Digital Jewellery: An Upcoming Technology

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Abstract: Jewellery has been a fascination for people of all ages since the inception of civilization. Although it serves a minimalistic purpose of just adorning ourselves, we've always been fond of it. In the modern age, our entire life is encompassed by and completely encapsulated under the effect of computers, tablets and other electronic gadgets. In recent years, researchers have tried to bridge the gap between fashion and technology and so in the next age of computing, there will be an explosion of computer parts across our bodies, rather than across our desktops. The latest computer fixation has been to be able to wear wireless computers. The combination of microcomputer devices and waxing computer power has allowed several companies to begin producing fashion jewellery with embedded intelligence i.e., Digital Jewellery. The whole concept behind it is to be able to communicate to others by means of wireless appliances. The other key factor of this concept market is to stay trendy at the same time. This paper reveals the concept and the idea behind the digital jewellery by showcasing other miniature devices that could be worn. These pint-sized devices are called "Wearable Computers". The definitions, history, advantages, and limitation of these portable devices are also mentioned.

Keywords: Digital Jewellery, Wireless, Embedded Intelligence, LED, LCD, Electromagnetic Beads, Java Ring.

Introduction

Many people have envisioned wireless devices effortlessly in communication with one another. In this panacea, devices of all types begin to correspond just by being in close-proximity of each other. This technology in combination with diminishing computer devices and increasing computer power has allowed several companies to begin producing fashionable jewellery with embedded intelligence. Today, manufacturers can place an assemblage of transistors on a microchip, which enables in making small devices that store tons of digital data. Researchers have already created precursors of digital-jewellery.

As can be observed from Fig. 1., instead of one single device, cell phones will be broken up into their basic components and packaged as various pieces of digital jewellery. Together, the digital jewellery cell phone (made up of the components) should work not just like a conventional cell phone but also as a personal digital assistant PDA and GPS receiver.

The fundamental issue in wearable computer is its ability to equip the individual with personalized and customizable information: owned, operated and controlled by the wearer. The wearable computer can be a video screen worn on the eyes like goggles, body worn processor, input devices such as buttons, switches held in one hand and a microphone.

The changes in technology have brought about many pint-sized devices which allow people to do things with ease. The rapid use of this portable technology and their multiple functionalities in assisting people to engage with other useful activities has made the technology a versatile tool for learning and leisure purposes. Various studies have investigated the potential of these pint-sized devices for ubiquitous learning systems, leisure and confirming their effectiveness and how they have impact on lives and other areas of human endeavor.

Concept of Digital Jewellery

According to Wikipedia, a wearable computer is a miniature electronic device that is worn by the user on top of or under clothing without any discomfort. It is a form of human-computer interaction that is capable of been worn and always available and collaborative to the user. It is a universal device that is always with the user which allows the user to enter commands and to do other activities without hindrance (Mann, 1998).

Digital jewellery is fashion jewellery which is a kind of wearable computer, with intelligence integrated into it. Digital jewellery can help in the security front as well by solving problems like forgotten passwords and security badges. These devices have a tiny processor and unique identifiers that interacts with local sensors. DJ or Digital Jewellery as popularly known is a cardinal catchphrase for wearable ID gadgets that contain personal data of the user like passwords, identification, and account information. They have the potential to be all-in-one replacements for your driver's license, keychain,

business cards, credit cards, health insurance card, corporate security badge, and loose cash. They can also solve a common predicament of today's wired world – the forgotten password.

Fig. 1.Cell phones may one day be comprised of digital accessories that work together through wireless connections

The digital jewellery is the beginning of the disintegration of the personal computer into tiny parts and pre-packaged as varied items of digital jewellery. Digital Jewellery, will be the progression in digital technology that produces PC components entirely compatible with the human type. IBM has developed a paradigm of a mobile phone than consists of many items of Digital Jewellery which will work along wireless technology such as, Bluetooth.

A quantum of Digital Jewellery was noticed Wikipedia in 2011 which described the history of wearable computer and dated it to 16th century when pocket watch was invented. The advent of some sophisticated software brought various types of wearable computers at this age. An early wearable system was a camera-to-tactile vest for the blind, published by C.C. Collins in 1977. It converted images into a 1024-point, 10inch square tactile grid on a vest. In 1981, Steve Mann built a backpack-mounted 6502-based computer to control flashbulbs, cameras and other photographic systems. In 1989, Reflection Technology marketed the Private Eye head-mounted display which scanned a vertical array of Light Emitting Diodes (LED) across the visual field using a vibrating mirror. In 1994, Edgar Matias and Mike Ruicci of the University of Toronto invented the wrist computer. Their wrist computer suggested an alternative approach to the emerging head-up display plus chord keyboard wearable. The system was built from a mutated HP 95LX palmtop computer and a Half-QWERTY one-handed keyboard. In 2002, as part of the Project Cyborg by Kevin Warwick his wife, Irena wore a necklace which had been electronically linked to Warwick's nervous system via an implanted electrode array. The colour of the necklace changed between red and blue based on the signals on Warwick's nervous system.

Digital Jewellery Features

There are a lot of features that distinguish wearable computers from other computers like Laptops, Desktops, and PDA etc. Some of the features were enumerated by Mann (1998) are listed below:

1. **Portability**: One of the most characteristic features of a wearable computer is that it can be used while walking or moving around because of its miniscule size. This particular feature distinguishes wearable computer from PCs or other smaller computers like laptops.

2. **Sensors**: In addition to user inputs, a wearable computer has sensors for its physical environment. Such sensors might include wireless communications, cameras, speakers and microphones.

3. **Constantly On:** By default, a wearable is always on and working, sensing, and acting. This is contradictory to the normal use of pen-based PDA, which normally sits in the person's pocket and needs to be woken up whenever necessary. It is constantly available to the user – always on, ready and accessible.

4. **User Attention-Free**: Shall not require the constant user synergy. It is self-effacing and unrestrictive to the user. The user shall be able to do other things while using it, like walk around or ride in a crowded bus.

5. **Communication**: It has the capability to communicate with the user within reasonable time limits. It can also communicate to other systems & external world.
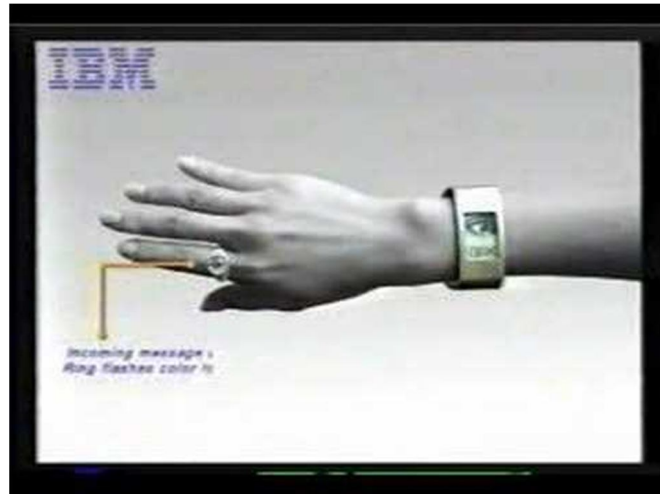
Fig. 2. Design of IBM's wearable computers

Digital Jewellery Components

The various components that are comprise a cell phone generally include: Microphone, Receiver, Touch pad, Display, Circuit board, Antenna, and Battery. IBM has developed a prototype of a cell phone that consists of several pieces of digital jewellery as shown in Fig. 2., that will work together wirelessly, possibly with Bluetooth technology, to perform the functions of the above mentioned components which are listed below;

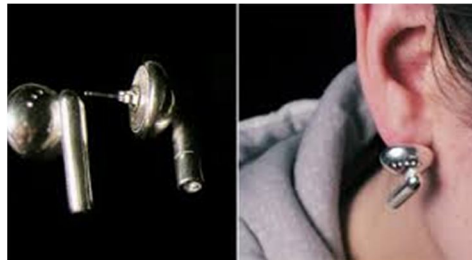**Earrings** - Speakers embedded into these earrings will be the phone's receiver.

Fig. 3. Earrings with embedded speakers

Necklace - Users will talk into the necklace's embedded microphone.

Ring - Perhaps the most captivating piece of such a phone is the "magic decoder ring" which is harnessed with light-emitting diodes (LEDs) that flash to indicate an incoming call. From Fig. 4., as seen it can also be programmed to flash different colours to determine a particular caller or indicate the usefulness of a call. The same ring that flashes for phone calls could also give a pointer to you that e-mail is piling up in your inbox. This flashing alert could also indicate the desperation of the e-mail.

Fig. 4. IBM's magic decoder rings

Bracelet - Equipped with a video graphics array (VGA) display, this wrist display could also be used as a caller identifier that shows the name and phone number of the caller. This is shown in Fig. 5.
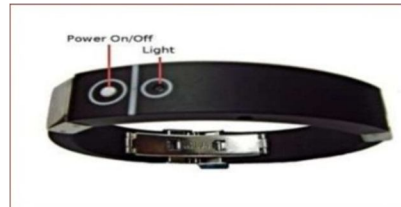
Fig. 5. Bluetooth Bracelet with built in rechargeable battery, when a call is coming the bracelet will vibrate and lamp flash

There are some potential designs for the above components that include;
1. *Garnet Broach:*

Fig. 6.Garnet Broach

Fig. 6., is a picture of a garnet broach containing a microphone. This enables you to record messages just by pressing a small button on the side.
2. *Red Ruby Necklace:*

Fig. 7. Red Ruby Necklace

The necklace as depicted in Fig. 7., would have a microphone built in. All you would need to do to use it click a small button in the back. Then you can continue and get on with recording your message.

Technical Specifications of Digital Jewellery
With a jewellery phone, the keypad and the dialing functions could be combined into the bracelet, or else put altogether. It's anticipated that the voice-recognition software will be used to make calls, a capability that is already undistinguished in many of today's phones. Simply say the name of the person you want to call and the phone will dial that person. IBM is also working on a miniature rechargeable battery to power these components.
Digital jewellery devices generally consist of a screen or display for information, which may generally comprise of 7-16-segment, or dot matrix, LEDs, LCDs, or surplus industrial science such as electroluminescent material (EL) or others of the same like, which could become an optional display. So, an audio-visual or other "display" could comprise of a speaker, a single flashing light, a sensor of a rare kind (such as a temperature driven EL display.,etc), and other informational aesthetic. The display layer sits on a face of the device, which is confined in a few materials serving as plastic, metal, crystal, or other material. It has external switches and buttons on its side and a data-port for accessing the programmable electronic circuit inner. A micro controller which is a surface mounted device (SMD) on a printed circuit board (PCB) with resistors (R) and capacitors (C) are the internal 'guts' of the jewellery.

Display Technologies
The mouse-ring which IBM is developing will benefit the company's Track Point technology towards wirelessly move the cursor on a computer-monitor display. (Track Point is the little button embedded in the keyboard of few laptops). IBM Researchers have transformed Track Point technology into a ring, which looks something like a black-pearl ring. On top of the ring is a little black ball that users will pivot to move the cursor, in the same way that the Track Point button on a laptop is

used. This Track Point ring will be very valuable when monitors shrink to the size of watch face. In the upcoming age of ubiquitous computing, displays will no longer be fixed to desktops or wall screens. Instead, you'll wear the display like a pair of sunglasses or a bracelet. Researchers are trying to overcome the several hardships in the usage of these advanced wearable displays, is the readability of information displayed on these tiny devices.

The digital jewellery display, for instance, every alphabet and number system has initiated representation in the electronics realm and 'dot-matrix' (a matrix of single LEDs) is used to display Chinese and Japanese and other character sets as well, as can the alternative display for LCDs (liquid crystal displays) also be used, as often found in watches.

Digital Jewellery can be made in many different sizes and shapes with a mixture of materials ranging from plastic and metal to rubber and glass. They utilize electromagnetic properties and electronics to display information over a screen or display of some kind. This could range from LED 7-segment, 16-segment, dot matrix, and other programmable LEDs devices to LCDs, LEDs, and other displays from Fig. 8, which are all driven by the self-contained jewellery devices themselves.
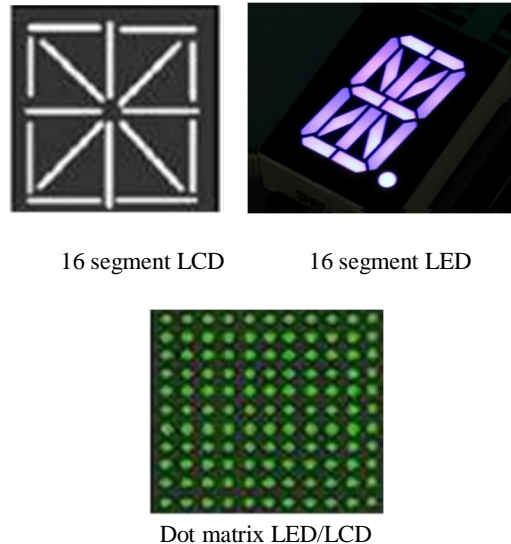

16 segment LCD   16 segment LED

Dot matrix LED/LCD

Fig. 8. Various display techniques

Electromagnetic Beads

The closest analogy to this model is that of 'beads' which are adhere together to cause a custom necklace or bracelet, with interchangeable electromagnetic component systems or devices from Fig. 9. One bead may be a capacitor on the inner, and a solar panel on the outer. Another bead may have an intramural resistor which feeds power into the programmed microcontroller bead which then drives an extraneous screen, with other supplementary options available in a mixture of bead configurations that compose a circuit, including beads with a piezo element, voltage regulator, crystal, or rechargeable battery as chunk of the modular jewel circuit. The figure of data pins on the microcontroller needs to be enough to easily program the display layer plus the switches without overly complex and advanced coding methods.
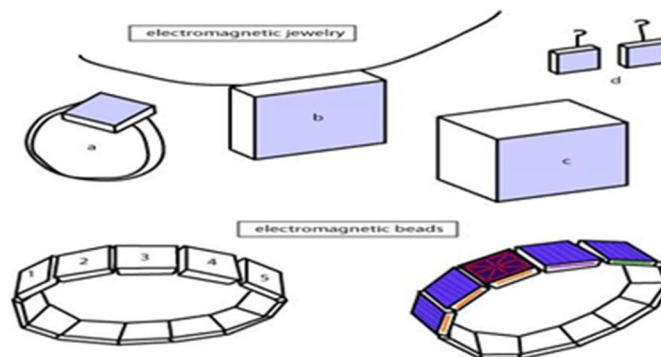

Fig. 9. Electromagnetic jewellery and beads

Prototypes of Digital Jewellery

Complete HIOX necklace from Fig. 10 showing all 26 letters of the Roman alphabet extended in 4-dimensional space-time metal with leather cord.
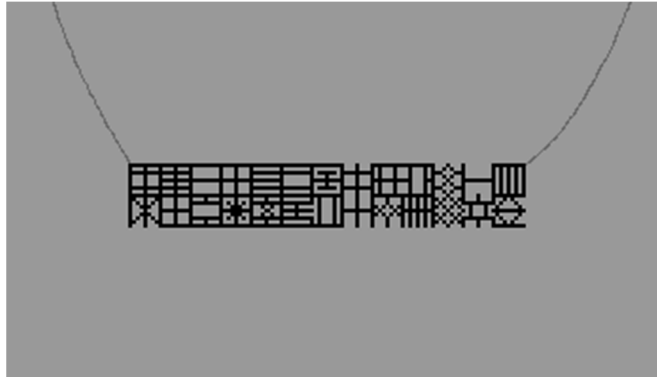

Fig. 10. Complete HIOX necklace showing all 26 letters of the Roman alphabet extended in 4-dimensional space-time.Metal with leather cord

Fig. 11.Programmable HIOX ring with 16-segment LED display

The Java Ring

It seems that everything we approach today is beneath lock and key. Even the devices we use are protected by passwords. It builds up quite a frustration trying to keep with all of the passwords and keys that are required to approach any door or computer program. Dallas Semiconductor is inventing a new Java-based, computerized ring that will automatically unlock doors and log on to computers from Fig. 12.

Fig. 12. The Java Ring is programmed to give you admittance to every door and device

Fig. 13. Blue Dot receptor

The Java Ring is a stainless-steel ring, 16-millimeters (0.6 inches) in diameter, from houses a 1-million-transistor processor, called an iButton. The ring has a 134 KB of RAM32 KB of ROM, a real-time clock and an in-built JVM, that is a part of software that notices the Java language and translates it for the user's computer system. Digital jewellery, (designed to supplant the personal computer) will be the transformation in digital technology that makes computer elements entirely compatible with the human form. A Highlights of Java Ring Runs Java improved (surplus portions strengthen Java Card 2.0) Precise consideration to physical security (rapid zeroization) Durability to stand up to everyday use High memory capacity (up to 134K bytes NV SRAM) Retail affinity to 250 million existing computers (less if designed-in before manufacturing) from Fig. 13.

Conclusion

The primordial concept behind digital jewellery is to incorporate convenience of wireless, wearable computers while maintaining the fashion quotient. It can be inferred from the research that digital jewellery has many pros, such as: they provide an aesthetic appeal to the users, helps in maintaining security, and they are portable. It is hoped to be marketable soon, however, certain bugs remain. Charging capabilities and cost are just a case of the questions which remain in digital jewellery.

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