

Beauty Tech Nails: Interactive Technology at your Fingertips

Katia Vega

Department of Informatics,
PUC-Rio
Marquês de São Vicente, 225,
Gávea, Rio de Janeiro RJ, Brazil
kvega@inf.puc-rio.br

Hugo Fuks

Department of Informatics,
PUC-Rio
Marquês de São Vicente, 225,
Gávea, Rio de Janeiro RJ, Brazil
hugo@inf.puc-rio.br

ABSTRACT

Looking for wearables that are fashionable, smart and augment human interaction, we introduce the term Beauty Technology as an emergent field in Wearable Computing. It is an on-body computing approach that turns non-invasive, wireless and without power required electromagnetic devices into beauty products for interacting with different surfaces and devices. This paper describes the materials and the prototyping process used in the making of Beauty Tech Nails exemplifying its application in everyday beauty products.

Author Keywords

Beauty Technology, Wearable Computers, Nails, RFID.

ACM Classification Keywords

H.5.2 Information interfaces and presentation: User Interfaces.

General Terms

Design; Human Factors.

INTRODUCTION

Wearable Computing in its inception proposed the use of body-borne computational and sensory devices in a way that human and computer were inextricably intertwined [1]. Two decades later, this revolutionary idea couple with the miniaturization trend, and the flexibility and the cheap prices of electronic components made it possible the widespread of wearable computing not just in the academy but also in industry. This wave of wearables flooding in the marketplace brings with it a few concerns. For instance, one of the arguments against the early adoption of wearable computers is their cyborg look. Even after designers making a great effort in hiding a camera and a microcontroller into glasses, making wearables look like bracelets and wristwatches, wearers still think that they

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don't meet their lifestyle and personality, and that it will take time for having them as everyday objects.

Wearable Computers are devices mostly attached to clothes and accessories [2]. But they may also be worn on the body surface like on the skin, hair and nails, and inside the body like implanted electronics. Beauty Technology is our Wearable Computing proposal of hidden electronic components into beauty products that could be worn on the body surface to enhance the wearer's appearance. False eyelashes, fake nails, conductive makeup and capacitance hair extensions are some examples of beauty technology prototypes.

Imagine that you don't need a card for opening your door, or for paying your bus ticket. Imagine that you don't need to carry any ticket for going to a movie session. Go and shop at the supermarket or rent a book at the library without a wallet or ID card, just point and pay for it, everything at your fingertips: your nails. Beauty Technology Nails embed technology components into fake nails in order to interact with the ambient in different ways. Beauty Tech Nails provide fashionable, inexpensive and wireless devices attached to fingernails, with no need of powered external components. These nails embed RFID tags for identifying the wearer and each of her fingernails. For example, instead of using a staff card for opening the office door, a secret combination of finger movements with RFID nails could identify employees and grant them access as it is shown in the project called Abrete Sesamo (Open Sesame) [3].

Next section introduces different approaches for using fingertips based technology. Section 3 presents the prototype design, and the materials used for hiding RFID tags into gel and fake plastic nails. Section 4 shows three examples of interaction through water (AquaDJing), other wearable (Gimmickiano) and other smart object (Twinkle Nails), just by approximating the fingernails. Last section discusses the conclusions and future works of Beauty Tech Nails.

RELATED WORK

Although many projects presented finger gesture recognition through cameras and Kinect, this work focuses its analysis on wearable computers and their always-

available and mobile features. Fingertips are in direct contact with objects that humans interact and finger's muscles are fine controlled by our motor system. Thus, devices mounted on nails and fingers have being developed for mobile and ubiquitous interactions like nail displays, embedded electronics rings and magnetic sensors bracelets.

Nail mounted displays are one example of wearable devices that augment reality by providing a visual feedback to the wearer [5]. "NailDisplay" [6] is an OLED display coupled with sensors atop a fingernail. When the finger is placed on the smartphone screen, the nail display augments its visualization. It also has sensors for identifying pressing and shaking motions. "Fingernail Displays" [7] envisions the use of a nail polish that automatically configures itself to an active matrix colour display.

Finger-worn devices could embed several sensors for gesture recognition. "FingerRing" [8] places rings coupled with accelerometers on every finger to sense different chord gestures in order to be used as a wearable keyboard. "Pingu" [9] is a ring that detects motion by using accelerometers and gyroscopes, and orientation by using magnetometers.

Another technique for recognizing gestures is by tracking hand's motion. A magnet located on any finger could be recognized by an object that has a magnetic sensor. "Neya" [10] is a tracking bracelet that detects the 1D input of a strong magnet ring and communicates wirelessly with other devices. Likewise, "Abracadabra" [11] uses a magnet on the fingertip to control a wristwatch.

BEAUTY TECH NAILS WITH RFIDS

Due to the increasingly advances in electronics, it is possible to have even smaller and more powerful devices. However, human factors do not change that fast: fingers retain the same size and shape. Even more, the interaction with a piano, a keyboard and any press-and-play object through a sequence of finger movements remains the same. The same could be said regarding the motor learning skills that humans had to gain in order to interact with specific targets with their fingers [12]. In addition, finger based interactions tend to be faster than interaction based on other body parts. Card et al. [13] conducted experiments comparing interactions with input devices through different body parts (fingers wrist, arm). They demonstrated that the motor cortex is highly devoted to muscles groups like fingers. These findings determinate that finger based input devices have a promising chance to succeed.

The major challenge that wearable input devices are facing today is to ensure that they are created as unobtrusive devices [14]. Related works aforementioned showed different finger-worn interfaces where batteries, wires and circuits are exposed and, therefore, they are not yet accepted as everyday objects. Beauty Tech Nails are plastic or gel nails that hide electronics like RFID tags, small magnets and conductive polish enabling the wearer to

interact with objects in the environment [15, 16]. This paper focuses on the ones that hide RFID tags.

RFID based interaction

The rapid adoption of RFID systems creates opportunities for new and innovative services. It enables organizations to deliver value-added applications related to the tracking and intelligent management of anything tagged with a RFID tag [17]. RFID tags fall into two categories: Active tags are read/write devices that require a power supply, while passive tags are generally read only eschewing batteries. Passive tags draw their power from the reader through inductive coupling that requires close proximity. Beauty Tech Nails RFID tags fall in the latter case by using a RFID glass capsule tag embedded into each fake nails. A 32-bit non-reprogrammable unique ID that works at 125 KHz frequency is used. The RFID reader [18] recognizes a tag that is about 2 cm of distance as it is shown in Figure 1. We chose this short distance reader due to the interspaces between fingers and their motion possibilities, because, whenever a specific finger is interacting with the reader, this finger is in the reader's range and there is a space between fingers of about 2 cm. With a long distance reader all Beauty Tech Nails would be recognized at once.

The main advantages of RFID systems are the non-contact and non-line-of-sight characteristics of the technology. Tags could be read through a variety of visually and environmentally challenging conditions such as snow, ice, fog, paint, grime, inside containers and vehicles and even insider storage [19]. A specific advantage of passive tags is that they do not require batteries or maintenance, have an indefinite operational life and are very small.

PROTOTYPE DESIGN

The chosen RFIDs' dimensions are 12.25mm width by 1.93mm of diameter. They are hidden either into a plastic/acrylic gel sandwich nails or salon gel nails. The former nails are easily attached and removed from the natural nails using a common fake plastic nails' glue. In this case, tags are sandwiched between the fake plastic nails and the acrylic gel.

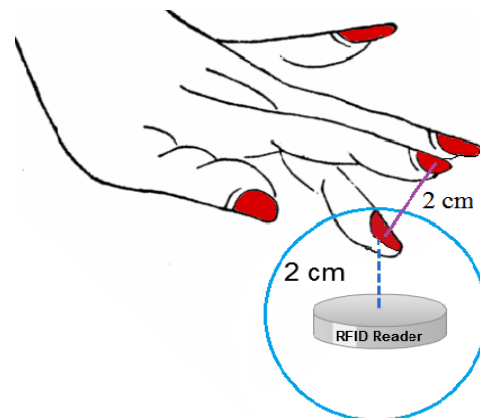


Figure 1. Interaction between Beauty Tech Nail and the reader.

Gel nails are a type of artificial nails that most closely resemble the natural nail. They could be kept on fingers for more than five weeks. The gel is applied to the natural nails in several thin layers, with each layer being cured under a UV lamp for about 2 minutes each. A tag is placed on the top of the basecoat after it dries. Then, several thin gel layers are applied until they completely cover the RFID. A decorative design using nail polish is applied at the end of the process. Figure 2 shows the first and last step of this process.

INTERACTIVE POSSIBILITIES AND APPLICATIONS

In this section, Beauty Tech Nails applications are presented. They embed RFID tags into fake nails and take advantage of the RFID possibilities for presenting different interactions: non-contact interaction, unusual interactions, and wearables interaction.

Non-contact Interaction

Using the RFID's proximity feature, the fingernail doesn't need to touch the smart object for identifying it. Whenever the finger is closer than 2 cm from the reader, the unique ID would be recognized. Twinkle Nails application is a musical combo comprising a Beauty Tech Nail and a box that hides a RFID reader that translates each ID tag into a different note.

Unusual interactions

RFID reader recognizes tags through different materials like water, glass and wood and also through different states of matter like ice and vapour. AquaDJing makes use of Beauty Tech Nails to interact through water. RFID nails are detected without touching the "DJ Controller" that is sitting at the bottom of a water container. Figure 3 shows the DJ's performance mixing 25 tracks "touching" the water. While Beauty Tech Nails on the right hand are recognized as tracks, the DJ controls sounds effects and mix them with the left hand nails. The controller is connected to a computer that plays the music effects and tracks while visualizations are being displayed.

Wearables Interactions

RFID readers could also be embedded into wearable devices for adding extra mobility to the Beauty Tech Nails' wearer, which is the case with Gimmickiano (Figure 4). It is a wearable piano belt that a performer wears while she moves around the auditorium. The wearable sends the notes to the computer by a radio module, and the notes are played and displayed in a piano visualization when he approximates each fingernail to her belt.

CONCLUSION

Beauty Technology is proposed as a novel Wearable Computing approach that hides electromagnetic components in beauty products worn on the body surface. Some are easy to attach and remove, and all of them are ergonomic and enhance one's looks.



Figure 2. Prototyping Beauty Tech Nails. Gel Nail process.

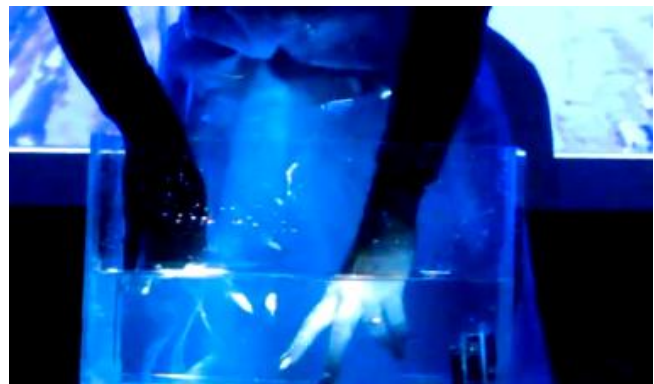


Figure 3. AquaDJing, mixing tracks touching water surface.



Figure 4. Gimmickiano, wearable that recognizes RFID nails.

Advantages of using low frequency RFID tags were appropriated in order to create interactive applications with Beauty Tech Nails. They are fashionable, wireless and always available and need no power required components. A small glass capsule RFID tag is protected for everyday use by acrylic gel in plastic nails and by salon gel in gel

nails. These tags need no contact for tag detection and recognition even when interacting through different materials and states of matter. Short distance passive tag readers make use of the interspaces between fingers for disambiguating targets. This technology identifies individual fingers motion, thus constituting a different subarea of gesture recognition.

Wearables and smart objects were created for interacting with Beauty Tech Nails. Applications for showcasing without touch interaction (Twinkle Nails), for interacting in unusual conditions like through the water (AquaDJing) and for adding extra mobility when interacting with wearables (Gimmickiano) were prototyped.

Future Beauty Tech Nails will combine low and high frequency RFID tags, magnets and conductive nail polish. As the miniaturization of sensors, batteries and other electromagnetic components evolves, these could be added into new Beauty Tech Nails. Then, these nails will also interact with a variety of different smart objects on the Internet of Things. Future applications could substitute known input devices for Beauty Tech Nails adding new kinds of interactions to the repertoire.

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