegas. The device, made available on June 4, 2010, is capable of both EV-DO (3G) and WiMAX (4G) as well as simultaneous data & voice sessions. The same applies to the HTC EVO 3D, which was released in 2011. A number of WiMAX Mobiles are expected to hit the US market in late 2011 and into 2012. Additionally, given the relatively low costs associated with the deployment of a WiMAX network (in comparison with 3G or HSDPA), it is now economically viable to provide last-mile broadband Internet access in remote locations.

MIMO: MIMO stands for Multiple-Input and Multiple-Output. It is an antenna technology for wireless communications in which multiple antennas are used at both for transmission and reception. The antennas at each end of the communications circuit are combined to minimize errors and optimize data speed. It increases the capacity of the wireless channel. MIMO technology has attracted attention in wireless communications, since it offers significant increases in data throughput and link range without additional bandwidth or transmit power. It achieves this by higher spectral efficiency (more bits per second per hertz of bandwidth) and link reliability or diversity (reduced fading).

OFDM: OFDM stands for Orthogonal Frequency Division Multiplexing. It is a method of digital modulation in which a signal is split into several narrowband channels at different frequencies.

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The technology was first conceived in the 1960s and 1970s during research into minimizing interference among channels near each other in frequency. In some respects, OFDM is similar to conventional frequency-division multiplexing (FDM). The difference lies in the way in which the signals are modulated and demodulated. Priority is given to minimizing the interference, or crosstalk, among the channels and symbols comprising the data stream. Less importance is placed on perfecting individual channels.

SDR: SDR stands for Software-Defined-Radio. Software-Defined Radio (SDR) is a rapidly evolving technology that is receiving enormous recognition and generating widespread interest in the telecommunication industry. Over the last few years, analog radio systems are being replaced by digital radio systems for various radio applications in military, civilian and commercial spaces. In addition to this, programmable hardware modules are increasingly being used in digital radio systems at different functional levels. SDR technology aims to take advantage of these programmable hardware modules to build an open-architecture based radio system software. SDR technology facilitates implementation of some of the functional modules in a radio system such as modulation/demodulation, signal generation, coding and link-layer protocols in software. This helps in building reconfigurable software radio systems where dynamic selection of parameters for each of the above-mentioned functional modules is possible.

C. Comparison with 3G

With minimum consistent Internet speeds of 144 Kbps, 3G was originally supposed to bring "mobile broadband." There are now so many varieties of 3G, though, that a "3G" connection can get you Internet speeds anywhere from 400Kbps to more than ten times that. New generations usually bring new base technologies, more network capacity for more data per user, and the potential for better voice quality, too.

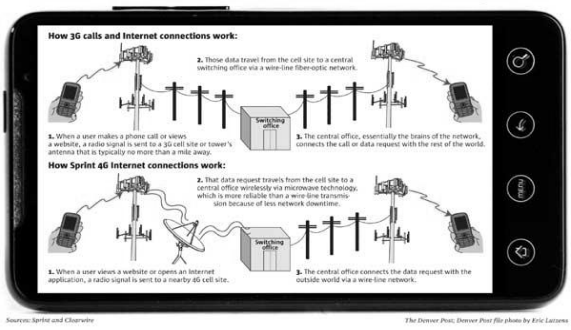

Figure6. Working of 4G

4G phones are supposed to be even faster, but that's not always the case. There are so many technologies called "4G", and so many ways to implement them, that the term is almost meaningless. But we must keep in mind that some networks claiming to use a 4G network are actually using a 3.9G instead because the network both exceeds the 3G, but falls short of the 4G. 4G is still in its initial phase, and so we can expect to get more from 4G in the coming days.

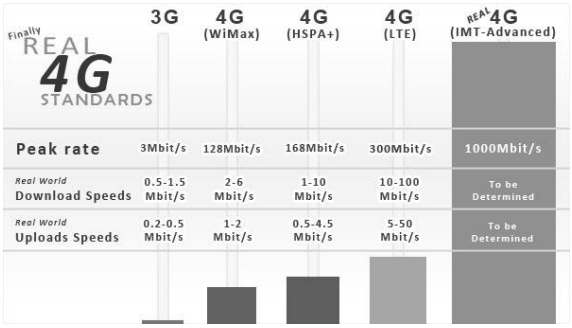

Figure7. 3G vs. 4G

Speed: A 3G capability means that you are using a phone that will typically download anywhere from 0.5 to 3 Mbps and upload at about 1 to 2 Mbps. On the other hand, a 4G mobile device can reach speeds over 37 Mbps down while still only uploading at no more than 3 Mbps.

Use of circuit: The 3G network combines circuit and packet technology for switching capabilities. The circuit design is older technology that helps stabilize the internet while packet is wireless technology that provides mobile internet. The 4G network disposes of the older technology and only uses a packet system.

More frequency band: The 3G network frequency band ranges between 1.8 to 2.5 GHz. A 4G network on the other hand has a frequency band between 2 to 8 GHz.

Forward Error Correction: 3G uses Turbo codes for error correction, while concatenated codes are used for error corrections in 4G.

Network Architecture: 3G is based on Wide Area Cell but on the other hand, 4G is based on an integration of wireless LAN and Wide area.

Upload Rate: The maximum upload rate of 3G is 50 Mbit/s, while the upload rate in the case of 4G can go up to a peak value of 500 Mbit/s.

Download Rate: The peak download rate of 3G is 100 Mbit/s, while the download rate in 4G can reach up to 1 Gbit/s.

Switching Technique: 3G uses packet switching while 4G uses both packet and message switching techniques.

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The word "MAGIC" rightly refers to 4G technology and stands for Mobile multimedia, Any-where, Global mobility solutions over, Integrated wireless and Customized services. The performance and capabilities of 4G technologies will only get better over time, and will represent a direct competitive threat to the existing broadband services. People will make a choice, just like today when people are disconnecting their wired lines for voice.

V. CELL-ALL

Recently, the cell phone has become a bad guy by causing distracted driving, crimes and even health problems. But it is possible for cell phones to save lives too. But how can a cell phone be a life-saver? The Cell-All initiative may be one such savior. Cell-All aims to equip cell phones with a sensor capable of detecting harmful gases. The threat of carbon monoxide, the silent, odorless, lethal gas known as the "silent killer", lurks in the average home and leads to at least 2,000 unintentional poisoning incidents per year. Experts believe the figure is far greater than this; poisoning can lead to flu-like symptoms and therefore go undiagnosed or unreported.

A. Working

In a Cell-All enabled phone, when a threat is sensed, an alarm is sounded.

Figure8. Cell-All

The user could set the tone of his choice for the alarm. This warning is sufficient in case of mild gases such as chlorine gas.

But in case the gas is deadly – for instance, sarin gas, which is five hundred times more poisonous than cyanide - chances are the user might become unconscious. In that case, realizing the seriousness of the situation, the phone sends the details - including time, location and the name of the gas - to emergency contacts and also to the nearest emergency operations center.

B. Advantages

Detection, identification and notification all take place in less than 60 seconds. Thus, emergency responders can get to the scene sooner and can save numerous precious lives.

C. Disadvantages

The drawback of the Cell-All technique is that it affects people's privacy. But Cell-All will operate only on an opt-in basis and will transmit data anonymously. And for Cell-All to succeed, people should be comfortable enough to turn it on in the first place.

Cell-All's commercialization may take several years. Yet the goal seems imminently achievable. The time is near, when the so called 'smartphones' will become smarter than us.

VI. CONCLUSION

In this fast-paced world, technologies invented today may become outdated tomorrow. Apart from the technologies described in this paper, there are several more, waiting to take control and dominate the world of Information Technology.

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